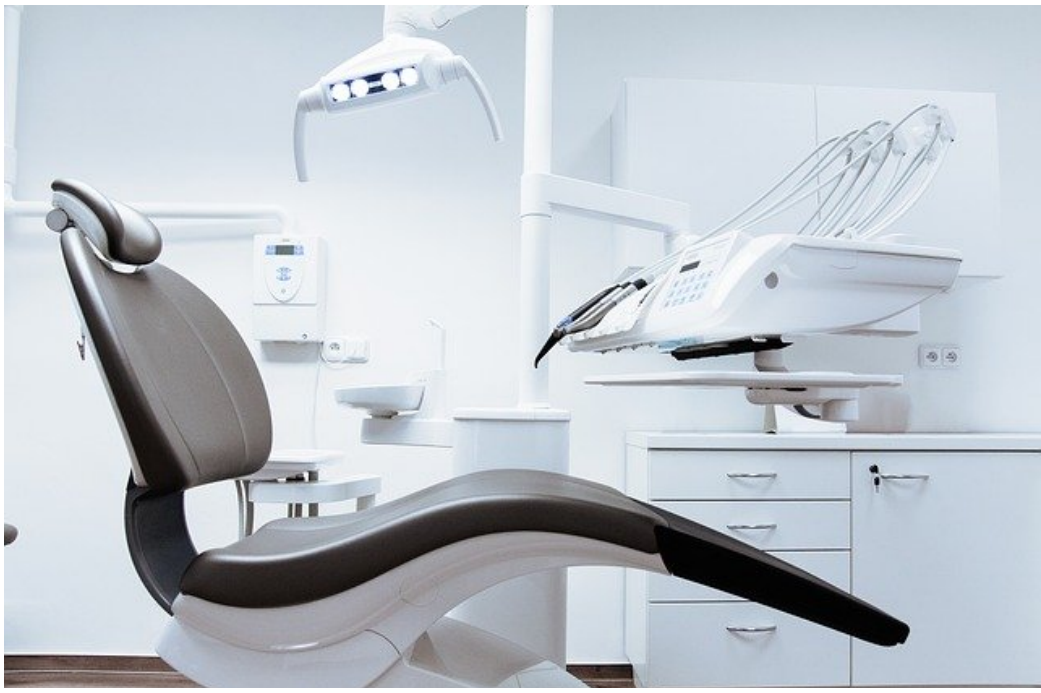
From the sticky floor to the glass ceiling and everything in between: A systematic review and qualitative study focusing on gender inequalities in Clinical Academic careers



End of project report
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This full report is accompanied by a short version: Inequalities in UK clinical academic careers: a systematic review and qualitative study.

Video summary

A video summary of the findings of this study is available here.

https://youtu.be/isuC8P8CBXA

Short report

A short report is also available via the funder or authors.

The title of this report is: "**Inequalities in UK clinical academic careers: a systematic review and qualitative study**."

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Abstract

Background:

The advancement of excellent healthcare requires a strategic funder approach to develop and retain talented, research-focused healthcare professionals who can balance clinical and academic activities effectively for the benefit of patient care. Unfortunately, there are many inequalities in clinical academia, often based upon protected characteristics such as gender, ethnicity and race. This inequality is well-recognised, yet there remain many barriers and facilitators associated with this career pathway that are poorly understood. Although funders are keen to support healthcare professionals to become Clinical Academics (CAs), there are currently gaps at certain levels with a drop-off from lack of support and progression. Thus, the aim of this study was to (a) conduct a systematic review to explore barriers, facilitators, and existing interventions within CA careers and, (b) collect qualitative data to explore the lived experiences of CAs across the career trajectory. This study considered medical and dental CAs within the UK.

Methods:

Five databases were searched in October 2019. Studies were eligible for inclusion if they included doctors or dentists, with or without CA careers. Outcomes were study-defined but related to success rates of joining or continuing within a CA career. Studies reporting quantitative and/or qualitative data were included. Title and abstract screening was performed using a novel two-staged search and screening process, making use of a machine learning algorithm. Full text screening was performed in duplicate. Risk of bias was assessed using standardised tools selected based on study design. Given the heterogenous nature of the studies identified, narrative synthesis of quantitative data was performed. Qualitative data were thematically analysed.

The qualitative phase of this study utilised multiple methods of data collection: (a) semi-structured interviews with 104 CAs, and (b) audio-diary and written diary data recorded by participants over an 8-month period, which coincided with the global COVID-19 pandemic. Participants were doctors and dentists who had various experiences of CA pathways including those who had successfully navigated clinical academia, those who had attempted to pursue a CA career but had been unsuccessful, or those who had given up research. Interviews explored their motivation to pursue, barriers, facilitators and possible interventions that could potentially improve the experiences of CAs. Audio-diary data were collected using voice recordings and enabled 30 participants to report on issues impacting their CA experience in the moment. Interview and audio-diary data were transcribed and thematically analysed. Data were subjected to (c) an additional text-mining stage to look for patterns in word frequencies. Data were (d) triangulated through the observation of funding panels and seeking expert opinion and consensus on the issues raised.

Results:

The systematic review initially identified 34,230 records. After screening, 239 studies were included in the review of barriers and facilitators, 141 included in the review of interventions and seven in both reviews. Of the 148 studies included in the interventions review, 28 were included in the quantitative synthesis, 17 included in the qualitative synthesis and two included in both. Notably, the literature lacked high quality, well-reported research studies.

The majority of included studies were from North America. Both quantitative and qualitative studies lacked methodological rigour and/or were hindered by incomplete outcome reporting.

Most quantitative evidence was available for multi-faceted academic training programmes. There is evidence to suggest that such programmes may increase recruitment to academia among clinicians, but findings are less clear for retention and for other outcomes such as participation in research and obtaining research funding. Studies reported benefits of supportive relationships for CAs, including peers and senior mentors. Across studies, having committed, supportive, and experienced programme staff was seen as a key facilitator of programme success. Respondents identified several other factors at a programme, organisational or national level which acted as a facilitator or barrier to success. Few studies reported on the effects of interventions for women or minority groups.

Interview data broadly pertained to eight major themes: identity; motivation to pursue; barriers; enablers; myths and the hidden curriculum; interventions; advice and top tips; and prescriptive and descriptive biases. The audio-diary data were predominantly related to the impact of the pandemic with themes of: barriers; enablers; fears and uncertainty; identity and protected characteristics. Across the data, discrimination based upon protected characteristics was rife; this led to many CAs leaving the research environment.

The narratives of CAs revealed common issues such as isolation, exhaustion and crises of confidence. The COVID-19 pandemic presented additional complexity for women who needed to juggle their work and family commitments; many reported wanting to relinquish their research. Participants proposed interventions including formal mentorship, making funding accessible and funders more approachable. A toxic culture of discriminatory behaviours and attitudes was described which led to many talented individuals being lost from the CA career pathway.

Conclusions:

Existing literature is limited by rigour and reporting, but there are significant lessons to be learned. Our primary qualitative data provide comprehensive evidence that CAs struggle to navigate the CA pathway and balance clinical duties with conducting research.

Research funders should commit to evaluating any future interventions they put into place which aim to address inequalities in the CA workforce. Successful interventions are likely to be comprehensive multi-faceted programmes of training, in which relational and support aspects are key. Interventions focused on individuals are felt to be less helpful than structural/environmental changes.

Lay summary

This study was designed to find out why some doctors and dentists choose to do research and what organisations can do to help them. Doctors and dentists who combine research with their clinical work are known as Clinical Academics (CAs). We know that some people are more likely to be a CA, particularly White men. It is harder for women and people from Black and Asian backgrounds to follow this career path. We wanted to know why people choose a CA career and what helped them with this career. We also wanted to know why people leave a CA career and their reasons. Our study used three approaches to help us understand this more:

1. We used the results from published research papers to find out why this problem exists. We also looked at what has been done to try to make it easier to pursue this career. We looked at ways to make things more equal for people from different backgrounds.

2. We interviewed doctors and dentists about their experiences of CA careers. We interviewed those who had been put off from doing research, had a negative experience or had reached the top of their research field.

3. We collected diary entries from doctors and dentists. We listened to when they had a good or bad experience at work. These recordings happened over an eight-month period during the COVID-19 pandemic.

Overall, we found that it is hard for CAs to provide patient care and do research. Previous studies in this area are of low quality and it is difficult to know what will help. However, there are lots of lessons to be learned from the United States of America.

When we talked to CAs, they told us that they felt isolated and over worked. The pandemic made it harder for women to juggle their work and family lives. Many women participants reported wanting to give up research. The solutions that the doctors and dentists would prefer included being assigned a mentor, making it easier to get money for research and for funders to have a better understanding of the challenges they face. Many doctors and dentists do excellent research, but they reported being anxious and not feeling good enough.

Organisations that fund research have tried different methods to improve the situation for CAs. What we need now is a large-scale evaluation to see what has worked and what still needs to be improved. Giving CAs more support, such as help with paperwork or guidance from a mentor may go some way to help.

Executive summary

A Clinical Academic (CA) is a clinician who is professionally trained, registered, and generally actively practising, and also employed to conduct research and/or teaching. The CA career pipeline is often described as “leaky”, whereby many stellar researchers are lost from the profession as they fail to progress along the trajectory. Women and Black Asian Minority Ethnic (BAME) individuals are the least likely to progress. This multi-phasic study sought to explore the barriers and facilitators to CA careers, with a focus on inequalities based upon gender and ethnicity. Funders and institutions globally have tried interventions to overcome such barriers with varying levels of success. The evidence is considered within this study.

The aims of this project were to:

1. Understand the experiences of CA careers from a fully representative sample of those within CA pathways from trainee to senior CA, including those who may have left or never embarked on a formal structured CA pathway;
2. Identify, critically appraise, and synthesise the literature on barriers and facilitators to progression throughout a CA career across medicine and dentistry, particularly for women, and support this with participant narratives;
3. Identify the key factors which impact career decisions and perceptions of how attractive CA careers are considered to be, by both those who have chosen to pursue these careers and those who have not;
4. Identify, critically appraise, and synthesise the literature on existing interventions to enhance CA pathways and propose new ones that may be relevant in UK settings.

Methods

For the systematic review, our full protocol was published (Brown et al, 2020a). The following databases were searched for studies in October 2019: MEDLINE (including MEDLINE Epub Ahead of Print, MEDLINE In-Process & Other Non-Indexed Citations, and MEDLINE Daily), Embase, Cochrane Controlled Register of Trials (CENTRAL), PsycINFO, and Education Resource Information Center (ERIC). We included studies of doctors, dentists, and/or those with a supervisory role in their careers, including those with and without CA careers. Outcomes were as defined in individual studies, but related to success rates of joining or continuing within a CA career, including but not limited to success in gaining funding support, proportion of time spent in academic work, and numbers of awards/higher education qualifications, as well as experiences of professionals within the CA pathway. Studies reporting quantitative and/or qualitative data were included.

Title and abstract screening used a two-staged search and screening process, incorporating use of a machine learning algorithm. Full text screening was undertaken independently, and in duplicate, by two researchers. Data extraction followed a staged approach and is summarised in narrative and tabular form. Study quality was assessed, for studies included in the synthesis, using the Cochrane risk of bias tool for randomised controlled trials, the Newcastle-Ottawa tool for non-randomised studies, the QARI tool for qualitative studies, the Mixed Methods Appraisal tool for mixed methods studies and the RAMESES II Quality Standards for Realist Evaluation. Given the heterogenous nature of the studies identified, narrative synthesis of quantitative data was performed. Qualitative data were synthesised using thematic analysis.

The qualitative arm of this study utilised semi-structured interviews with 104 doctors and dentists who had various experiences of CA pathways. These included:
(1) Those who had successfully navigated clinical academia and remain active,
(2) Those who had attempted to pursue a CA career but had been unsuccessful, for example by not securing funding or academic posts,

(3) Those who had given up research due to insurmountable challenges.

From January to September 2020, audio-diary data were collected from 30 participants, seven of whom had not participated in the semi-structured interviews. Audio-diary data were collected using voice recordings that were transferred to the team using encrypted WhatsApp files. Audio-diaries enabled participants to report on issues impacting their CA careers in the moment.

Interview and audio-diary data were transcribed and thematically analysed using inductive and deductive coding. Data were subjected to an additional text-mining stage to look for patterns in word frequencies. Following analysis, findings were triangulated through the informal observation of funding panels and seeking expert consensus on the issues raised.

Key findings:
The systematic review included 239 studies in the review of barriers and facilitators, 141 in the review of interventions, and seven in both reviews. Of the 148 studies included within the interventions review, 28 were included within the quantitative synthesis, 17 included within the qualitative synthesis, and two included within both. The majority of included studies were from North America. There were no studies included within the synthesis of this review that described interventions for CA dentists.

There were few high quality, well-reported research studies. Both quantitative and qualitative studies lacked methodological rigour and/or did not describe adequately the populations included, the interventions applied and the results from those interventions.

Most quantitative evidence derived from multi-faceted academic training programmes. There was evidence to suggest that such programmes may increase recruitment to academia among clinicians, but findings were less clear for retention or for other outcomes related to participation in research and research funding. Qualitative studies reported benefits of supportive relationships for CAs, including peers and senior mentors. There was consistent evidence of the importance and benefit of having protected time, particularly to mitigate the negative impact of competing clinical demands on research-related activity. However, there was also some evidence to suggest that maintaining protected time for research could be difficult in practice. Across studies, having committed, supportive, and experienced programme staff was seen as a key facilitator of programme success. Respondents identified several other factors at a programme, organisational, or national level which acted as a facilitator or barrier to success. Few studies reported the effects of interventions for women or minority groups.

Interview data broadly pertained to eight major themes: identity; motivation to pursue; enablers; barriers; myths and the hidden curriculum; prescriptive and descriptive biases. interventions; and advice and top tips.

Identity: Participants detailed that there is a lack of appreciation of the role and remit of CAs. This lack of awareness has implications on a practical level, for example when clinical shift allocations are provided that clash with academic working hours. CAs perceived hostility from colleagues based upon the perception that they are not visible in their clinical or academic environments enough, again the root cause of which was the lack of clarity about the identity of a CA. Imposter syndrome was rife within the community; CAs felt inferior to colleagues and that their achievements were insufficient to identify as a true CA.

Motivation to pursue: While some CAs reported an opportunistic commencement to their careers, others reported being inspired by role models and mentors. Previous research exposure, typically intercalation during undergraduate degrees, was the more significant

source of motivation for aspiring CAs. The CA career track is attractive to those who prefer a varied portfolio, many cited having two employers to hold some benefit.

Enablers: Working within a supportive culture, both clinical and academic, was essential for CAs to be successful in their career. Alongside this, mentorship was one of the most impactful enablers. Having protected time in order to conduct research activities, in parallel with clinical work, was a major factor noted by participants. This was also linked to employers and colleagues having an awareness about participants' academic role and need to be away from the ward on certain days. White male privilege was acknowledged as an enabler, but both men and women reported that this power was utilised to help support female colleagues.

Barriers: The balance of working within two fields, academic and clinical, was difficult for CAs. They struggled with competing demands and duplication of effort in relation to appraisal and mandatory training processes. Many barriers related to protected characteristics such as gender and ethnicity. Women were subjected to biases, particularly in relation to their reproductive decision making. Gay men were also subjected to discrimination that was so severe it impacted upon their choice of speciality. Women were often held back by senior women who had been trailblazers - the attitude of 'I suffered so why should you have it easy' was prevalent. Causes of discrimination were difficult to delineate due to the intersectional identities of participants. Some men reported that the tide has changed and they now feel discriminated against, 'it is the wrong time to be a white male'.

Myths and the hidden curriculum: Tacit messaging played a significant role in the career decisions of CAs, particularly early career researchers. Organisational culture, principally in relation to research, impacted upon the career aspirations of institution members.

Interventions: Participants proposed a range of interventions to support CAs and develop the field. Seemingly trivial actions such as promoting clinical academia, and the multi-faceted role of the CA were discussed. Funding targeted to under-represented groups within CA was proposed to help access for those floundering.

Advice and top tips: Seasoned CAs advocated for networking and academic socialisation. Surrounding one's self with like-minded, motivated individuals was key to success.

Prescriptive and descriptive biases: The maternal wall bias, whereby women are discriminated against due to their maternal status, was commonly reported within the study population. Women felt that having children had been detrimental to their careers as they were not afforded the same opportunities as men and assumptions about their ambitions were made due to their maternal status.

The audio-diary data collection coincided with the COVID-19 pandemic. The audio-diary data were predominantly related to the impact of the pandemic with themes of; barriers, enablers, fears and uncertainty, identity and protected characteristics. There was a differential detrimental impact on female CAs and those from BAME backgrounds. Women reported unequal distribution of labour within the home; this resulted in there being less opportunity to conduct research. BAME participants were adversely impacted by concerns for their health due to the higher prevalence of COVID-19 within their ethnicities. Fear and anxiety were inhibitory for all participants; however, the pandemic was fruitful in delivering opportunities for networking and new avenues of research. The pandemic was isolating for many and worryingly, for others, it initiated reflections on terminating their research to resume clinical practice only – typically citing this as the less tortuous path.

Conclusions:

Our data provides comprehensive evidence that CAs struggle to navigate the CA pathway and balance clinical duties with conducting research. Both the literature and the participant narratives advocated for the importance and benefit of having protected time for research. Participants described the challenges of working in two competing environments, thus protected time provides a means of mitigating the negative impact of pressing clinical demands on research-related activity. The narratives of CAs revealed common issues such as isolation and exhaustion. Imposter syndrome was experienced by many CAs, consistently across the career trajectory. A detrimental culture of discriminatory behaviours and attitudes was described resulting in talented individuals being lost from the CA career pathway.

The COVID-19 pandemic presented additional complexity for women who needed to juggle their work and family commitments – some stating that the inequality within the gendered division of labour in their homes was reminiscent of the 1950s. COVID-19 was declared a 'disaster for feminism', with many women feeling the necessity to relinquish their research. However, the pandemic provided an unexpected opportunity for participants to develop their research network, forming new academic communities of practice.

Within the qualitative data, participants proposed interventions including formal mentorship, making funding accessible, and funders more approachable. Many myths regarding the CA career trajectory perpetuate; addressing such fallacies may serve to increase recruitment of clinicians who have previously been deterred from an academic path. Through fostering a supportive culture, built upon academic socialisation, clinical academia will be able to better nurture aspiring CAs. Early exposure to research through such socialisation is imperative to future workforce development.

Existing literature is limited by a lack of methodological rigour and incomplete reporting, but there are significant lessons to be learned. We recommend that research funders commit to establishing large scale national infrastructure to facilitate research into the careers of UK CAs and interventions to support them. Interventions evaluated within this infrastructure are most likely to be successful when embedded within comprehensive multi-faceted programmes of training, in which relational and support aspects are key. Interventions focused on individuals are felt to be less helpful than structural/environmental changes. Results should be presented in a disaggregated form, as a minimum reporting gender and ethnicity differences, so as to better understand the impacts of interventions on these groups, with analyses that clearly consider the intersectionality of factors experienced by CAs. The data collected within such programmes should be regularly reviewed, analysed and transparently shared with the community through open access publications, including accessible summaries, with close attention to the clarity of reporting of methods, populations and interventions.

There are multi-factorial causes of the leaky pipeline within clinical academia; although there is no single solution or quick fix, stakeholders should seek to drive forward a culture of support for CAs and develop an infrastructure to evaluate interventions for those marginalised within the CA workforce. It is imperative to ensure equity in access and parity in experience for CAs, present and future.

Keywords

Academic, BAME, bias, clinical academic, clinician, COVID-19, dentist, dentistry, discrimination, doctor, ethnicity, evaluation, funding, gender, health, integrated academic training, interventions, medicine, qualitative, quantitative, synthesis, systematic review, underrepresented, women

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Disclaimer

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Note on gender

The research team appreciates the entire gender spectrum. For the purposes of this study, gender is referred to as binary male or female. For the qualitative data this is due to the demographic of our participants – none of whom identified as transgender or non-binary. Within the systematic review, the majority of included studies, and all synthesised studies, reported gender as a binary construct. For the purpose of our analyses, gender has been reported in this way.

Abbreviations

AACR	American Association for Cancer Research
ACF	Academic Clinical Fellow/ Fellowship
ACIT	Academy for Collaborative Innovation and Transformation
ACL	Academic Clinical Lecturer/ Lectureship
AFP	Academic Foundation Programme
ARCP	Annual Review of Competency Progression
Athena SWAN	Scientific Women's Academic Network
BAME	Black Asian Minority Ethnic
BDS	Bachelor of Dental Surgery
BMA	British Medical Association
Bmed Sci	Bachelor of Medical Sciences
BSc	Bachelor of Science
BS / BCh	Bachelor of Surgery
CA	Clinical Academic
CCST	Certificate of Completion of Specialist Training
CCT	Certificate of Completion of Training
CIP	Clinician Investigator Program
CL	Clinical Lecturer/ Lectureship
COVID-19	Coronavirus disease 2019
CRUK	Cancer Research UK
CTU	Clinical Trials Unit
CV	Curriculum Vitae
DCT	Dental Core Training/Trainee
DF1	Dental Foundation Year 1
ELAM	Executive Leadership in Academic Medicine
FY1	Foundation Doctor (Year 1)
FY2	Foundation Doctor (Year 2)
GDC	General Dental Council
GMC	General Medical Council
HEE	Health Education England
HEI	Higher Education Institution
HICs	High Income Countries
HYMS	Hull York Medical School
IATP	Integrated Academic Training Pathway
KiT	Keeping in touch days
LGBTQIA+	Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual (+ denotes other sexualities on spectrum)
LPP	Legitimate peripheral participation
MB	Bachelor of Medicine
MD/ DDS /PhD	Doctor of Medicine/ Dental Surgery/ Philosophy
Med Ed	Medical Education
ML	Machine Learning
MMAT	Mixed Methods Appraisal Tool
MRC	Medical Research Council
MSC	Medical Schools Council
MSc	Master of Science
NCLAM	National Center of Leadership in Academic Medicine
NIHR	National Institute for Health research
NOS	Newcastle-Ottawa Scale
PhD	Doctor of Philosophy
PRISMA	Preferred Reporting Items for Systematic Reviews and

	Meta-Analyses
QARI	Qualitative Assessment and Review Instrument
QI	Quality Improvement
RCT	Randomised Controlled trial
SHO	Senior House Officer
STEM	Science, Technology, Engineering and Mathematics
URM	Underrepresented in Medicine/Underrepresented minority

Outputs from research (to date)

Published outputs

Interim report: Inequalities in Clinical Academic Careers

Registration of systematic review protocol with Open Science Framework (OSF): https://osf.io/mfy7a

Published systematic review protocol: Brown JVE, Crampton PES, Finn GM and Morgan JE. From the sticky floor to the glass ceiling and everything in between: protocol for a systematic review of barriers and facilitators to clinical academic careers and interventions to address these, with a focus on gender inequality. Systematic Reviews. (2020) 9:26. https://doi.org/10.1186/s13643-020-1286-z

Research paper (in revision): Finn GM, Crampton PES, Balogun-Katung A, Buchanan JAG, Taylor E, Morgan J, Soto C, Tiffin PA, Kehoe A. An audio diary study exploring the impact of the COVID-19 pandemic on clinical academics: A further hurdle for female clinical academics.

Published abstracts:
Finn, G., Kehoe A., Crampton, P., Tiffin, P., Leppink, J., Buchanan, J., Nattress, B., & Morgan, J. (2020). Riding two horses: Gender inequalities, enablers and barriers to careers in clinical academia. The Clinical Teacher, Journal supplement October 2020.

Morgan, J., Brown, J., Evans, C., Uphoff, N., Stewart, L., & Finn, G., on behalf of the wider project team. From the sticky floor to the glass ceiling and everything in between: a systematic review of barriers and facilitators to clinical academic careers and interventions to address these. The Clinical Teacher, Journal supplement October 2020.

Oral communications

Finn, GM., Kehoe A., Crampton, P., Tiffin, P., Balogun-Katung A., Leppink, J., Buchanan, J., Nattress, B., & Morgan, J. Riding two horses: Gender inequalities, enablers and barriers to careers in clinical academia. Association for the Study of Medical Education – Prestigious Oral Presentation. https://youtu.be/PA0P6xRc5Yk

Finn, GM., Kehoe A., Crampton, P., Tiffin, P., Balogun-Katung A., Buchanan, J., Nattress, B., & Morgan, J. From the sticky floor to the glass ceiling and everything in between: Preliminary results from a systematic review and qualitative study of (gender) inequality in clinical academic careers. Equality, Diversity and Inclusion Conference 2020, Advance HE. Edinburgh, UK. 17-19th March 2020.

Finn, GM., Kehoe A., Crampton, P., Tiffin, P., Balogun-Katung A., Leppink, J., Buchanan, J., Nattress, B., & Morgan, J. It's like riding 2 horses simultaneously: A qualitative study exploring barriers and enablers to clinical academia careers in medicine and dentistry. Association for Medical Education in Europe – oral communication (virtual). AMEE September 2020.

Invited Workshop: NIHR Academy Members Conference, 24th November 2020. Smashing the glass ceiling: Encouraging inclusive participation in clinical academia. Facilitators: Prof Gabrielle Finn, Dr John Buchanan, Dr Millie Kehoe, Dr Abisola Balogun, Dr Paul Crampton, Dr Jess Morgan

Related invitations on gender:

Invited symposium: Professor Gabrielle Finn. Moving beyond gender: an intersectional approach to diversity in academia. Women in Academic Medicine. BMA. 2nd October 2020.

Invited keynote: Professor Gabrielle Finn. University of York, International Women's Day Lecture. From the sticky floor to the glass ceiling: Barriers and enablers to clinical academic careers.

Invited symposium: Professor Gabrielle Finn. Being a Woman in Healthcare. Invited speaker at Barts Women in Healthcare Society. Thursday 8th December 2020.

Invited contribution: Professor Gabrielle Finn. British Association for Physicians of Indian Origin's Institute for Health Research. Invited speaker at workshop on Tackling Differential Attainment in Research & Academia. 25th November 2020. (BAPIO)

Student presentaions:

This project was supported by an intercalating medical student who had the following outputs:

Oral presentation: Ellie Taylor (Supervised by Prof Gabrielle Finn). Clinical Academia: Barriers and Enablers: A longitudinal study of clinical academics through audio diaries with a focus on gender inequality. Saturday 13th March: Royal Medicine Society Sustaining our Healthcare workforce

Poster presentation: Ellie Taylor (Supervised by Prof Gabrielle Finn). Clinical Academia: Barriers and Enablers: A longitudinal study of clinical academics through audio diaries with a focus on gender inequality. 27th February 2021. The Institute of Medical Ethics National Student Conference.

Masters thesis: Ellie Taylor (Supervised by Prof Gabrielle Finn). Clinical Academia: Barriers and Enablers: A longitudinal study of clinical academics through audio diaries with a focus on gender inequality. Submitted to Hull York Medical School for the award of Master of Science in Clinical Anatomy and Education.

Report structure

The report firstly introduces the context and need for the study, leading to the project aims and research questions. Detailed methods for all phases of the study are then discussed in turn. Following this, findings from each phase are presented separately. Triangulation of various sources is presented including case studies, data mining and observations. A comprehensive intervention plan is then provided, drawing together findings from the qualitative side of the project. All phases of the project are then pulled together and synthesised in the discussion section, where the contextual relevance, strengths and limitations, and further research are outlined. The report concludes with a summary addressing the original research questions.

Background

The Clinical Academic pathway

A Clinical Academic (CA) is a clinician who is professionally trained, registered, and generally actively practising, and also employed to conduct research and/or teaching. Their workload is split in varying proportions between clinical and related duties (such as service development and leadership roles), scientific research, and teaching. The proportion of time spent on each part of the role differs between individuals and varies relative to their career stage and interests. CAs can be from any health professions backgrounds, but for the purposes of this study, CAs refer to dental and medical professionals engaged in research and teaching.

There are structured pathways to becoming a CA, as well as more opportunistic and informal routes to the career. In the UK, bodies such as NIHR, CRUK and Wellcome have affiliated programmes that fund training pathways, schemes, and research projects. Such formal pathways are often composed of fellowships, such as doctoral and postdoctoral (advanced) fellowships, as well as Clinical Academic Lectureships (CALs), at an earlier career stage. These fund the academic time of the award holder whilst they continue with their clinical training in their chosen field. There are also more senior posts and awards available for experienced mid- and late-career CAs. These include senior investigator awards and funded Professorships. Some funders offer integrated academic training pathways, where a trainee tends to remain with the same funder across a certain span of their career trajectory, through doctoral studies to postdoctoral research. Other CAs may move between funders at various points. Some clinicians have a less planned research career, taking opportunities as they arise to engage in research and teaching on an ad hoc basis, perhaps building up academic time via external grant funding or provided by Higher Education Institutes.

Table 1: Example of the NIHR Integrated Academic Training Pathway for (i) Medicine and (ii) Dentistry. *=Clinical Training Levels (NIHR, 2020)

Integrated Academic Training Pathway	University	Foundation programme	Specialist training			Senior positions
			In practice fellowship	Personal training fellowships	Clinician 5-year award	
(i) Medicine	Medical School: MB, Intercalated BSc, MD/PhD, Graduate entry medicine	Academic foundation programme: FY1-FY2	Academic clinical fellowship 1-3*	Clinical lectureship 4-6*	Certificate of Completion of training (CCT)	Research professor Senior lecturer Senior clinical fellowship Continued professional development Consultant research sessions
(ii) Dentistry	Dental School: BDS, Intercalated BSc, DDS/ PhD, Graduate entry dentistry	Foundation and core training: DF1 or DCT 1-3	Academic Clinical fellowship 1-3*	Clinical lectureship 4,5*	Certificate of Completion of Specialty Training (CCST)	

Table 2: Example of the range of fellowships offered by CRUK mapped to their competency framework (CRUK, 2020)

Develop independence	Establish independence	Transition to scientific leadership
Developing your career in a specific field of research	*Ready to establish your own independent cancer research programme*	*Further developing your programme and becoming an internationally recognised leader in your field*
AACR-Cancer Research UK Transatlantic Fellowship	Career Development Fellowship	Programme Foundation Awards
Population Research Postdoc Fellowship	Career Establishment Award	Senior Cancer Research Fellowship
Clinician Scientist Fellowship	Advanced Clinician Scientist Fellowship	
Clinical Trial Fellowship		

Current issues facing Clinical Academics

Health Education England's (HEE) Clinical Academic Careers Framework provides a strategic approach for the development of talented, research-focused and expert healthcare professionals (Health Education England, 2020). However, there are many barriers that need to be addressed for pathways to be fair to all.

The glass ceiling is well documented in academia (Williams, 2004, Williams, 2005, Carnes et al., 2008) and is described as a barrier, usually affecting women and members of marginalised groups, that prevents their professional advancement. These groups include those from Black Asian Minority Ethnic (BAME) backgrounds or Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual and other genders on the spectrum (LGBTQIA+). People belonging to such groups are less likely to reach positions of prestige and are more likely to work in positions that are not permanently contracted, known as non-tenure track. Although the glass ceiling is a metaphor, it is demonstrative of a complex struggle and interplay that appears to persist, despite efforts to shine the spotlight on underrepresented groups. This is particularly true within clinical academia (Brown et al., 2020a). More recently, the medical literature has been using the term 'the sticky floor' which describes the position of women in (academic) medicine where fewer are promoted and fewer are given institutional resource at the start of their careers to set them on their way (Zhuge et al., 2011, Carnes et al., 2008). The metaphor gained traction following research by Tesch and Nattinger (1997) who surveyed male and female medics who began their roles at the same time. Women not only face the glass-ceiling in terms of promotion, but have been reported to be stuck to the floor by the lack of investment (Tesch and Nattinger, 1997, Tesch et al., 1995). Assumed gender roles and expectations of women to do household work in addition to their waged labour poses a further barrier to women's professional advancement (Johnson et al., 2014). Although the 'sticky floor' metaphor has been used mainly to describe challenges faced by women in their professional advancement, like the 'glass ceiling effect', it can also be extended to explain the employment inequalities observed in BAME and LGBT+ groups (Morgan, 2015).

In 2009, Baroness Ruth Deech led a National Working Group on Women in Medicine on behalf of the Chief Medical Officer to investigate the barriers faced by female doctors in reaching leadership positions (Deech, 2009). The report set the scene by describing the apprehension within medicine regarding future targets for an increasingly female workforce, the ongoing challenges and issues related to gender inequality. However, such challenges are not unique to medicine. There has been a call within clinical academia for further research, as well as transparency and accountability with respect to the recruitment and selection of academics, especially in order to overcome the inequalities that have led to the underrepresentation of women as professors within academia (Van den Brink et al., 2010). Likewise, BAME populations within academia are more likely to occupy the lower end of the job spectrum and research suggests that vacancies are more likely to go to white colleagues (Ishaq and Hussain, 2019).

Professions, such as teaching or law, have undergone similar demographic changes and present evidence which suggests that such a workforce change may be accompanied by a decline in the perception of esteem in relation to the profession in question. This is often coupled with a reduction in remuneration, specifically pay which is best evidenced by the existence of the gender pay gap (Williams, 2005). A prime example from a non-medical discipline is research from the Law Society salary survey in 2007 which showed that female salaried partners earned an average of £46,999, whereas their male colleagues earned £80,000. Furthermore, it was reported that only 45% of female solicitors with 10 years' experience in private law practice are partners, compared with 65% of males (Deech, 2009). Such observations within executive professions are important for framing the context within clinical academia. Research within academia suggests that, with an increasing number of women, BAME and LGBT+ the prestige and income associated with the profession is lowered (Williams, 2005, Ishaq and Hussain, 2019). Within the higher education context, there are evident differences. Munir reported that women are most significantly impacted. Women tend to be have lower representation in science subjects, yet have better representation in language-based subjects (Munir et al., 2013).

Comparatively, women are well represented within healthcare, representing 44% of doctors and 89% of nursing staff (Penny et al., 2014). Similarly, within the NHS, BAME and LGBT groups represent 17.7% and 5% of the workforce respectively (NHS Improvement, 2018). Therefore, the medical profession is likely to be the first previously male-dominated profession to achieve parity. Clinical academia, however, is a different story. The gender imbalance and lack of diversity is particularly prominent at senior levels (Penny et al., 2014) (Resar et al., 2020), and has been recognised as a significant problem internationally (Caffrey et al., 2016). Data from the Medical Schools Council (2012) show that only 26.3% of CAs are female (Fitzpatrick, 2012). The imbalance increases substantially through the ranks, with female lecturers accounting for 45.5%, whereas only 21.5% achieve Professor. Likewise, for individuals from BAME backgrounds, where 21.9% account for lecturers and only 14.2% achieve professor. The same report found that there are gender differences in age and CA grade which imply that men are more likely to achieve senior levels at a younger age. The underrepresentation of females and other minority groups in leadership roles has been well documented within the literature, particularly in the broader context of academia and education systems (Williams, 2005; Crosby et al., 2014).

Democracies with Western ideology have long been dominated by the 'White, male, middle-class norm' (Lumby and Coleman, 2007). The same is true of many educational institutions (Hall, 1999), including universities and medical schools, and within clinical academia (Marsh and Chod, 2017, Arday, 2020). The lack of diversity in leadership roles within clinical academia is a global phenomenon (Marsh and Chod, 2017). Historically, leadership has been regarded as a male pursuit (Lumby and Coleman, 2007) as understandings of leadership have intrinsically been described as where 'orthodox leadership' is characterised as male. Hereby where the orthodox is referring to the norm (Coleman, 2003). Therefore, the

stereotypical ‘macho’ style of male leadership becomes an orthodox, which is not only detrimental for women but also for men (Coleman, 2003). Explorative studies have attempted to understand this normative view of a leader being a male role. Al-Khalifa (1992) reported that the image of male leadership, which is perceived as being characterised by aggressive, competitive behaviours, having an emphasis on control rather than negotiation and collaboration, is unappealing to women (Al-Khalifa, 1992). Although many of the studies which explore such presuppositions are based within the United States and school-level education, their findings are transferable to the context of Higher Education and clinical academia. Evidence from Australia, demonstrates that discriminatory behaviours towards women, particulary those in senior roles, is a global phenomenon and that ‘white male’ management culture perpetuates (White, 2003). While higher education remains a troublesome and hostile environment for senior academics from marginalised groups, their participation rates are unlikely to substantially increase.

For women in particular, some argue that they tend to choose their families over their careers (Carnes, 1992, Tesch and Nattinger, 1997, Tesch et al., 1995). However, studies have demonstrated that women are as eager to pursue leadership positions as men (Lopes et al., 2017, Williams, 2015). Williams (2015) stated that theories have been tabled to suggest that women are less likely to assume careers in STEM subjects. This has been linked to their pursuit of balance between their work and family commitments, it is not always an artefact of bias. However, Williams argues that evidence for that is thin and that new studies add to the growing body of evidence that documents the role of gender bias in driving women out of science careers.

Within clinical academia, a high rate of attrition, disproportionately affecting women, BAME and LGBTIA+ groups has been observed. In a study conducted by Lopes and colleagues (2019), less than two-thirds of previous academic clinical fellows already on the CA pathway planned on pursuing a CA career. Evidence suggests that roughly 33% of post holders progress to a junior postdoctoral clinical lectureship or senior CA (Lopes et al, 2019). Factors studies have shown to be responsible for high dropouts include work-life balance, securing funding, uncertainties about career progression, mentorship and obtaining career guidance (Ranieri et al., 2015, Lyons et al., 2010).

A number of persistent barriers that contribute to the glass-ceiling effect within clinical academia have been documented by Zhuge and include ‘traditional gender roles, manifestations of sexism within the medical environment and a lack of effective mentors’ (Zhuge et al., 2011). The issue of the underrepresentation of females remains firmly rooted within organisational culture at many higher education institutions. In 2005, the Athena SWAN[1] (Scientific Women’s Academic Network) charter was established by the British Equality Challenge Unit. Athena SWAN requires academic institutions to demonstrate their performance in a number of predefined areas, focusing on the advancement of women’s careers (Brown et al, 2020a). The need for universities to achieve higher levels of award has been cemented by the fact that funding bodies, such as the National Institute of Health Research (NIHR), would only accept applications from institutions who have achieved a silver award (Ovseiko et al., 2020) until 2020 when the requirement was removed (Stewart-Brown, 2020, NIHR, 2020). In 2016, AdvanceHE undertook research funded by Wellcome to showcase best practice initiatives to tackle gender inequalities across the UK (AdvanceHE, 2016).

[1] To accelerate women’s advancement and leadership, the UK’s National Institute for Health Research (NIHR) introduced an innovative policy intervention in 2011 linking its research funding to the implementation by universities of gender equality action plans through the Athena SWAN charter

This project sought to explore these barriers further, whilst also looking at how CAs have been successful in their careers and how effective existing interventions have been to date, in order to understand how the current CA pipeline and processes can be enhnaced.

Project aims and research questions

The aims of this project were to:

1. Understand the experiences of CA careers from a fully representative sample of those within CA pathways from trainee to senior CA including those who may have left or never embarked on a formal, structured CA pathway;
2. Identify, critically appraise, and synthesise the literature on barriers and facilitators to progression throughout a CA career across medicine and dentistry, notably female careers, and support this with participant narratives;
3. Identify the key factors which impact career decisions and perceptions of how attractive CA careers are considered to be, by both those who have chosen to pursue these careers and those who have not;
4. Identify, critically appraise, and synthesise the literature on existing interventions to enhance CA pathways and propose new ones that may be relevant in UK settings.

The research questions were:

1. What are current and recent trainees' experiences of CA careers; how do they conceptualise a CA career?
2. What are key factors impacting career decisions and perceptions of how attractive CA careers are considered to be?
3. What factors influence the decision to become and maintain a CA career and how do these factors change over time?
4. What are the main reasons for leaving a CA career?
5. How do clinical training demands impact research activity at different CA career transition points, and does the type of research make a difference?
6. What are facilitators and barriers to progression through a CA career across medicine and dentistry?
7. What factors impact upon access to clinical academia?
8. How do prescriptive and descriptive biases impact upon careers in clinical academia?
9. What existing or new interventions aimed at helping clinicians to pursue, and or transition across CA career pathways may have potential in UK settings?
10. What existing or new interventions could help to reduce attrition in CA careers?
11. How can organisations support trainees and CA in their career decisions and academic pathways?
12. How do medicine and dentistry compare in terms of the aforementioned facilitating and hindering factors, interventions and attrition?

Methods: Phase 1- Systematic Review

Specific Background

The original protocol for the systematic review was registered and published (Brown et al., 2020a). Sections of this report derive directly from the published protocol; these are denoted by the citation to Brown et al., 2020a. This report is presented according to the PRISMA reporting guidelines for systematic reviews (Moher et al., 2009).

Interventions to address gender inequality in academic medicine and dentistry have generally been poorly described. In 2018, a team based in Australia concluded that targeted interventions can be effective in supporting women's careers in academic medicine and dentistry, among other disciplines. However, their systematic review also revealed that it is important how these interventions are delivered. Bottom-up approaches, which place the onus largely on the individual wishing to progress their career, were less successful (Laver et al., 2018). Our review aimed to expand on these findings by using a more comprehensive search strategy and whilst also considering discrimination and biases based on characteristics other than gender (Brown et al., 2020a).

Specifically, this systematic review aimed to evaluate the existing evidence on factors that promote or hinder progression in academic medicine and dentistry, and interventions to support CA careers. There are scoping elements to the review, followed by deeper evaluation and synthesis. We report a high-volume, mixed methods review which evaluates and summarises a wide breadth of literature within the area, including both quantitative and qualitative data. The review plays a key role in situating the qualitative findings of Phases 2 and 3 of the overarching project within the broader literature, specifically informing the interventions advised as a result of this work.

We aimed to shed light on the evidence base surrounding aspects of CA careers for both men and women. Once we had explored the overall picture, we shifted our focus to potential gender differences, in line with the overarching project. While acknowledging that inequality is not exclusively about gender, the focus is on gender differences with the aim of identifying strategies to increase the proportion of female CAs across all levels/grades, and to support the progression of women beyond postgraduate level (Brown et al., 2020a).

Search and information sources

The following databases were searched for studies in October 2019: MEDLINE (including MEDLINE Epub Ahead of Print, MEDLINE In-Process & Other Non-Indexed Citations, and MEDLINE Daily), Embase, Cochrane Controlled Register of Trials (CENTRAL), PsycINFO, and Education Resource Information Center (ERIC) database. The search strategies included subject headings and free-text terms. Both search strategies were limited to human studies published in the English language, after 2004, reflecting the era of the Athena SWAN initiative. The search also excluded editorials and letters. The full search strategies can be found in Appendix 1. Time constraints precluded searching of reference lists and forward citation searches. We contacted the project funders to request any relevant reports or other work within their portfolio. Published and unpublished studies were sought and no study design restrictions applied. A time limit for eliciting further studies of three months was applied to ensure timely results of the review (Brown et al., 2020a).

This systematic review used a two-staged search process.

Search A was a more focused and specific search, which identified a subset of search B. It included population terms related to CAs AND terms related to career development, recruitment, retention, and attrition. Our pilot work found this search contained a higher proportion of potentially eligible records.

Search B was a broader and more sensitive search which only included terms related to CAs.

Inclusion and exclusion criteria

Studies were included in the review if they met the following criteria:

Population

The study population included doctors, dentists, and/or those with a supervisory role over their careers (e.g. programme directors, deans). Studies which include mixed groups of professionals were only included if the doctor/dentist group was reported separately, or if they comprised more than 50% of the participants. Studies of qualified doctors and dentists of all specialties and at all levels of career were eligible for inclusion. Those with academic careers were at any level from pre-doctoral to professor. The review expressly did not include medical and dental students, though future work may wish to explore the various influences on those at such an early career phase. Studies which explored why doctors and dentists had chosen not to undertake a CA career or why they no longer had a CA career (when they previously were following one) were eligible for inclusion. For the purpose of the review, an academic career referred to those engaged in research, not purely teaching or educational roles (Brown et al., 2020a).

While there are pathways that offer a CA career to nurses, midwives, and other allied health professionals, this review focused exclusively on doctors and dentists, consistent with the needs of the funders. This also reflects that the main pathways for CA careers in the UK (funded by the NIHR) separate doctors and dentists from other healthcare professionals. Given that the funders of the review and the main dissemination targets for the findings are based within the UK, we mainly searched for the British terms for clinical and academic career pathways. We did not expressly search for American terminology, or those from other countries; however, if identified by the search, these studies were eligible for inclusion (Brown et al., 2020a).

Topics of interest

– Factors influencing recruitment and retention to CA careers, including barriers and facilitators. This included but was not limited to funding, training opportunities, cultural aspects, barriers experienced by underrepresented minorities, issues related to academics with young families, and experiences surrounding role models (Brown et al., 2020a).

– Interventions to increase recruitment to CA careers and to improve retention in CA careers. These included, but were not limited to, specific funding opportunities, training opportunities, development programmes, mentorship programmes, and strategies which aimed to increase academic engagement of specific groups, e.g. family-friendly strategies aiming to increase the involvement of women in clinical academia.

– Where multiple barriers, facilitators, and interventions were described within and across studies, each were extracted and included for analysis within the review (Brown et al., 2020a).

Outcomes

We accepted outcomes and outcome measures as defined by the studies, as long as they were related to success rates of joining or continuing within a CA career, including but not limited to success in gaining funding support, proportion of time spent in academic work, and numbers of awards/higher education qualifications, as well as experiences of professionals within the CA pathway (Brown et al., 2020a).

Study design

Studies were included from all forms of quantitative and qualitative research provided they informed the research objectives. This included but was not limited to:

– Quantitative research: randomised controlled trials (RCTs); including quasi-RCTs and cluster-RCTs; observational cohort studies (prospective and retrospective); and studies reporting survey data.

– Qualitative research: methodologies including ethnography, phenomenology, and grounded theory. Studies that use qualitative methods but which did not state an explicit methodology were also eligible to be included, provided they presented qualitative data. This included, but was not limited to, studies using focus group discussions, interview studies, and observational studies (Brown et al., 2020a).

Similarly, mixed methods studies were eligible for inclusion if they provided sufficient data.

Studies were limited to those written in the English language for two reasons. Firstly, these are most likely to reflect the cultural experiences of the group in which the results are to be applied, that is CAs in the UK. Secondly, the benefit of qualitative research is to allow participants to express their experiences and perceptions, the clarity of which could be lost through translation and thus the results of the synthesis could become inaccurate. Furthermore, studies were limited to those performed in high-income countries (HICs), according to the World Bank classification, in recognition of the cultural and organisational setting in which the research findings are to be applied. Studies were included where they are available in full-text format. Conference abstracts were not eligible for inclusion. Editorials, letters, and opinion pieces were not eligible for inclusion (Brown et al., 2020a).

Amendments to the original protocol

Given the large volume of potentially relevant studies identified during the screening process, the objectives of the review were modified in discussion with the larger team and with approval of the funders' Project Steering Group. The clear priority was to identify potential interventions. Studies on barriers and facilitators to CA careers were explored only within a general overview.

Additional exclusion criteria were also introduced at the full text screening stage to allow us to focus on the most recent and relevant evidence. We therefore excluded studies published before 2005, studies where the majority of the data was collected before 2004 (in line with the publication date cut-off), and those studies conducted in HICs with considerable differences in culture and/or health care provision compared with the UK, for example Japan and Singapore.

Similarly, the analysis plan was adjusted to enable a time and resource efficient reporting process. The amendments to the analysis are further described within the summary of synthesis methods section of the methods.

Data management and study selection process

References were managed in EndNote X9 (Clarivate Analytics, 2020) and exported into Rayyan (Ouzzani et al., 2016) for study selection. Title and abstract screening incorporated the use of Rayyan's machine learning algorithm. Records identified in search Awere used for training the Rayyan algorithm, facilitating more efficient screening of the remaining records in search B.

We added and screened titles and abstracts in three steps:

Step 1: All references identified in search A were added to Rayyan ('batch A'). This batch was screened independently and in duplicate in its entirety.

Step 2: We then added a randomly selected sample of 1,000 records identified in search B ('batch B.i'). These records were also screened independently by two reviewers.

Step 3: The remaining records identified in search B ('batch B.ii') were added to Rayyan in the third and final stage.

As specified in the published protocol, title and abstract screening stopped once the rate of potentially eligible records had fallen sufficiently from baseline (and at a minimum of 25% of identified records) (Brown et al., 2020a).

Full-text screening was undertaken independently and in duplicate. At each stage of screening, disagreements were resolved by consensus and/or recourse to another team member.

Data extraction

This systematic review used a staged approach to data extraction, given the large volume of studies identified. The stages of data extraction were as follows:

- General overview: performed for all full texts included within the review. This focused on high-level descriptive data for the studies, including location, funding, methods, population, and focus of the study (barriers and facilitators or interventions).

  Following discussion with the funders, further exploration and analysis of this large dataset on barriers and facilitators has not been performed.
- Interventions: performed only for studies describing interventions (as identified in General overview data extraction). This focused on an understanding of the intervention design, target groups, the reach of the intervention and the presence or absence of a control group.
- Outcomes: performed only for intervention studies which reported quantitative data and included a control group (as identified in Interventions data extraction).

Data were extracted by one researcher using a standardised data extraction form and independently checked by a second researcher. For many studies, due to the extent of information within the reports, it was difficult to accurately determine the nature of the intervention, and/or the population to which it was applied. Where this occurred, data extraction sought to best reflect the included studies. Where the same intervention was clearly used in multiple studies, the most detailed descriptor of the intervention components is used for all studies. When extracting population data, where possible, we grouped clinical status into trainee (to include FY doctors, SHOs and registrars in UK training terms and residents/fellows in US training) or post-training (including UK consultants and US faculty). Many US studies used the phrases "junior faculty" or "senior faculty" to describe the population studied and this information has been captured as such. Academic level was

often more difficult to accurately capture, with many studies reporting mixed populations (e.g. “faculty at a School of Medicine”). Thus, our data extraction sought to identify broad categories only.

Summary of synthesis methods

Data extracted at all three stages have been summarised in narrative and tabular form.

Given the extensive number of studies included in the interventions section of the review, as an amendment to the planned protocol, a decision was made to synthesise only those studies most likely to contribute to answering the specific aims of the research. This was agreed to be studies using quantitative methods which included a control group and studies using qualitative methods to evaluate the interventions. For the purpose of this review, a study was considered to have a control group if it described a discrete group of individuals who did not receive the intervention, either concurrently or historically, and who were directly compared with the intervention group. Studies were only included in the qualitative synthesis if it could be determined that the qualitative data was derived predominantly from verbal data collection methods such as interviews or focus groups. Findings based on the thematic analysis of responses to open-ended survey questions and other written sources of data were not eligible for inclusion. Quality assessment was performed only for studies to be included in the synthesis.

Quality Assessment

The quality of studies was assessed using the Cochrane risk of bias tool for RCTs (Higgins et al., 2011), the Newcastle-Ottawa scale (NOS) for non-randomised studies (Wells et al., 2014), the Qualitative Assessment and Review Instrument (QARI) Checklist for qualitative studies (Joanna Briggs Institute, 2014), the Mixed Methods Appraisal Tool (MMAT) for mixed methods studies (Hong et al., 2018) and the RAMESES II Quality Standards for Realist Evaluation (Wong et al., 2017). Each study was individually assessed and checked by a second reviewer, and any conflicts resolved via discussion. The results from the quality assessment were used to inform the conclusions on the strength of the evidence and implications for research and policy.

The Newcastle-Ottawa scale was used for non-randomised case-control and non-randomised cohort studies. Certain items on the NOS are predefined whilst others typically require further specifications relating to the individual review. Due to the variability in study design, population and outcomes of each included study, we did not pre-specify any items and instead, judged each study separately. We also did not calculate summary scores for each study according to this scale, as the value and validity of such overall scores is debatable (CRD, 2008); instead, we used a colour-coding system. For each individual item we coded responses representing high quality as green, medium quality as orange, poor quality as red, whilst anything not reported in the study was coded grey.

Evidence Synthesis

Synthesis of quantitative data

Due to the heterogeneous nature of the studies included in this review, there were insufficient data to conduct meta-analyses. Therefore, quantitative evidence on interventions was synthesised narratively, within eight broad outcome categories relating to CA careers: aspiration, satisfaction, skills & knowledge, funding, research participation, recruitment, retention/promotion, and publication outcomes. Attention was paid to the similarities and differences in findings both across and within studies.

Synthesis of qualitative data

Qualitative data were synthesised using an approach consistent with the principles of thematic analysis (Braun and Clarke, 2006). All relevant qualitative findings in papers were coded line-by-line by one researcher and the codes subsequently reviewed by another member of the research team. Codes were developed inductively and further refined as appropriate. During the synthesis process, findings related to specific codes were brought together to identify cross-cutting themes and issues of potential relevance. Attention was paid to the similarities and differences in findings both across and within studies.

Note that only references to studies included in the evidence synthesis are listed within the main report bibliography. References to other studies included within the review are provided in separate bibliographies in the Appendices, which table the study characteristics. This is to provide a more concise bibliography for this extensive review.

Methods: Phase 2 and 3 Qualitative exploration

Study design

This initial phase of the qualitative exploration utilised in-depth, semi-structured interviews.

Issue scoping and pilot interviews

The research team consulted with the funders, the Clinical Academic Training Forum (CATF) and policy makers at funding organisations to scope issues and provide context. In addition, the qualitative protocols were informed by previous research in the field and the developing systematic review. Scoping interviews were conducted face-to-face and via telephone in order to pilot the topic guides, ensuring they were covering the required areas. Scoping interviews followed the normal consenting process previously described.

Methods

Phases 2 and 3 of this study utilised qualitative methods. Each phase will be described in turn. Phase 2 utilised semi-structured interviews, while Phase 3 utilised audio diaries. The overarching methods common to both phases, including consent, recruitment and data analysis will be described, before delineating phase specific methods.

Patient and Public Involvement

The study had a steering group which included Patient and Public representation, provided by Health Watch York. The steering group inputted into the study design and interpretation.

Ethics

Ethical approval for Phases 2 and 3 of the study was obtained from the Hull York Medical School Ethics Committee (ref: 19 32). A subsequent amendment was approved for completion of online consent forms, due to the onset of the COVID-19 pandemic.

Recruitment

To maximise recruitment numbers, a multi-pronged approach was utilised to recruit a stratified sample. Recruitment methods involved:

1. Personal email invites sent to a purposive sample of participants known to the research team or the steering committee,
2. Advertisements through a dedicated Twitter account established to support the project (@GenderClinical),
3. ‘Snowballing’ by participants,

4. Email circulars to past and present applicants facilitated by the funding bodies,
5. Emails to associations, networks support groups and collectives related to clinical academia and for CAs with specific protected characteristics,
6. Emails to specific marginalised and underrepresented groups such as transgender and BAME medical and dental associations

Inclusion and exclusion criteria

Participants were included if:

- They were a doctor or dentist (presently or formerly) *and*
- Had previously, successfully or unsuccessfully, applied for CA funding schemes *or*
- Were in the process of applying for funding *or*
- Had considered a CA career but did not pursue this *or*
- Had withdrawn from clinical academia at some point in their career

Participants were excluded if:

- They were based outside of the UK and Ireland
- Had applied for a funding programme that did not include doctors or dentists within its remit

Consent

All participants were provided with research information sheets and consent forms (see Appendix 6 and 7 respectively) upon receipt of their enquiry by the research team. Research information sheets outlined the purposes of the study, the participants' involvement, data protection and storage, and how to withdraw. Consent and information sheets detailed Phase 2 and 3 of the study.

Consent: Participants opted to sign electronic consent forms returned by email or online consent forms stating they were aware that their participation was voluntary and refusal to take part was without penalty. These consent forms were compliant with GDPR regulations. No deception took place.

Confidentiality: Confidentiality of participants was assured by the redaction of identifying data in reporting.

Incentives and remuneration: There were no incentives or remuneration for phase 2 of the study. Participants for Phase 3 received an Amazon voucher in acknowledgement of their additional time commitment and not as an incentive.

Data collection for in-depth interviews

Participants were able to request interviews to be held via telephone or using an online platform (such as Zoom or Skype). Interviews were semi-structured, based upon interview stems informed by the ongoing systematic review, the study's theoretical framework and underpinning research questions. Interview stems were adapted depending on the participant demographic. For example, stems were used if the participant had withdrawn from clinical academia or if they reported being an active CA (see Appendix 8 for interview stems).

Interviews were conducted by five researchers (GF, AK, AB, PC, JB) over a nine-month period (October 2019 – June 2020). All interviews were digitally recorded and transcribed verbatim. Data were encrypted, as per the ethics protocol. Researchers also made field notes during interviews. Although written consent had been obtained prior to the interview, it was also confirmed at the commencement of the interview.

Data collection for audio diaries

This phase of the qualitative exploration utilised audio and written longitudinal diary entries. Diaries enabled participants to discuss their views on a wide range of factors related to CA careers, and latterly, their experiences of working within clinical academia during the COVID-19 pandemic. The diary method enabled researchers to collect 'novel' real-time data over an eight-month period (February 2020 - September 2020).

The impact of the COVID-19 pandemic

Since the first cases of COVID-19 were reported in the UK at the end of January 2020, a huge national effort has gone into providing care for patients during the pandemic. The result has been more CAs being recalled to clinical practice, CAs being restricted to their homes due to lockdown restrictions, or CAs being unable to conduct research due to facilities being inaccessible or procedures being prohibited.

Audio-diary data were collected to further inform the central research questions relating to barriers and enablers to CA careers. However, data collection coincided with the onset of the COVID-19 pandemic and thus, a secondary aim of this study evolved to capture the experiences of CAs during the pandemic.

Audio-diary recruitment
Recruitment was primarily through the study participant pool from Phase 2. Following their interview, participants were emailed to thank them for their time and to signpost the opportunity to contribute to the audio-diary phase. As consent had been previously obtained during Phase 2 interviews, participants were made aware at recruitment that each diary submission was taken to be informed consent. Additional participants who only wished to complete the diary phases were permitted to participate. Participants were reminded that they could withdraw at any point.

Data collection
Participants were issued with a guide to follow which was informed by the Phase 1 concurrent systematic review (Brown et al., 2020a). The guide suggested frequencies of entries, instructions for submission and indicative content (Appendix 9). The guide was accessible via email or using the project website. In order to promote engagement, participants were also permitted to write their diary entry, in line with recommendations made by Gordon et al. (2017). Participants were able to submit diaries as frequently as they wished, with each submission being acknowledged to maintain rapport. Participants submitted diary entries via email or encrypted WhatsApp messaging, following best practice (Gordon et al., 2017). Reminder emails were sent monthly. Audio files were received in mp3 format and saved to an encrypted drive for verbatim transcription. Written entries were submitted via email, as either email text or an attached document. These entries were saved to the encrypted drive for analysis. Audio diaries were collected until September 2020 when the study was closed.

Audio-diary data were collected between January 2020-September 2020. Each entry submitted was personally acknowledged. Participants were provided with prompts that scoped out general experiences of clinical academia upon registration for this phase of the study. They were subsequently issued with prompts relating to the COVID-19 pandemic (Appendix 10). Participants were able to reflect on all prompts and any situation pertaining to clinical academia that they wished. Prompts were broad and participants were informed of the interest in protected characteristics.

Phase 2 and Phase 3 data analysis

All data (transcripts) were thematically analysed (Braun et al., 2013, Braun and Clarke, 2006). Thematic analysis was chosen as it is an appropriate method for seeking to understand experiences, thoughts, or behaviours across a dataset (Kiger and Varpio, 2020). Transcripts were analysed by a team of researchers (GF, AK, AB, JB, PC, ET). The authors read the data in its entirety and developed a codebook as a tool to assist in the analysis of the large dataset (Roberts et al., 2019). The six-step process of thematic analysis was followed: (1) data familiarisation, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report (Braun and Clarke, 2006, Braun and Clarke, 2013). Both inductive and deductive approaches were taken, with deductive analysis based on existing theory including maternal wall bias, feminist theory and intersectionality. (Williams and Segal, 2003, Brown et al., 2020b, Williams, 2004). Authors engaged in a process of negotiation to refine codes and themes, before utilising member checking with a subset of participants. Authors were reflexive, recording reflexive journals and acknowledging their biases and presuppositions. The research team consisted of clinicians and non-clinicians, CAs at varying stages, expert qualitative researchers to novices, females and males, and a mix of ethnicities.

Theoretical considerations

Gender
It is worth noting that gender bias is an extremely complex construct. It is a construct that can evolve and one that is uniquely experienced at an individual level. Despite this, it the concept is somewhat embryonic as a theoretical consideration within medical education. The theoretical underpinnings upon which the research is built included; critical theory (including feminist theory), maternal wall bias, gender roles, intersectionality and their associated metaphorical representations such as ‘the sticky floor’ and ‘the glass ceiling’.

The theory of gender is beyond the scope of this section and is considered in the subsequent discussion. However, it is imperative that gender roles are defined, this study utilised the following – gender roles are ‘socially and culturally defined prescriptions and beliefs about the behaviour and emotions of men and women’ (Anselmi and Law, 1998).

A number of prescriptive and descriptive biases were explored in the development in the research. These are delineated below where each bias is described as either descriptive bias (regarding what women are like), prescriptive bias (regarding how women should behave) or both (Williams and Dempsey, 2018).

Four patterns of prescriptive and descriptive biases experienced by women in the workplace have been described. Adapted from Williams & Dempsey (2018) (pxxi) and Brown et al., (2020):

Prove-It-Again!
- Descriptive bias: Stems from assumptions about the typical woman.

- Women have to prove themselves over and over again to be seen as equally competent to men

Tight-rope bias

- Prescriptive bias: Stems from assumptions about how women should behave
- Describes a double-bind: if women behave in traditionally feminine ways they exacerbate prove-it-again problems. If they behave in masculine ways they are seen as lacking social skills.

The Maternal Wall bias

- Descriptive bias: Strong negative competence and commitment assumptions triggered by motherhood.
- Prescriptive bias: Disapproval on the basis that mothers should be at home and working fewer hours
- Women with children are routinely pushed to the margins of the professional world.

Tug of War

- Occurs as women navigate own path between assimilating masculine traditions and resisting them.
- Women's different strategies (tom boy vs preserving feminine tradition) pit them against each other.
- Leads to judgement on the right way to be a woman.

Intersectionality

When considering the data and resultant analysis presented within this report, it is important to be cognisant of intersectionality. Intersectionality is the theoretical consideration of the interconnected nature of social categorisations and protected characteristics including ethnicity, social class, parental status, and gender as applied to a given individual or group (Brown et al., 2020b). This interconnection is regarded as creating overlapping and interdependent systems of discrimination or disadvantage. Intersectionality is a useful approach to analyse how overlapping or competing identities, for example being a clinician and a carer, affect the experiences of individuals in society.

Bhopal (2020) advocates for intersectional analysis as data as it is difficult to explain inequity on the basis of one factor alone. Intersectionality permits the consideration of how competing factors interplay resulting in different outcomes of power relations. In light of this, attention must be paid not only to the participants' demographics but also to their intersectionality and their narratives. It is difficult to disaggregate the impact of specific protected characteristics in isolation when considering the discrimination or disadvantages experienced by participants. For example, a Muslim female with children may have been discriminated against due to her religion, gender or maternal status, or the discrimination may be a result of all factors in conjunction. Thus, intersectionality needs to be considered in order to examine the mutually reinforcing intersections of multiple protected characteristics that are frequently irreducible. The cumulative effect of such multi-dimensional discriminations needs careful consideration as the authors cannot easily describe any dependency, or synergistic effects of multiple categories potentially associated with reported disadvantage.

*"First, the notion of **interlocking oppressions** refers to the macro level connections linking systems of oppression such as race, class, and gender. This is the model describing the social structures that create social positions. Second, the notion of **intersectionality** describes micro level processes—namely, how each individual and group occupies a social position with interlocking structures of oppression described by the metaphor of intersectionality. Together they shape oppression."*

- Hill Collins, 1995 (cited in Hulko, 2009: 47)

Findings: Phase 1- Systematic review

Study selection

Electronic databases were searched in October 2019. Search A returned 7,789 unique references (batch A); an additional 26,441 unique references were identified by search B (batches B.i and B.ii), bringing the total number of records to be screened to 34,230. The study selection process is illustrated in Figure 1.

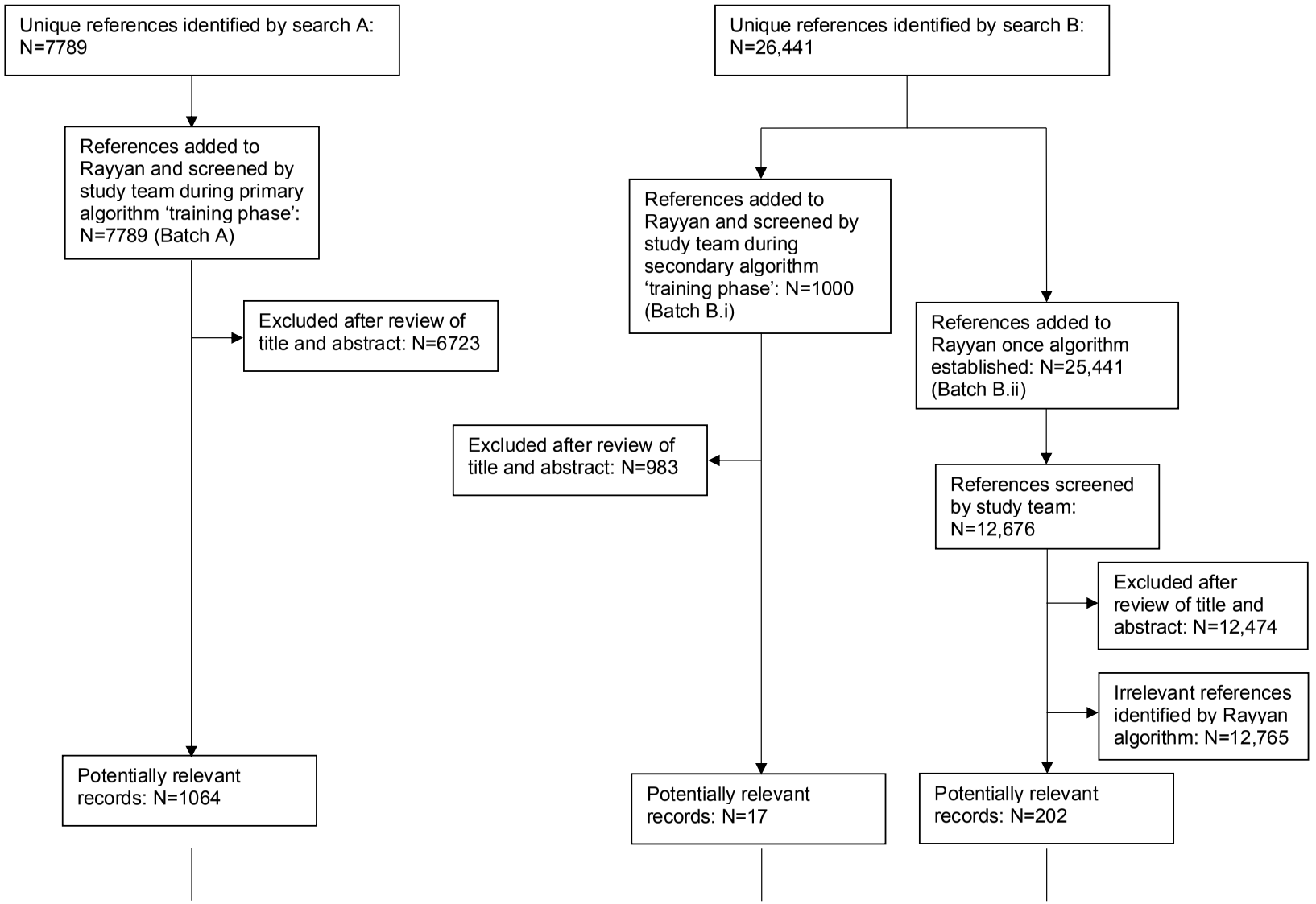
Duplicate screening of all records in batch A identified 1,064 potentially relevant titles and abstracts. A further 17 records were considered potentially eligible following duplicate screening of the 1,000 records in batch B.i. Out of the 25,441 records in batch B.ii, 4,652 were screened in duplicate. The remaining 20,816 records were unlikely to be relevant based on the ML algorithm. We single screened 8,051 of those records with none deemed eligible for inclusion. From the 12,676 records in batch B.ii assessed by the research team, 202 were considered potentially eligible. In total, 1,283 (3.7% of the 34,230 records identified by both searches) titles and abstracts were considered potentially relevant. The majority of these records were selected from batch A (1,064/1,283, 82.9%). We were unable to obtain full texts for 25 of these studies and excluded four duplicates, leaving 1,254 full texts to be assessed by the study team.

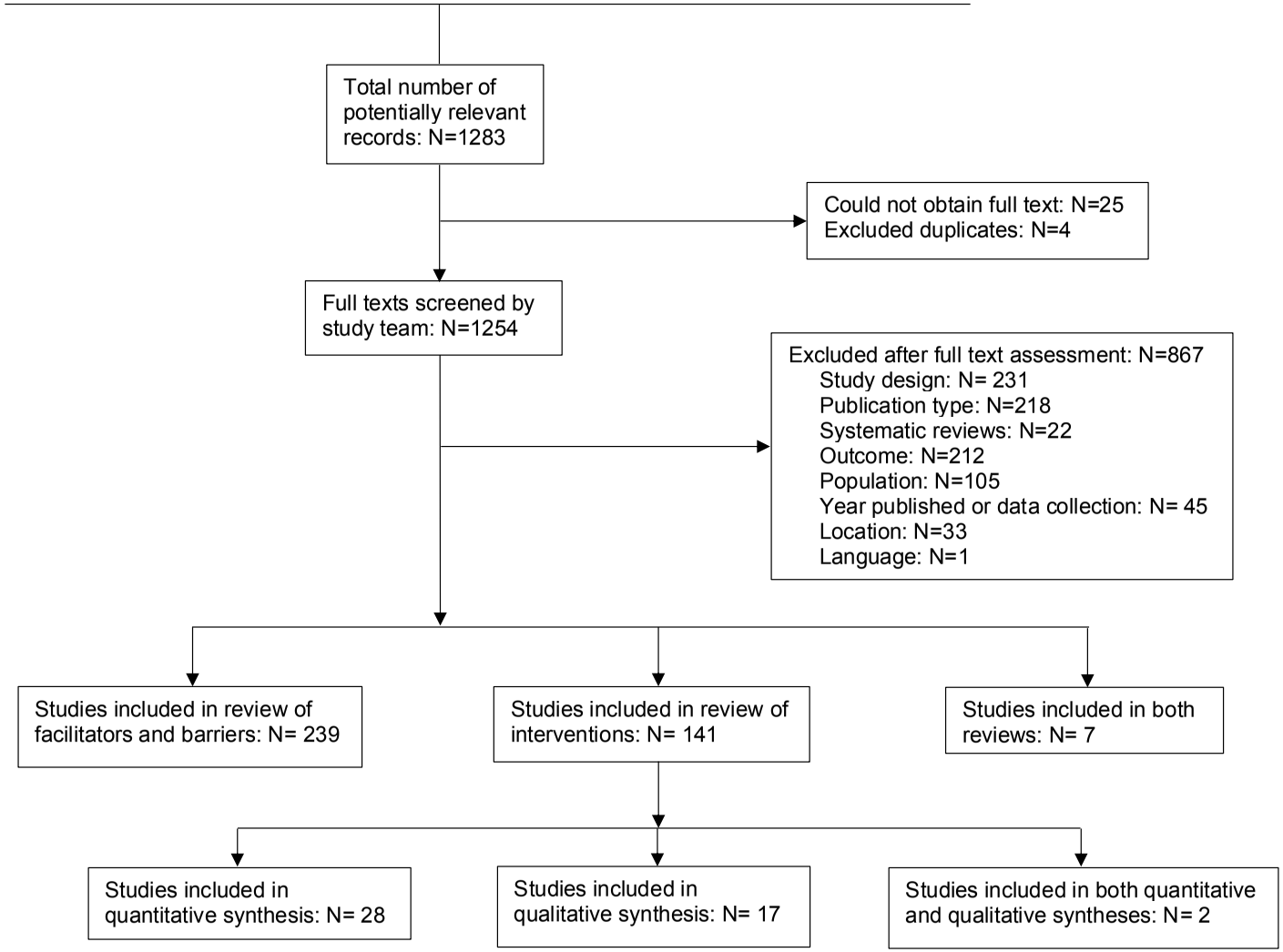
Of these, 867 were excluded after full text assessment (study design: 231, publication type: 240 (including 22 systematic reviews), outcome: 212, population: 105, year of publication or data collection: 45, location: 33, language: 1) which left 387 eligible full texts.

Following the three-stage data extraction process described above, 246 full texts were categorised as studies of barriers and facilitators. Descriptive data are provided below and in Appendix 2. In keeping with the project's primary focus, these studies were not synthesised further.

The remaining 148 papers were reports of interventions. (NB: Seven studies reported both an intervention and barriers and facilitators.) Of the 148 reports of interventions, 28 were included in the narrative synthesis of quantitative data, 17 in the qualitative synthesis, and data from two studies were included in both. Based on data extracted, the remaining 101 studies were not eligible for further synthesis, as they did not meet the pre-specified requirements described within our methods, and thus only descriptive data are provided.

Figure 1: Flowsheet for study selection




Total number of potentially relevant records: N=1283
Could not obtain full text: N=25
Excluded duplicates: N=4
Full texts screened by study team: N=1254
Excluded after full text assessment: N=867
Study design: N= 231
Publication type: N=218
Systematic reviews: N=22
Outcome: N=212
Population: N=105
Year published or data collection: N= 45
Location: N=33
Language: N=1
Studies included in review of facilitators and barriers: N= 239
Studies included in review of interventions: N= 141
Studies included in both reviews: N= 7
Studies included in quantitative synthesis: N= 28
Studies included in qualitative synthesis: N= 17
Studies included in both quantitative and qualitative syntheses: N= 2

Study characteristics

We now outline the study characteristics for three key groups of studies:

1. Studies included in the review of Barriers and Facilitators
2. Studies included in the review of Interventions
3. Studies included within the synthesis
    a) of Quantiative data
    b) of Qualitative data

For the study characteristics described in sections 2 and 3, these are structured according to: Year of population and study setting, Study design, Participants, and Delivered Interventions. As demonstrated within the flowsheet (Figure 1), the synthesised studies which are summarised in section 3 represent a sub-group of the studies outlined in section 2.

1. General overview – Studies included in review of Barriers and facilitators

Out of the 246 studies that examined barriers and facilitators to CA careers, almost half were published in the last five years (2015-2020) (n=122). Eighty-one were published between 2010-2014 and 43 between 2005-2009. Most were quantitative cohort studies (n=156), a quarter used a qualitative methodology (n=62) and 22 adopted a mixed methods approach. The remaining six studies were of various types including combined primary research and review and case study research.

Most studies were from North America (n=205, 83%), with 171 conducted in the USA, 30 in Canada and four in both countries. Eighteen studies were conducted in Europe, an additional 16 in the UK, six were from Australia and New Zealand, and one study involved clinicians from several continents. Research focused on individuals from a range of medical specialities and dentistry and included clinicians of varying grades, although a majority of studies involved clinicians in post-training roles. Twenty-seven studies focused on a sample of women only. For 149 of the studies, no ethnicity data about the participants was reported. Out of the remaining 97 that did report the ethnic breakdown of participants, six studies reported a sample comprising individuals from a minority ethnic background only.

As previously discussed, these studies were not explored beyond this general overview. Further information regarding study characteristics is given in Appendix 2. This group of identified studies provides a dataset for further exploration in future research.

2. General overview – Studies included in review of Interventions

Year of publication and study setting

We included 148 studies of interventions to improve CA careers that were published in the last 15 years. The number of such publications appears to be rising; almost half were published in the last five years (2015-2020) (n=72, 49%). Forty-six were published between 2010-2014 and 30 between 2005-2009.

The vast majority of included studies (n=133, 90%) were conducted in North America (USA: 122; Canada: 9; USA and Canada: 2). Nine studies were conducted in the UK, four in Australia and New Zealand, and two were from Western Europe. Over half of the interventions were implemented in single institutions only (n=83, 56%), four studies reported interventions at a regional level, and 60 studies were of national-level interventions. One included study did not report the reach of the intervention.

Study design

The 148 studies included 99 single-group cohort studies, 25 controlled cohort studies, two case-control studies, one randomised controlled trial (RCT) and one case study. Nine studies used a mixed methods design, of which two included a controlled quantitative component. The remaining seven had quantitative components that did not include a control group.

There were 11 qualitative studies. Based on our staged data extraction process, ten of these were eligible for inclusion in the qualitative evidence synthesis. One qualitative study included data that could not be separated from other written sources of data and thus, was not eligible for inclusion in the synthesis. Thus, these ten qualitative studies and the nine mixed methods studies combined to create the group of 19 studies included in the qualitative synthesis.

Participants

Studies collected data from respondents of various types and grades. Sixty-seven included faculty staff in post-training roles only, 47 included trainee clinicians, 32 included both faculty staff and trainees, and in two studies details about respondents were not reported.

Delivered Interventions

Most interventions consisted of multiple components. Of the 148 studies included, 59 reported interventions aimed at trainees, 38 at junior faculty, and four aimed at senior faculty, including leaders and managers. The remaining studies reported interventions aimed at a mixed population (trainees and junior faculty: 22; trainees and any faculty: 8; junior and senior faculty: 16; clinical researchers in hospital departments: 1).

The majority of studies reported interventions that were not targeted at a specific demographic group. Of those studies that did have a specified target population (n=35), 20 were aimed at women, and nine at individuals from ethnic groups underrepresented in medicine. A further four were targeted at women and individuals from a minority ethnic background, or more generally at any population group historically underrepresented in medicine. One intervention was for “busy clinician educators” and another targeted junior faculty staff with substantial caregiving challenges.

3a) Detailed study characteristics - Studies included within synthesis of quantitative data

In accordance with the methods described above, only controlled quantitative studies were eligible for inclusion in the evidence synthesis.

Year of publication and study setting

We synthesised quantitative data from 30 studies that were published between 2006 and 2020. Of these, 26 were conducted in the USA (Brandt et al., 2018; Campion et al., 2016; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Ehlers et al., 2018; Emans et al., 2008; Goldenberg et al., 2012; Grisso et al., 2017; Guevara et al., 2018; Harrison et al., 2020; Joshua Smith et al., 2014; Khot et al., 2011; Kohlwes et al., 2006; Kohlwes et al., 2016; Libby et al., 2016; Mandel et al., 2018; Mills et al., 2011; Nasab et al., 2019; Ockene et al., 2017; Patel et al., 2018; Ries et al., 2009; Ries et al., 2012; Sheridan et al., 2010; Valantine et al., 2014; Winn et al., 2018). Two studies were conducted in Canada (Klimas et al., 2017; Merani et al., 2014), one in Australia (Sweeny et al., 2019), and one in Germany (Löwe et al., 2008). Twenty-three interventions were single centre programmes (i.e. within individual institutions), and seven were national programmes that were available across

multiple institutions within the same country. Six out of seven national programmes were set in North America (USA: 4 and Canada: 2) and one in Australia.

Study design

All 30 studies incorporated a control group. Of these, there was one RCT (Grisso et al., 2017), two studies with a case-control design (Goldenberg et al., 2012; Ries et al., 2012) and 27 studies with a cohort design (Brandt et al., 2018; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Ehlers et al., 2018; Emans et al., 2008; Harrison et al., 2020; Joshua Smith et al., 2014; Khot et al., 2011; Klimas et al., 2017; Kohlwes et al., 2006; Kohlwes et al., 2016; Libby et al., 2016; Löwe et al., 2008; Mandel et al., 2018; Merani et al., 2014; Mills et al., 2011; Nasab et al., 2019; Ockene et al., 2017; Patel et al., 2018; Ries et al., 2009; Sheridan et al., 2010; Sweeny et al., 2019; Valantine et al., 2014; Winn et al., 2018), including two studies which used a mixed methods approach (Campion et al., 2016; Guevara et al., 2018).

Participants

The population studied was varied, especially in terms of grade of clinicians, academic level of clinicians and medical background of clinicians included (see Appendix 3). Due to this high degree of variability, it was often difficult to determine the exact population investigated. The majority of studies (14/30) focused solely on post-training CAs (Campion et al., 2016; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Emans et al., 2008; Grisso et al., 2017; Khot et al., 2011; Kohlwes et al., 2016; Libby et al., 2016; Mandel et al., 2018; Ockene et al., 2017; Ries et al., 2012; Sheridan et al., 2010; Valantine et al., 2014), whilst 11 papers studied just trainees (Brandt et al., 2018; Ehlers et al., 2018; Goldenberg et al., 2012; Harrison et al., 2020; Joshua Smith et al., 2014; Klimas et al., 2017; Kohlwes et al., 2006; Löwe et al., 2008; Merani et al., 2014; Mills et al., 2011; Winn et al., 2018), three included mixed populations (Guevara et al., 2018; Nasab et al., 2019; Patel et al., 2018) and two were unclear/not reported (Ries et al., 2009; Sweeny et al. 2019).

For the majority of studies, the academic level of participants was unclear or not reported. Where information was provided, the majority included participants with a mix of academic levels. There was considerable diversity in the clinical specialities involved in the studies (see Appendix 3).

Delivered Interventions

Studies encompassed a range of diverse interventions and development programmes. The majority of studies evaluated interventions involving a complex organisation of various elements such as mentoring, protected research time, leadership training and teaching workshops. Academic training programmes tended to focus on advancing academic skills, productivity and interest for trainees, whilst career/faculty development programmes centred on enhancing junior/senior faculty workforce within clinical academia through promotion, retention and recruitment. Twelve studies featured academic training programmes (Brandt et al., 2018; Ehlers et al., 2018; Goldenberg et al., 2012; Joshua Smith et al., 2014; Khot et al., 2011; Klimas et al., 2017; Kohlwes et al., 2006; Kohlwes et al., 2016; Löwe et al., 2008; Merani et al., 2014; Mills et al., 2011; Patel et al., 2018), whilst ten studies evaluated career/faculty development programmes (Campion et al., 2016; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Emans et al., 2008; Grisso et al, 2017; Guevara et al., 2018; Ries et al., 2009; Ries et al., 2012; Valantine et al., 2014).

The remaining eight studies included interventions that were directed more to enhancing CA careers via specific intervention elements. There were three programmes that focused solely on mentorship (Libby et al., 2016; Nasab et al., 2019; Ockene et al., 2017), two research-tailored curriculum programmes (Harrison et al., 2020; Mandel et al., 2018), two support network programmes (Sweeny et al., 2019; Winn et al., 2018), and one intervention which exclusively centred on recruitment training to improve diversity in clinical academia (Sheridan et al., 2010). Although the support network programmes involved mentoring, we

considered them to be different from the mentorship-focused programmes as they provided a greater emphasis on enhancing careers through collaborative work from outside supporters, who were not necessarily mentors.

Of the three studies that evaluated mentorship-specific programmes, one study focused on junior/senior mentorship (Nasab et al., 2019), one emphasised peer-mentorship (Ockene et al., 2017), whilst the third integrated both types of mentorship (Libby et al., 2016). The mentorship programmes studied by Libby et al. (2016) and Ockene et al. (2017) were designed specifically for junior faculty, whereas Nasab et al. (2019) studied a programme that aimed to support trainees as well as junior faculty in Obstetrics and Gynaecology. All three programmes prioritised development through the form of dedicated mentoring with the aim of increasing productivity and promotion for people within clinical academia.

Although most of the interventions (22/30) were not aimed towards a specific group in terms of population characteristics (Brandt et al., 2018; Campion et al., 2016; Ehlers et al., 2018; Goldenberg et al., 2012; Harrison et al., 2020; Joshua Smith et al., 2014; Khot et al., 2011; Klimas et al., 2017; Kohlwes et al., 2006; Kohlwes et al., 2012; Libby et al., 2016; Löwe et al., 2008; Mandel et al., 2018; Merani et al., 2014; Mills et al., 2011; Nasab et al., 2019; Ockene et al., 2017; Patel et al., 2018; Ries et al., 2009; Ries et al., 2012; Sweeny et al., 2019; Winn et al, 2018), four were focused upon gender (and tailored specifically to women) (Chang et al., 2016; Dannels et al., 2008; Grisso et al., 2017; Valantine et al., 2014), two were aimed at ethnicity/underrepresented minority (URM) faculty in medicine (Daley et al., 2006; Guevara et al., 2018), and two were aimed at historically underrepresented faculty including women and URM populations (Emans et al., 2008; Sheridan et al., 2010).

3b) Detailed study characteristics - Studies included within synthesis of qualitative data

Year of publication and study setting

We synthesised qualitative findings from 19 studies published between 2008 and 2019, which focused on a diverse range of interventions and initiatives. Both papers by DeCastro et al. (DeCastro et al., 2013a; DeCastro et al., 2013b) and Klimas et al. (Klimas et al., 2017a; Klimas et al., 2017b) were based on data collected from a single sample of respondents.

Five studies were from Canada (Archibald et al., 2017; Hayward et al., 2011; Klimas et al., 2017a; Klimas et al., 2017b; Moss et al., 2008) and three from the UK (Caffrey et al., 2016; Darbyshire et al., 2019; Iversen et al., 2014). The other 11 studies all reported on interventions from the USA. Eleven studies were national level initiatives (Caffrey et al., 2016; Comeau et al. 2017; Darbyshire et al., 2019; DeCastro et al., 2013a; DeCastro et al., 2013b; Guevara et al., 2018; Hayward et al. 2011; Helitzer et al., 2016; Iversen et al., 2014; Jones et al., 2019; Lin et al., 2019) and eight were programmes implemented in single institutions only (Archibald et al., 2017; Campion et al., 2016; Klimas et al., 2017a; Klimas et al., 2017b; Kraemer et al., 2018; Moss et al., 2008; Reader et al., 2015; Stubbe et al. 2008).

Study design

Ten of the included papers were based on research that collected data using a qualitative methodology only (Archibald et al., 2017; DeCastro et al., 2013a; DeCastro et al., 2013b; Helitzer et al., 2016; Jones et al., 2019; Klimas et al., 2017a; Klimas et al., 2017b; Lin et al., 2019; Moss et al., 2008; Stubbe et al. 2008). Eight papers reported qualitative findings from studies that adopted a mixed/multiple methods approach (Campion et al., 2016; Comeau et al., 2017; Darbyshire et al., 2019; Hayward et al., 2011; Iversen et al., 2014; Kraemer et al., 2018; Reader et al., 2015; Guevara et al., 2018), and one was described as a realist evaluation (Caffrey et al., 2016).

Participants

There was considerable diversity across included studies in terms of the types of respondents from whom qualitative data were collected. Seven studies collected data from intervention participants only (Comeau et al., 2017; Helitzer et al., 2016; Jones et al., 2019; Kraemer et al., 2018; Moss et al., 2008; Reader et al., 2015; Stubbe et al., 2008). One study collected qualitative data from Academic Foundation Programme (AFP) supervisors only (Darbyshire et al., 2019) and another used a sample of Clinician Investigator Program (CIP) faculty including programme directors (Hayward et al., 2011). In another six studies, qualitative data were collected from a varied mix of respondents including intervention participants, intervention staff, and other key stakeholders (Archibald et al., 2017; Caffrey et al., 2016; Campion et al., 2016; Iversen et al., 2014; Klimas et al., 2017a; Klimas et al., 2017b). The sample used by DeCastro et al. (2013a,2013b) included both mentees and mentors. Guevara et al. (2018) interviewed both programme scholars and unsuccessful applicants. Finally, Lin et al. (2019) interviewed members of a national women-focused organisation for academic emergency physicians, with over half of the sample comprising present or past leaders of the organisation.

Delivered Interventions

Of the 19 papers, nine were studies of initiatives aimed broadly at career/faculty development (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Guevara et al., 2018; Helitzer et al., 2016; Jones et al., 2019; Kraemer et al., 2018; Lin et al., 2019; Reader et al., 2015). Four had a primary focus on mentoring (DeCastro et al., 2013a; DeCastro et al., 2013b; Iversen et al., 2014; Moss et al., 2008); another five were focused on academic training programmes for trainee clinicians such as foundation doctors and residents (Darbyshire et al., 2019; Hayward et al., 2011; Klimas et al., 2017a; Klimas et al., 2017b; Stubbe et al., 2008) and one examined the UK Athena SWAN gender equity programme (Caffrey et al., 2016).

Of the studies reporting career/faculty development initiatives, seven focused on a single initiative that largely aimed to build capacity in relation to research and academic scholarship or improve understanding of academic careers (Archibald et al., 2017; Campion et al., 2016; Guevara et al., 2018; Jones et al., 2019; Kraemer et al., 2018; Lin et al., 2019; Reader et al., 2015). Helitzer et al. (2016) examined the impact of three different national career development programmes. The study by Comeau et al. (2017) evaluated two nationally funded K award programmes, one based in a single institution and the other implemented by the same institution as part of a consortium. K awards are career development awards that provide mentorship, protected research time and research funding. The primary focus of the evaluation was the KL2 career development programme implemented by the consortium, which provided protected time for mentored, didactic research training. Not all included papers reported in detail on the structure of interventions, but most appeared to involve multiple components, such as protected time, a funding award, mentoring and teaching sessions or workshops.

Seven of the career/faculty development interventions were post-training initiatives for junior and/or senior faculty staff (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Helitzer et al., 2016; Jones et al., Lin et al. 2019; Reader et., 2015). Participants in one programme were a mix of faculty staff and trainee clinicians (residents and fellows) (Guevara et al., 2018). The programme evaluated by Kraemer et al. (2018) was aimed at trainee clinicians only.

Out of the four studies on mentoring, two focused on mentoring of junior CAs by senior colleagues (DeCastro et al., 2013b; Iversen et al., 2014). One had a specific focus on peer group mentoring only (Moss et al., 2008), and one reported findings related to both peer and junior/senior mentoring arrangements (DeCastro et al., 2013a). The UK study by Iversen et al. (2014) focused on the Academy of Medical Sciences mentoring scheme.

The five academic programmes for trainee clinicians provided clinical and research training of various types. Klimas et al. (2017a,2017b) focused on combined research and clinical training in addiction medicine. Darbyshire et al. (2019) focused on the UK's AFP, and Stubbe et al. (2008) examined integrated research pathway programmes in child and adolescent psychiatry. Finally, Hayward et al. (2011) studied the Canadian CIP, which is a postgraduate medical education pathway that provides integrated clinical and research training for residents.

Several of the career/faculty development initiatives were targeted at a specific group of CAs. Two were aimed at women (Helitzer et al., 2016; Lin et al., 2019), one at individuals from ethnic groups underrepresented in medicine (Guevara et al., 2018) and another at "busy clinician educators" (Reader et al., 2015). In addition, Jones et al. (2019) reported on an intervention targeted at junior faculty physician–scientists who experienced substantial caregiving challenges. The programme was open to both men and women, but notably 85% of awardees were women.

Study quality assessments

Quality assessment was performed for all studies to be included in the syntheses: studies using quantitative methods which included a control group and studies using qualitative methods to evaluate the interventions. In total, 47 studies were quality assessed:

- one RCT (included within the quantitative analysis),
- two case-control studies (included within the quantitative analysis),
- 25 cohort studies (included within the quantitative analysis),
- 16 studies using qualitative methodology of which ten used qualitative methods only and six were non-controlled mixed methods studies from which only the qualitative findings were extracted and synthesised, (included within the qualitative analysis),
- one realist evaluation (included within the qualitative analysis), and
- two controlled mixed methods studies (included within both analyses).

Randomised control trial

We used the Cochrane risk of bias tool (Higgins et al., 2011) to assess the quality of the one eligible RCT (Grisso et al., 2017), as seen in Table 1 (Appendix 4).

The RCT by Grisso et al. (2017) was judged low risk of bias as it used random sequence generation, research participants who were blinded to participant status to assess the outcome data, and incomplete data were minimal and similar for intervention and control groups. In contrast, participants allocated to the intervention and control groups were not blinded, which results in a risk of performance bias whereby knowledge of group allocation could influence subsequent outcomes. This is difficult to avoid given that participants would have known whether they took part in a long-term multi-faceted faculty development programme or not; nonetheless, risk of performance bias should be acknowledged. This study was also judged at high risk of bias for the 'other bias' domain as it used a cluster-randomised technique which can lead to recruitment bias whereby individuals are recruited to a trial after assigning cluster groups and knowledge of the allocation could affect the types of participants recruited. There was no clear description of how participants were allocated to each group and there was no protocol to compare against to assess selective outcome reporting; therefore, these domains were judged unclear.

Case-control studies

There were two non-randomised case-control studies assessed using the Newcastle-Ottawa case-control inventory (Wells et al., 2012). Table 2 (Appendix 4) shows the quality assessment for the two case-control studies (Goldenberg et al., 2012; Ries et al., 2012).

Both studies scored highly on four items: they both used appropriate community controls (i.e., trainees/faculty from the same departments as the intervention participants), whilst the method of ascertainment of exposure and non-response rate was the same for intervention and control groups in both studies. For both studies, record linkage or self-report methods were used to determine which groups participants were enrolled in.

Goldenberg et al. (2012) was judged poor quality for representativeness of cases due to a risk of selection bias as intervention participants were selected based on criteria including experience and career ambitions, whilst Ries et al. (2012) used consecutively representative cases and was judged high quality. Comparability also differed between these studies: Goldenberg et al. (2012) did not adjust for any type of factor when comparing intervention and control groups and so was deemed poor on this item, whereas Ries et al. (2012) did match for key characteristics such as gender and academic rank. When assessing the actual method used to determine ascertainment of exposure, Ries et al. (2012) continued to score highly with using secure records in the form of a faculty database, whilst Goldenberg et al. (2012) used self-reports which were deemed medium quality. Overall, the majority of items on the scale were judged positively for both studies.

Cohort studies

Twenty-five non-randomised cohort studies were assessed using the Newcastle-Ottawa cohort inventory (Wells et al., 2012). Table 3 (in Appendix 4) shows the quality assessment for these cohort studies (Brandt et al., 2018; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Ehlers et al., 2018; Emans et al., 2008; Harrison et al., 2020; Joshua Smith et al., 2014; Khot et al., 2011; Klimas et al., 2017; Kohlwes et al., 2006; Kohlwes et al., 2016; Libby et al., 2016; Löwe et al., 2008; Mandel et al., 2018; Merani et al., 2014; Mills et al., 2011; Nasab et al., 2019; Ockene et al., 2017; Patel et al., 2018; Ries et al., 2009; Sheridan et al., 2010; Sweeny et al., 2019; Valantine et al., 2014; Winn et al., 2018).

The majority of studies were deemed high quality for including representative populations, selecting appropriate non-exposed control cohorts, appropriately ascertaining exposure information, obtaining assessment of outcomes via record linkage and including long enough follow-up times. In contrast, demonstration of outcomes not being present before the start of the study, and comparability of cohorts, were judged poor quality for the majority of studies. This is because there may have been differences in outcomes at baseline, and intervention and control groups were not matched.

Ehlers et al. (2018) was the only cohort study to receive high quality judgements for all items on the NOS. Chang et al. (2016) and Ries et al. (2009) were judged positively within the quality assessment on seven out of eight items and were considered high quality, though they provided no description relating to cohort follow-up. Overall, for 20 of the studies, the majority of individual items were judged high quality (Brandt et al., 2018; Chang et al., 2016; Daley et al., 2006; Dannels et al., 2008; Ehlers et al., 2018; Harrison et al., 2020; Joshua Smith et al., 2014; Khot et al., 2011; Kohlwes et al., 2006; Kohlwes et al., 2016; Libby et al., 2016; Löwe et al., 2008; Mandel et al., 2018; Merani et al., 2014; Mills et al., 2011; Ockene et al., 2017; Patel et al., 2018; Ries et al., 2009; Sheridan et al., 2010; Sweeny et al., 2019), one study had an even number of high and low quality judgements (Nasab et al., 2019), whilst the majority of items were judged a combination of medium, poor and unclear for the

other four studies (Emans et al., 2008; Klimas et al., 2017; Valantine et al., 2014; Winn et al., 2018).

In addition to the results from formal quality assessments, several issues regarding the quality of reporting became apparent when extracting data. For example, incomplete outcome reporting in Mandel et al. (2018) hindered data extraction. Similarly, we identified a possible bias in some studies which used highly motivated groups or participants who aimed to take part in a particular programme but didn't get accepted, as their control group. For example, Dannels et al. (2008) compared female faculty who took part in a development programme against women who applied for the programme but didn't get accepted. This type of design raises the question of whether there was a reason why certain groups were not accepted onto an intervention programme. Such interventions and control groups are consequently not directly comparable which could lead to biased results that may have been caused by baseline differences.

Studies using qualitative methodology

Ten studies utilising a qualitative methodology were assessed using the QARI tool (Joanna Briggs Institute, 2014) (Archibald et al., 2017; DeCastro et al., 2013a; DeCastro et al., 2013b; Helitzer et al., 2016; Jones et al., 2019; Klimas et al., 2017a; Klimas et al., 2017b; Lin et al., 2019; Moss et al., 2008; Stubbe et al., 2008). The QARI tool was also used to assess six non-controlled mixed methods studies from which only the qualitative findings were extracted and synthesised (Comeau et al., 2017; Darbyshire et al., 2019; Hayward et al., 2011; Iversen et al., 2014; Kraemer et al., 2018; Reader et al., 2015).

Assessments of the 16 studies against the QARI criteria are shown in Table 4 (Appendix 4). It shows that only one study met all ten appraisal criteria (Jones et al., 2019). DeCastro et al. (2013a) met nine out of the ten criteria and both DeCastro et al. (2013b) and Reader et al. (2015) met eight. A further seven studies had positive ratings for seven criteria (Archibald et al., 2017; Comeau et al., 2017; Darbyshire et al., 2019; Helitzer et al, 2016; Klimas et al., 2017b; Kraemer et al., 2018; Lin et al, 2019), and Klimas et al. (2017a) was rated positively for six criteria. The studies by Hayward et al. (2011) and Iversen et al. (2014) each met five criteria and Moss et al. (2008) met four criteria. The study by Stubbe et al. (2018) was rated as meeting only one of the QARI criteria.

Inadequate reporting of key information was a central issue across most papers, which precluded positive assessments for multiple criteria. Only Jones et al. (2019) reported any detail locating the researchers culturally or theoretically. Broader reflexivity was also often lacking, with only four papers providing any reflection on the potential influence of the researchers on the research process and vice-versa (DeCastro et al, 2013a; DeCastro et al., 2013b; Jones et al., 2019; Moss et al., 2008). Furthermore, it was not possible to determine from the information provided in 12 studies whether there was congruity between the researchers' philosophical perspective and the research methodology used (Archibald et al., 2017; Comeau et al., 2017; Darbyshire et al., 2019; DeCastro et al., 2013b; Hayward et al., 2011; Iversen et al., 2014; Klimas et al., 2017a; Klimas et al., 2017b; Kraemer et al., 2018; Lin et al., 2019; Moss et al., 2008; Stubbe et al., 2008) In most cases, we did judge there to be congruity between the research methodology used and: (i) the research question or objectives (ii) data collection methods (iii) data analysis and representation (iv) interpretation of results. However, all four of these congruity related criteria were assessed as 'unclear' in the study by Stubbe et al. (2008) owing to the lack of methodological details reported. Similarly, two of the four criteria were rated as 'unclear' in the studies by Iversen et al. (2014) and Moss et al. (2008). One of the four criteria was judged to be 'unclear' in the study by Hayward et al. (2011). Almost all studies reported having ethical approval, but it was less

common for authors to comment on adherence to key ethical principles in research such as gaining informed consent from participants and ensuring confidentiality.

Realist Evaluation

The realist evaluation by Caffrey et al. (2016) was assessed using the RAMESES II Quality Standards for Realist Evaluation tool (Wong et al., 2017). As Table 5 (see Appendix 4) shows, the evaluation was rated as 'adequate' or 'good' for the majority of the quality standards criteria. The study was assessed as 'inadequate' for three out of the 13 criteria, which related to the description and refinement of programme theory, and aspects of data analysis.

Mixed methods studies

The controlled mixed methods studies by Campion et al. (2016) and Guevara et al. (2018) were assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018), and the ratings are reported in Table 6 (Appendix 4). Both studies met the majority of the MMAT criteria (11/15 criteria for Campion et al., 2016 and 13/15 for Guevara et al., 2018). In terms of the criteria we assessed as not having been met, the paper by Campion et al. (2016) did not report complete outcome data. As a result of the lack of complete outcome data, it also had to be assessed as not adhering fully to the quality criteria of both methodological approaches used in the study. Guevara et al. (2018) did not provide an adequate rationale for using a mixed methods design. In both papers, it was unclear whether the intervention was administered as intended, and in the Campion et al. (2016) study, it was difficult to judge whether the outputs of the qualitative and quantitative integration were adequately interpreted.

Synthesis of quantitative data

We identified eight broad outcome categories relating to CA careers: aspiration, satisfaction, skills & knowledge, funding, research participation, recruitment, retention/promotion, and publication outcomes. A wide range of outcome measures were included within each category (see Appendix 5).

Aspiration

Although several studies focused on interventions that aimed to improve clinicians' perceptions of, and increase interest in, CA careers, only one study included a measure of aspiration (Dannels et al., 2008). Dannels et al. (2008) found that the percentage of female faculty who aspired to achieve a higher leadership position within academic medicine was significantly higher for faculty who took part in the Executive Leadership in Academic Medicine (ELAM) programme versus two control groups: matched faculty who applied to the programme but didn't get accepted (who they report were matched on their "aspiration to leadership"), and mid-career faculty women identified from a faculty roster database (76.4% vs 63.0% vs 49.4%, p=0.002).

Career satisfaction

We extracted a total of seven outcomes broadly relating to career satisfaction from three studies (Campion et al., 2016; Grisso et al., 2017; Winn et al., 2018). Grisso et al. (2017) assessed changes in work self-efficacy and three measures relating to work-family conflict and work culture (see Appendix 5), between junior faculty who were randomised to a multi-faceted faculty development programme versus non-participants. Similarly, Campion et al. (2016) compared overall career satisfaction between junior faculty who attended a faculty development programme versus an "equivalent" reference group who didn't take part in the programme. In contrast, Winn et al. (2018) assessed a support network intervention in the

form of resident academies (scholarly homes), comparing participants' feelings of support in presenting scholarly projects and making career decisions.

We found that, despite the majority of outcomes showing favourable results towards the intervention groups, there was no single outcome which demonstrated a significant difference between the interventions and respective control groups.

Skills and Knowledge

Four studies reported on a total of eight outcomes relating to skills and knowledge (see Appendix 5). Outcomes included clinical/research competence scores (Kohlwes et al., 2006; Löwe et al., 2008), percentage of people learning how to present a poster, give a talk/presentation and feel prepared for scholarly work post-residency (Winn et al., 2018), change in methodological research knowledge (Löwe et al., 2008), and knowledge, skills and attitudes scores alongside sense of community scores (Campion et al., 2016).

Both studies measuring competence scores were significantly in favour of the intervention groups (Kohlwes et al., 2006; Löwe et al., 2008). Winn et al. (2018) used a residency assessment survey and found that significantly more participants agreed or strongly agreed that they had learned how to give a talk/presentation from attending support networks in the form of scholarly homes versus participants who completed residency before the introduction of these additional support networks (75% vs 36%, $p=0.02$). However, the percentage of participants agreeing with learning how to present a poster or feeling prepared for post-residency scholarly work wasn't significantly different between intervention and control (Winn et al., 2018). Löwe et al. (2008) found that change in methodological research knowledge was significantly in favour of participants who attended a residency training programme versus non-participants ($p<0.001$). In contrast, Campion et al. (2016) found no significant benefits of the Academy for Collaborative Innovation and Transformation (ACIT) faculty development programme for improving sense of community scores, and no significance value was reported for change in knowledge, skills and attitudes scores.

Funding

Six studies reported on ten outcomes relating to research funding (Appendix 5). Outcomes included number of successful grant applications or percentage of people receiving a grant (Goldenberg et al., 2012; Grisso et al., 2017; Guevara et al., 2018; Libby et al., 2016; Löwe et al., 2008; Sweeny et al., 2019), amount of funding awarded (Goldenberg et al., 2012; Guevara et al., 2018; Libby et al., 2016), and successful grants as a proportion of submitted grant proposals (Libby et al., 2016).

Of the ten outcomes from six studies reporting on differences between the intervention and control groups in the number of funded grants or percentage of people with a successful grant application, three studies showed a statistically significant benefit of the intervention (Guevara et al., 2018. Libby et al., 2016. Löwe et al., 2008). Two of these were evaluations of programmes combining mentorship and research training (Libby et al., 2016., Löwe et al., 2008) and one study evaluated a faculty development programme including a funding award (Guevara et al., 2018). Two results were not statistically significant (Goldenberg et al., 2012; Grisso et al., 2017) and for one study no statistical analysis was reported (Sweeny et al., 2019). Three studies reported that amount of funding received was greater among intervention than control groups and two of these findings were statistically significant (Guevara et al., 2018; Libby et al., 2016). Libby et al. (2016) found no difference in the success rate of submitted grant proposals after participation in a mentorship programme.

Research participation

Eight studies reported on 20 outcomes relating to participation in research, such as time spent doing research, or participation in research activities such as writing papers, applying for funding, or presenting research findings (see Appendix 5).

Two studies showed an increase in involvement in research for participants of a multi-faceted training programme compared to control groups (Brandt et al., 2018; Goldenberg et al., 2012), while one study of a similar programme did not find a difference (Kohlwes et al., 2016). The study by Sweeny et al. (2019) found a potential benefit of a research support network for increasing research participation, but no statistical analysis was provided. Mandel et al. (2018) reported a positive effect of a research-tailored curriculum intervention with more residency graduates taking part in clinical research or current academic practice but not basic or translational science; although results of this evaluation were not clearly reported.

Two out of three measures relating to grant submissions did not show any difference between groups in two evaluations of interventions that included comprehensive research training (Harrison et al., 2020; Löwe et al., 2008). Some studies reported a positive correlation between participation in interventions which included research training and delivering presentations (Harrison et al., 2020; Löwe et al., 2008; Sweeny et al., 2019), although there was no statistical analysis reported for the study by Sweeny et al. (2019). For participants currently writing a book article or book chapter, no statistically significant difference was found for a resident training programme (Löwe 2008).

Recruitment

Nine studies reported 35 different outcomes relating to recruitment in academia and achievement of a specific academic level (Appendix 5).

Two studies investigated the relationship between training programmes offering protected research time and employment in academia at any level. Both reported that participants in the intervention group were more likely to enter a first job in academic practice (Brandt et al., 2018; Joshua Smith et al., 2014), although one of them found no difference in ‘ever held a full-time academic appointment’ (Brandt et al., 2018).

Several studies showed that intervention participants were more likely to achieve a senior rank, either through recruitment or promotion, than those who did not participate in the intervention. This was the case for achieving the rank of chair or above in a faculty development programme (Dannels et al., 2008) and the time taken to achieve the ranks of professor or chair (Khot et al., 2011) and assistant professor (Goldenberg et al., 2012) in two training programmes. Khot et al. (2011) also found that participants of an academic training programme were more likely to be appointed at top 10 or top 20 ranked medical schools compared to non-participants. For several estimates, no results of statistical analyses were reported, even though the direction of effect suggested a benefit of the interventions (Dannels et al., 2008; Sweeny et al., 2019).

Percentages of female faculty increased as a result of two interventions aimed at improving diversity (Sheridan et al., 2010; Valantine et al., 2014), although not all of these findings were statistically significant when investigated by academic level. For example, Valantine et al. (2014) found statistically significant increases in the percentage of female faculty recruited at full professor level, for faculty who took part in a faculty development programme compared to peer and national non-participants, but no significant increase was found at assistant or associate professor level. One study found that, in the intervention group receiving support through research training and mentoring, the percentage of women at

different academic levels increased more than in the control group (Emans et al., 2008). However, this finding was only statistically significant for the associate professor rank ($p=0.023$). The same study reported either no difference or a small change in the percentage of staff who belong to an underrepresented minority or who are Asian, depending on academic rank.

Retention and promotion

Ten studies reported on 28 outcomes relating to retention in academia, or promotion to a higher level in academia (see Appendix 5).

For two studies of the same faculty development programme (National Center of Leadership in Academic Medicine (NCLAM) programme), retention of staff in academic medicine was higher for the intervention than the control groups (Ries et al., 2009; Ries et al., 2012), while studies of two academic training programmes (Ehlers et al., 2018; Kohlwes et al., 2016) and one career/faculty development programme (Guevara et al., 2018) reported no statistically significant differences. Kohlwes et al. (2016) did find that research experience during residency positively influenced the career choice of residents. In other words, residents were more likely to choose to stay in academia after taking part in the programme. Findings were less clear for the influence of being successful in conduct and publication of research on career choice (Kohlwes et al., 2016).

For programmes dedicated to improving diversity in clinical academia, Daley et al. (2006) reported no statistically significant difference in retention of underrepresented minorities as a result of participation in a research programme for URM faculty. In contrast, Chang et al. (2016) reported on a faculty development programme aimed at women which found higher retention rates for assistant professors, associate professors, and full professors in the short term and after ten years.

Three studies reported mixed findings on change in academic promotions (Emans et al., 2008; Guevara et al., 2018; Ockene et al., 2017). One study of a peer mentoring programme found a higher rate of promotion to associate professor among intervention participants than in the control group (Ockene et al., 2017), while another study found no statistically significant difference for overall promotions among those who had received research funding (Guevara et al., 2018). Both of these studies adjusted for time in academic rank. The third study found an increase in promotions among men, women, and underrepresented minorities who take part in a faculty development programme, but authors did not report results of statistical analyses (Emans et al., 2008).

Publications

Fourteen studies reported 41 outcomes relating to publications (see Appendix 5).

All 14 studies included a measure of the number of publications during the intervention or within the five years after, as an indicator of publication productivity. Nine studies found that the intervention was associated with higher publication productivity in the short term ($p<0.05$) (Brandt et al., 2018; Ehlers et al., 2018; Goldenberg et al., 2012; Joshua Smith et al., 2014; Kohlwes et al., 2016; Löwe et al., 2008; Merani et al., 2014; Mills et al., 2011; Nasab et al., 2019). All of these were academic training programmes, except for one study of a mentorship programme (Nasab et al., 2019).

Findings were not statistically significant for two studies of faculty development programmes (Grisso et al., 2017; Guevara et al., 2018), a research-tailored curriculum (Harrison et al., 2020), and an academic training programme (Klimas et al., 2017).

For one study of an academic training programme, no results of statistical analyses were reported (Patel et al., 2018). One study reported on publication productivity during participants and non-participants' careers after implementation of an academic training programme, and found that increased productivity for the intervention group continued over time (Brandt et al., 2018).

Five studies reported on differences between intervention and control groups in the number of first-author publications in the short term. Results from three studies evaluating academic training programmes suggested a benefit of the intervention (Ehlers et al., 2018; Joshua Smith et al., 2014; Merani et al., 2014), while results from two studies focusing on women's professional development (Grisso et al., 2017) and an academic training programme (Löwe et al., 2008) did not show a statistically significant difference.

Four studies used H-index and journal Impact Factor scores as indicators of publication impact. Ehlers et al. (2018) found that the H-index score was higher in the intervention group participating in an academic training programme than the control group, while a similar result suggesting a benefit of the intervention was not statistically significant in the study of a faculty development programme by Guevara and colleagues (2018). As for the two studies reporting on journal impact factors, one study of a mentorship programme found no statistically significant difference (Nasab et al., 2019) while the other study found that the impact factor of published papers was higher in the group participating in an academic training programme (Joshua Smith et al., 2014).

Other measures for which no differences were found between intervention and control groups included peer review of journal articles (Grisso et al., 2017) and publications of literature reviews and books (Löwe et al., 2008).

Synthesis of qualitative data

The following sections present the key themes identified from the main findings reported in included studies. The themes we present relate predominantly to three broad areas: professional and personal impacts or benefits of interventions; views of participants about specific intervention components or content; factors influencing intervention participation, experiences, and success.

Developing knowledge, skills and confidence in research and scholarship

Participants in seven studies reported improvements in research/scholarship knowledge and skills, and their confidence to conduct research activities, from the planned teaching or learning sessions of programmes (Archibald et al., 2017; Campion et al., 2016; Comeau et al., 2017; Helitzer et al., 2016; Klimas et al., 2017a; Moss et al., 2008; Reader et al., 2015).

Various components and specific content of individual programmes were mentioned by respondents across three studies as being useful for developing research/scholarship knowledge and skills (Comeau et al., 2017; Moss et al., 2008; Reader et al., 2015). For example, positive views were expressed about the didactic content offered in the career/faculty programmes evaluated by both Comeau et al. (2017) and Reader et al. (2015). The didactic sessions that were considered by respondents in the study by Reader et al. (2015) to have been most helpful in improving their research-related skills focused on conducting a literature review, survey methodology and reference management. The programme also employed a coordinator who provided individual research-focused coaching to participants. Their involvement in the programme was highly valued by participants.

"The coordinator was an absolute incredible value to this faculty development and to the overall aid of the project." (Reader et al., 2015).

In addition, respondents in the study by Reader et al. (2015) valued having individual consultations with a visiting professor who also presented seminars and gave feedback on research projects.

The formal didactic curriculum in the KL2 programme evaluated by Comeau et al. (2017) was highly regarded. Programme scholars valued the opportunity they gained to develop critical research skills, which had not been taught in previous clinical or research training. Knowledge and skills specifically mentioned as being beneficial included: grant writing and management; development of a research timeline, and information on funding sources. Several participants reported that the course curriculum had provided the foundation for successful grant applications in the second year of the programme (Comeau et al. 2017).

Moss et al. (2008) reported that programme participants particularly valued having sessions on supervising residents and creating a teaching dossier. They also believed it important to have an improved understanding about the functioning of clinical and academic systems.

Scholars of the programme evaluated by Guevara et al. (2018) reported an unmet need for advice and skill development in a number of areas including negotiation, grant management, and work-life balance. They also highlighted a need for advice about coping with a lack of faculty diversity and dealing with unconscious bias.

At a whole programme level, faculty staff believed that the Canadian CIP, which has a structured programme of research training, was successful at developing highly skilled clinical investigators (Hayward et al., 2011).

In addition to gaining greater confidence in conducting research-related activities, participants across included studies also often spoke of developing confidence in relation to other aspects of their careers from specific interventions or intervention components. This will be discussed further in the sections that follow.

Leadership skills and opportunities

Four studies reported positive findings about the leadership skills or opportunities that intervention participants gained (Campion et al., 2016; Guevara et al., 2018; Helitzer et al., 2016; Lin et al., 2019). For example, some respondents in the study by Lin et al. (2019) gained leadership experience through involvement with a women-focused national organisation at an earlier stage in their career than had been anticipated, and in some cases, this helped them earn promotion. Individuals in two studies had decided to pursue new leadership opportunities, or progress their careers in other ways, as a result of gaining greater self-confidence from participating in faculty development programmes (Campion et al., 2016; Helitzer et al., 2016).

Personal characteristics and behaviour of individuals

The personal characteristics and behaviour of individuals were described as a key factor that influenced the decision to initially apply to a programme and/or participants' programme experiences in six studies (Darbyshire et al., 2019; Decastro et al., 2013a; Helitzer et al., 2016; Iversen et al., 2014; Klimas et al., 2017b; Stubbe et al., 2008). This included participants' level of personal ambition, enthusiasm, motivation, self-direction, interest and commitment to the programme (Darbyshire et al., 2019; Helitzer et al., 2016; Klimas et al., 2017b; Stubbe et al., 2008).

Some participants in the UK Academy of Medical Sciences mentoring scheme reported less successful relationships with mentors (Iversen et al. 2014). They reported that this was due, at least in part, to mentees not having been sufficiently proactive in arranging meetings and maintaining contact with mentors.

"Partly my own fault, but I have not been proactive in asking to meet with the mentor specifically to discuss career progression..." (Iversen et al., 2014)

Another said: *"we only met once, and a second meeting was cancelled at short notice. I didn't know enough at the time to realise I should have simply continued to make arrangements to meet, but after this didn't make contact again. The fault for this lies with me, not the mentor!"* (Iversen et al., 2014).

K award holders in the study by Decastro et al. (2013a) believed that it was necessary for junior faculty researchers to be proactive in identifying their own personal needs and then seeking out potential mentors.

"You have to do a lot of seeking it out yourself... you have to figure out what you need and you have to go after it." (Decastro et al., 2013a)

One mentor also commented on the need for junior staff to be proactive:

"Find the people [who] help you... realize that you don't sit and wait for somebody to come and find you." (Decastro et al., 2013a)

Good planning and preparation by trainees was identified as an important facilitator of success in the UK AFP programme. This included trainees arranging early contact with their supervisors and maintaining engagement at key stages of the training. Conversely, one supervisor thought that some candidates did not fully appreciate the amount of time and work involved in the AFP and this was seen as a barrier to success (Darbyshire et al., 2019).

Interactions and relationships

This broad theme focuses on the evidence related to the relationships and other forms of interaction with peers and senior colleagues that CAs experienced through participating in interventions.

Networking for career advancement

The networking that occurred through participation in three career/faculty development initiatives, especially with individuals from other institutions, was valued for the benefits gained in relation to career advancement (Guevara et al., 2018; Helitzer et al., 2016; Lin et al., 2019). This included the opportunities to identify and develop relationships with potential mentors, which were provided as part of the initiatives (Helitzer et al., 2016; Lin et al., 2019).

Through networking at a national women-focused organisation, junior academic physicians also benefited from sponsorship. This was distinct from mentoring and mainly involved senior physicians nominating junior members for promotion and/or writing references to support their promotion (Lin et al., 2019). Engaging with more experienced colleagues gave junior physicians confidence to advance their careers (Lin et al., 2019).

"Here were women… who had risen to those roles, who seemed mere mortals, and were telling me that I had that potential. That was very influential for me … so the senior women

were there to do what I needed which is to provide mentoring and sponsorship." (Lin et al., 2019)

In addition, participants in the studies by Guevara et al. (2018), Helitzer et al. (2016), and Lin et al. (2019) used networking to develop beneficial relationships with their peers, and this is described further below.

Interaction and relationship with peers

The support and other benefits gained by intervention participants from their interaction and relationships with peers and colleagues was an important theme in 11 studies (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Darbyshire et al., 2019; DeCastro et al., 2013a; Guevara et al., 2018; Helitzer et al., 2016; Lin et al., 2019; Moss et al., 2008; Reader et al., 2015; Stubbe et al., 2008).

Findings often referred to the emotional support, encouragement and assistance that had been provided by peers (Campion et al., 2016; DeCastro et al., 2013a; Guevara et al., 2018; Helitzer et al., 2016; Lin et al., 2019; Moss et al., 2008; Reader et al., 2015). The encouragement that some individuals received had given them the confidence to pursue new opportunities (Lin et al., 2019). Furthermore, interacting and engaging with peers was beneficial in terms of reducing feelings of professional isolation (Helitzer et al., 2016; Lin et al., 2019; Moss et al., 2008; Stubbe et al., 2008). Some participants also described the development of a sense of belonging, community or collegiality (Campion et al., 2016; Lin et al., 2019; Moss et al., 2008). In one study, departmental and institutional managers commented on the high degree of camaraderie and connectiveness that had developed amongst attendees of a mid-career faculty development programme (Campion et al., 2016).

Respondents also highly valued the opportunities for professional collaboration that arose from peer relationships and networking (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Darbyshire et al., 2019; DeCastro et al., 2013a; Helitzer et al., 2016; Lin et al., 2019). As a result of these collaborations, some participants developed new skills and greater confidence in their writing ability, which in-turn had led to journal publications (Lin et al., 2019). More generally, participants reported gaining self-confidence or feeling empowered from peer interaction (Lin et al., 2019; Moss et al., 2008; Reader et al., 2015).

Having monthly project update meetings as a group and receiving peer feedback on work was also viewed as being useful by programme participants interviewed by Reader et al. (2015). Notably, a common suggestion for programme improvement given by respondents in the study by Archibald et al. (2017) was to have a peer feedback and review process similar to the one described by Reader et al. (2015).

Women valued peer interaction, and the opportunity to share experiences, with other women (DeCastro et al., 2013a; Helitzer et al., 2016; Lin et al., 2019).

"…I have surrounded myself with peers ... female colleagues at my level who do think to help another colleague... That type of day-to-day working together, I think has been crucial for me." (DeCastro et al., 2013a)

"The [career development program/CDP] offered me the chance to meet other women and talk about the challenges we are facing. The networking that you gain from having interactions with other capable women is really important." (Helitzer et al., 2016)

"I cannot quantify the impact of knowing that there's a community of women who have my back, and who I can go to with honesty, about whatever challenges I'm facing, and get honest feedback." (Lin et al., 2019).

Some of the findings on peer relationships related to interactions that were explicitly described as peer mentoring (DeCastro et al., 2013a; Campion et al., 2016; Guevara et al., 2018; Moss et al., 2008; Reader et al., 2015). Notably, multiple terms were used both across and within included studies to describe peer interaction including: peer mentoring; peer learning; peer support; peer group support; peer coaching; and peer encouragement. It was often difficult to draw a clear distinction between the terms used and determine the extent to which they represented differing forms of peer interaction.

A similar issue to the one described above arose when synthesising findings on the mentoring of junior CAs by senior colleagues. There was sometimes a lack of clarity around the use of the terms mentor, coach and teacher and it was difficult to determine whether authors were describing different roles.

Senior/junior relationships

Participants often spoke positively about the mentorship they received from senior colleagues, which was mentioned in the majority of studies (12 studies) (Archibald et al., 2017; Comeau et al., 2017; Decastro et al., 2013a; Decastro et al., 2013b; Guevara et al., 2018; Helitzer et al., 2016; Iversen et al., 2014; Klimas et al., 2017a; Klimas et al., 2017b; Lin et al., 2019; Reader et al., 2015; Stubbe et al., 2008).

"They provided moral support, which is actually very important to me when I am engaged in something that I really don't have a lot of experience with." (Reader et al., 2015)

"The thing about a mentor… is … believing in you when you don't always believe in yourself… Where mentors can be really wonderful is that … they can … serve as cheerleaders." (Decastro et al., 2013b)

In addition to being a source of moral support, self-confidence and encouragement, findings revealed that mentors had provided a wide range of other forms of assistance to junior mentees. This included: offering career-related advice; teaching research and academic scholarship skills; facilitating leadership opportunities; assisting with grant applications; suggesting ways of dealing with rejection and setbacks; and providing mentees with resources such as staff or equipment (Archibald et al., 2017; Comeau et al., 2017; Decastro et al. 2013a; Decastro et al. 2013b; Guevara et al., 2018; Iversen et al., 2014).

"When the challenges of combining clinical training and research clouded my judgment about future career steps, my mentor proved to be indispensable in making the most objective and adequate choice." (Iversen et al., 2014)

"Without his mentoring, I worry that I might have gone down the wrong path, rather than following my long-term aims. He was truly brilliant throughout." (Iversen et al., 2014)

"When I was writing this grant, I really was kind of in the dark … [mentor] just sat down with me and we wrote it…. it was just this side-by-side writing of the grant that was eventually well scored and we got funded…" (Decastro et al., 2013b)

In the study by Decastro et al. (2013b), the support and assistance provided by mentors had helped foster resilience in mentees. In addition, trainees in an addiction medicine fellowship felt that interaction with mentors had improved their empathy towards patients (Klimas et al., 2017a).

The benefits of mentoring 'teams' or 'networks'

Whilst mentoring was commonly viewed positively, respondents in one study considered it unlikely that a single individual could successfully perform all the activities and roles required to meet the diverse needs of a mentee (Decastro et al., 2013a).

"There's no way that a mentor can be all things to all people and some mentors are good for just one thing." (Decastro et al., 2013a)

Several individuals reported mentoring experiences in which a mentor had been able to provide support in some areas, but not in others (Decastro et al., 2013a). Consequently, mentees believed it was important to develop a 'network', 'team' or 'portfolio' of several different mentors. In this way, the mentee can draw on the different strengths and areas of expertise of each mentor (Decastro et al., 2013a). Respondents in two other studies also spoke of seeking out and developing multiple mentoring relationships (Comeau et al., 2017; Lin et al. 2019).

"I had a mentoring team, a variety of individuals that I could go talk to about different aspects of clinical research, and I found that to be a very useful and helpful way of doing it…It's nice to get a bunch of different opinions…" (Comeau et al., 2017)

Programme scholars interviewed by Comeau et al. (2017) viewed having a diverse team of mentors as critical to achieving career success. Having multiple mentors was seen as a way of potentially guarding against inadequate mentoring (Decastro et al., 2013a). There was also recognition that the mentors in a 'network' are likely to require changing over time, if they are to remain of benefit, as an individual's needs alter as their career progresses. Some participants reported a transition over time to a more collaborative relationship with original mentors as they developed professionally and gained greater independence. Participants also spoke of the growing role and importance of peer relationships over time, particularly in terms of collaboration and knowledge sharing (Decastro et al., 2013a).

The gender of mentors

Having at least one mentor of the same gender as themselves was important to some women in four studies, particularly in terms of mentors acting as a role model, and providing guidance on balancing a career and family life (Decastro et al., 2013a; Decastro et al., 2013b; Helitzer et al., 2016; Lin et al., 2019).

"I do think women mentors are really important.... I think it`s very important to have women just because I think it's important for women to see other women who have been successful.... I think it`s nice to have at least one woman who's a good mentor." (Decastro et al., 2013a)

"I'm also a mother … it has been extremely important to have somebody who … has shared their experiences of how they have navigated early childhood and early stages of academic medical career and really maintained success in both of those arenas." (Decastro et al., 2013b)

''Academic medicine is more challenging as a woman. The traditional path just tends to kind of exclude women the higher you go up. So the support of women mentor who'd gone or is going through what I'm going through with kids, husband, would be helpful." (Helitzer et al., 2016)

The ethnicity of mentors

Two studies reported findings on issues related to the ethnicity of mentors (Decastro et al., 2013a; Guevara et al., 2018). Views from one study were mixed on whether there was a

need for both mentor and mentee to be from an ethnic group underrepresented in medicine (Guevara et al., 2018). Some respondents believed that it was important, and suggested individuals should have a mentor who had personally experienced and overcome bias. In contrast, others suggested that having a mentor from any ethnic group was sufficient, if they understood the nature of unconscious bias and could offer relevant advice and support. One respondent interviewed by Decastro et al. (2013a) believed that some individuals may experience difficulties in finding mentors of the same ethnicity who could act as role models.

Other factors related to mentoring

Some mentees in two studies believed that they had gained more objective and impartial advice from having mentors who were from a different institution (Decastro et al., 2013a; Iversen et al., 2014).

"I think it is very important to have a mentor from outside one's own institution to allow for impartiality and objectivity." (Iversen et al., 2014)

"People who are at other institutions have been helpful... my gut feeling is that they kind of encourage me to do what's best for me rather than having any issues with... how it's going to look from their standpoint." (Decastro et al., 2013a)

Fellowship trainees in one study expressed a preference for having physicians as mentors because of their medical background, and these individuals were viewed as role models (Klimas et al., 2017b). Non-physician mentors were reported to request too many updates, and this sometimes created stress for trainees (Klimas et al., 2017b). In addition, one respondent in the UK study by Iversen et al. (2014) did not support having appointed mentors as he believed it impacted negatively on the mentoring process.

"This was an expectation of the DoH Clinician Scientist fellowship scheme so I did it. I already knew the person, so the scheme per se changed nothing. I am not a fan of appointed mentors, either as a mentee or as a mentor. I think formalising a relationship ruins its mentoring capability." (Iversen et al., 2014)

Suggestions for improving mentoring were offered in several included studies. For example, one participant felt that trainees and early career faculty would benefit from having 'financial mentors', who could provide guidance in managing personal finances (Decastro et al., 2013b). In addition, a respondent in the study by Klimas et al. (2017b) would have liked regular and mandatory meetings with mentors to discuss progress and to facilitate closer supervision of research work.

Mentor and supervisor experiences and training

Mentors in three studies reported professional benefits from mentoring junior clinicians, including maintaining up-to-date clinical knowledge and keeping informed about the challenges and realities of being an early career academic (Iversen et al., 2014; Klimas et al., 2017a; Klimas et al., 2017b). In addition, Klimas et al. (2017a and 2017b) reported that some respondents thought that being a mentor and teacher had made them a "better doctor" and improved their own clinical practice.

Respondents in three studies raised issues related to the training of mentors or supervisors (Darbyshire et al., 2019; Guevara et al., 2018; Iversen et al., 2014). Scholars of the programme evaluated by Guevara et al. (2018) reported an unmet need for training in mentoring. Mentors and mentees in the study by Iversen et al. (2014) differed in their views on mentorship training. Mentees believed that mentors should receive training and they were also supportive of training for mentees. In contrast, mentors did not believe there was a

need for mentoring training or they did not view it as important. Darbyshire et al. (2019) reported that some supervisors in the UK AFP felt inadequately prepared for the supervisory role, especially in relation to choosing a suitable project for trainees. In another study, some participants would also have liked more formalised guidance on how to maximise relationships with mentors (Comeau et al., 2017).

Normalising experiences in academic medicine

Junior CAs in two studies found it useful hearing about the career difficulties experienced by mentors and other senior colleagues, and how they overcame such challenges. This provided trainees with reassurance, inspiration and encouragement, whilst also serving to normalise challenges in academic careers (Iversen et al., 2014; Kraemer et al., 2018). In another study, interaction with peers through group mentoring enabled individuals to discover that they shared a range of concerns, which normalised and legitimised those issues for participants (Moss et al., 2008).

Related to the above, one respondent in the study by Kraemer et al. (2018) highlighted the usefulness of hearing about the career paths of successful academics.

"I really like hearing the stories of different faculty members and what their thoughts were when they were in our shoes and the steps that they took to get to that spot in their career." (Kraemer et al., 2018)

Time and competing demands in clinical academia

Issues related to time and the time pressures experienced by CAs formed a consistent narrative across multiple studies, and these are explored in the current section.

Having protected time was viewed as an important feature of career/faculty development programmes and training fellowships in seven studies (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Hayward et al., 2011; Klimas et al., 2017b; Jones et al., 2019; Reader et al., 2015). In particular, protected time was valued by participants in terms of managing competing research and clinical demands and commitments.

"Really what I needed was dedicated time so I'd have relief time from clinic to work on the project…it gave me a chance to… really move the project forward a lot more than I would have without it." (Reader et al., 2015)

"*It actually freed up time that I would not have had otherwise. Having the protected time is very important…With the demands of clinical work…it would be really easy for the people in charge to just dump a lot of clinical work on us…"* (Comeau et al. 2017)

In the study by Jones et al. (2019), junior faculty physician-scientists with substantial care-giving demands used a funding award to gain greater control, flexibility, and choice over their use of time through buying more protected research time and hiring staff to take over various research-related tasks. As a result, awardees reported greater research productivity and an improved work-life balance through having more time to spend with family and engage in caregiving activities. The award had also assisted with awardees' career progression and retention in academia at critical time points. One participant in the study by Comeau et al. (2017) also viewed their funding award as a facilitating factor in achieving more publications.

"I've had 14 publications…and I will say that alone is directly attributed to the KL2 because it gave me protected time." (Comeau et al., 2017)

However, Reader et al. (2015) reported that some participants found it difficult in practice to maintain a dedicated period of time for research owing to factors such as a lack of clinical coverage. One individual in the programme commented:

"The expectation is that even though you are not at the health center, you're still covering your patients so you are still liable to get phone calls, see patients in the hospital…" (Reader et al., 2015)

This was consistent with the prior experiences of some participants interviewed by Jones et al. (2019), who had frequently been asked in the past to perform clinical duties and other work-related tasks that encroached on protected research time. Other participants in the study by Reader et al. (2015) reported that administrative staff were not always supportive of projects which made scheduling protected time difficult.

Time conflicts, particularly in relation to competing clinical demands, sometimes acted as a barrier to organising or participating in specific programme elements, research training or implementing training fellowships across four studies, (Jones et al., 2019; Klimas et al., 2017a; Klimas et al., 2017b; Reader et al., 2015). For example, some participants interviewed by Reader et al. (2015) reported a reduction in the frequency of group meetings, which was attributed to competing scheduling demands. In another study, time constraints were also an important factor in the decision made by some individuals not to complete the application process for a faculty development programme (Archibald et al., 2017).

Related to the findings above, Caffrey et al. (2016) reported that the impact of the Athena SWAN programme was potentially undermined by institutions holding meetings at a time that could make it difficult for staff with caring responsibilities to attend.

Service pressures associated with working in a clinical setting and the competing commitments of clinical supervisors were identified as barriers to success in the UK AFP (Darbyshire et al., 2019). In Canada, several CIP programme directors did not have protected time for managing the programme (Hayward et al. 2011).

Similarly, the competing demands and obligations on some senior faculty staff detracted from their ability to be a good mentor in the study by Decastro et al. (2013a). One mentor stated:

"…I think where I was deficient came in the last decade ... I was Section Chief and I basically got pretty inundated with administrative work … I allowed my lab to grow to twenty people… and that proved to really be too much... I ended up being a pretty crummy everything … I was not as good a mentor as I should have been." (Decastro et al., 2013a)

Facilitating programme participation and success

Competing clinical demands and service pressures are organisational level influences over which intervention participants have little control. Evidence of the influence of various other programme and organisational level factors on intervention participation and impact was identified across included studies.

Supportive and committed programme staff

Having supportive, committed, and experienced programme staff was an important factor in facilitating progress and success in six studies (Archibald et al., 2017; Campion et al., 2016; Comeau et al. 2017; Hayward et al., 2011; Klimas et al., 2017b; Reader et al., 2015). The term programme staff was largely not described, with authors using phrases that related the

staff to the intervention but did not provide further detail. For example: *"Participants expressed that they felt supported throughout the process by the PIME staff and the programme lead"* (Archibald et al., 2017). We have interpreted that the term programme staff refers to any faculty, staff or other individuals that were involved in the delivery of the programme, including those who teach on the programme, administrative staff, and programme leads.

"Having [Programme Lead's name] is everything. Having somebody who has that knowledge base and medical education and methodology on what the latest trends are is priceless…" (Archibald et al., 2017)

"They were really helpful with direction, logistical problems, helping to clarify thinking, and ready to review things…over time, they provided just the right amount of support as I went along..." (Reader et al., 2015)

Management support for programmes

Management support was identified as an important influence on programme participation in four studies (Caffrey et al. 2016; Campion et al., 2016; Hayward et al., 2011; Helitzer et al., 2016). In one study, the provision of financial support to faculty women had enabled them to attend a career development programme (Helitzer et al., 2016). One participant said:

"I have good support, both in time and in money to attend [CDP]. For someone to have paid for me to attend is a pretty big thing." (Helitzer et al., 2016)

In contrast, postdoctoral researchers interviewed by Caffrey et al. (2016) perceived a lack of support from research project leads and expressed scepticism that they would be given the time to participate in Athena SWAN activities.

"We get those [courses on personal/career development for postdoctoral researchers …] I know that at least my boss doesn't encourage us to go to those and we have to, yes we kind of have to push it…" (Caffrey et al., 2016)

Findings reported by Campion et al. (2016) suggested that management support for a faculty development programme (ACIT) had potential benefits for the institution in terms of staff retention. Participants often expressed an intention to remain at the institution because management had invested in their career development. Several individuals spoke of feeling more focused, energised, positive, and empowered as a result of the programme (Campion et al., 2016).

"*…this program has taken me from a fairly discouraged mid-career faculty member who was seriously considering leaving the institution, to a newly energized leader with many new and valuable contacts and a thirst for being involved in medical campus leadership at a more significant level.*" (Campion et al., 2016)

Campion et al. (2016) reported that departmental leaders were unanimously supportive of the faculty development programme because they recognised that having more fulfilled and focused faculty staff would strengthen departments as well as potentially improve the satisfaction of students and patients.

The promotion of programmes

Issues related to the promotion of programmes to staff was reported in two studies (Caffrey et al. 2016; Helitzer et al., 2016). Postdoctoral interviewees in the study by Caffrey et al. (2016) had often not accessed Athena SWAN related initiatives, such as mentoring

schemes, as they were not aware of them or had ignored relevant information received in emails to prevent 'email overload'. Helitzer et al. (2016) also noted a lack of information promoting programmes at an institutional level, which meant some faculty members had only found out about them from colleagues.

Workload requirements

Most respondents in the study by Caffrey et al. (2016) were supportive of the Athena SWAN programme and they believed the implementation of its principles had resulted in positive outcomes for the institution. However, the application process was found to have substantially increased the workload of members of the Athena SWAN self-assessment team. Moreover, it was female staff who performed a large proportion of the Athena SWAN workload and this potentially had negative consequences for the career progression of individual women as the extra administrative work did not count towards promotion. This was seen to reproduce and reinforce gender inequity within the institution and in doing so undermined the aim of the Athena SWAN programme (Caffrey et al. 2016).

Design and delivery of learning

Participants across seven studies highlighted various facilitators and barriers to success that related to the design and delivery of learning sessions and training fellowships (Campion et al., 2016; Comeau et al., 2017; Darbyshire et al., 2019; Hayward et al., 2011; Klimas et al., 2017a; Klimas et al., 2017b; Moss et al., 2008). For example, being involved in the initial planning and development of programme sessions was considered important by participants in the study by Moss et al. (2008). Various teaching methods were cited across studies as being influential including the use of: diverse educational methods; a mix of both guided and independent learning approaches; experiential learning; tailored coursework; and utilising the expertise of faculty staff from different institutions (Campion et al., 2016; Comeau et al., 2017; Klimas et al., 2017a; Klimas et al., 2017b). The 'supportive' learning environment and high degree of autonomy in research training were viewed as key strengths of a fellowship in addiction medicine (Klimas et al., 2017a). More broadly, trainees reported that the development of research skills was facilitated by the flexibility, structure and clear guidance provided within the fellowship (Klimas et al., 2017a). Flexibility in training was also seen as an important factor by CIP staff (Hayward et al., 2011).

In terms of barriers, Campion et al. (2016) reported that the didactic content in some sessions was judged by multiple respondents as being too jargonistic and delivered using language not accessible to all participants. Furthermore, supervisors in the UK AFP viewed the short period of time that trainees had in academia (on average four months) as a barrier (Darbyshire et al., 2019).

Some participants in one study were critical of a perceived emphasis in the Athena SWAN programme on only supporting women through family-friendly policies. Such an emphasis was considered to reinforce existing gendered social norms related to the provision of childcare (Caffrey et al., 2016).

Infrastructure and logistics

In two studies, the newness of training fellowships had created challenges related to infrastructure and logistics (Klimas et al., 2017b; Stubbe et al., 2008). For example, some participants in the study by Klimas et al. (2017b) reported a lack of infrastructure on some clinical rotations, such as the lack of a suitable learning space with a desk.

National policy

Caffrey et al. (2016) highlighted several ways in which national funding arrangements could undermine family-friendly policies implemented by institutions to support Athena SWAN. This included not providing funds to hire maternity cover in national grant awards. Participants in the study by Hayward et al. (2011) highlighted a financing issue with CIP programmes, particularly in relation to a lack of protected funds for trainees. Indeed, inadequate funding and salary support for trainees was commonly viewed as a barrier to CIP entry and it was common for participants to be required by programmes to apply for external funding to support their training (Hayward et al., 2011).

Funding and financial support

Funding and financial support were variably discussed throughout the included studies. The most common factors covered included: funding for protected time, funding for support staff (research and administrative), and other issues related to funding. Many of these factors are closely linked to the issues discussed in previous themes, in particular, funding for protected time is discussed within the *Time and competing demands in clinical academia* theme, and some specific funding issues, particularly those related to national policies, are discussed within the *Facilitating programme participation and success* theme. These issues are therefore not discussed further here.

In a number of studies, suggested improvements in the intervention included funding towards administrative staff or research personnel (Reader et al., 2015, Jones et al., 2019). Klimas et al. (2017b) reported that their funded fellowship programmes were more successful because they provided protected time for developing the infrastructure of the programme. Meanwhile, Darbyshire et al. (2019) reported that the lack of funding attributed to the UK's Academic Foundation Programme limited access to specialist statistical support.

Helitzer et al. (2016) reported that limited financial resources at institutions impacted on initiatives for faculty advancement, particularly those in certain groups.

"If there was ample funding I think the administration would be much more open to hearing different possibilities and ideas for [the advancement of] women and minorities." (Helitzer et al., 2016)

One participant in Jones et al. (2019) reported the importance of funding requirements considering factors such as time worked rather than chronological time limits for applicants:

"[A]pplications [where] eligibility [is limited to] 3 years within starting your faculty position or 8 years within graduating [should] have this prorated…. so that the eligibility is based on time worked, not just a chronologic year, which may have a 3-month maternity leave… in it." (Jones et al., 2019)

The concepts of bridge or seed funding was also mentioned in some studies. For example, within Jones et al. (2019), one participant said:

"Having that protected 20% check that nobody else could touch, that I know could be devoted to my stuff, my activities, my projects … was kind of like the saving grace … awards like this are much needed … There's just such a need for bridge funding … making that transition to independent funding is a really hard one." (Jones et al., 2019)

DeCastro et al. (2013b) shared how mentorship could support some of the financial challenges for junior CAs, either through supporting grant application writing, helping to find bridging funds, or providing research and administrative staff support.

“We often have a capacity to help them solve a problem that’s making them feel like they want to quit or give up. And we can often have access to resources that might get them through the crisis. There have been many times when grants didn’t come through and we could find bridge funds.” (DeCastro et al., 2013b)

Findings: Phase 2- Interviews

Phase 2 Demographic summary

Table 3 provides an overview of the descriptive statistics of the participant sample and the data collected for the semi-structured interviews.

Participants were from a wide range of specialties. To protect anonymity, we have been unable to list specialties due to the specificity. Specialties included: adult medical specialties, dental specialties, paediatric specialties, general practice, oral surgery, psychiatry, public health medicine and surgery.

Table 3: Summary of participant demographics for interview phase

Profession	**Total (n=104)**	**%**
Dentistry	16	15.4
Medicine	88	84.6
Mean Age	40	
Age Range	27 – 74	
Gender		
Female	61	58.7
Male	42	40.4
Prefer not to say	1	1.0
Predominant Clinical Work Area		
Primary	21	20.2
Secondary	39	37.5
Tertiary	41	39.4
Did not disclose	3	2.9
Employment Status (overall)		
Full Time	75	72.1
<Full Time	6	26.9
Did not disclose	1	1
% of hours spent on academic work		
100%	11	10.6
50%	18	17.0
<50%	70	67.3
Did not disclose	5	4.8
Out of programme for research		
No	63	60.6
Not applicable	27	26
Yes	13	12.5
Did not disclose	1	1
Ethnicity		
White	82	78.8
Black	5	4.8
Asian	11	2.9
Arabic	3	2.9
Did not disclose	3	2.9
Marital Status		
Civil partnership	2	1.9

Divorced	4	3.8
Long-term relationship (not married)	15	14.4
Married	72	69.2
Single	11	10.6
Sexuality		
LGBTQIA+	7	6.7
Heterosexual	87	83.7
Did not disclose	10	9.6
Disability		
No	98	94.2
Yes	4	3.8
Prefer not to say	2	2.0
Number of Children/Dependents		
0	35	33.7
1	21	20.2
2	31	29.8
3	10	9.6
4	2	2.9
Did not disclose	4	3.8
Pregnant		
No	84	80.8
Yes	3	2.9
Not applicable	15	14.4
Did not disclose	2	1.9
Current Clinical Academic Career Level		
Doctoral Fellow/ PhD student	20	19.2
Clinical Research Fellow	2	1.9
Academic Clinical Fellow	18	17.3
Academic Clinical Lecturer	17	16.3
No longer an academic	13	12.5
Senior Clinical Lecturer and above (including Deans and Programme Directors)	31	29.8
Did not disclose	3	2.9
Current grade within Clinical Role		
Clinical Fellow	3	2.9
Dental Specialty Registrar (ST1-5)	8	7.7
General Practitioner / General Dental Practitioner	10	9.6
Medical Consultant / Dental Consultant	37	35.5
Medical registrar equivalent (ST4-8)	31	29.8
Medical SHO equivalent (CT1-2, ST1-3)	13	12.5
Out of Programme for Experience	1	1
Did not disclose	1	1
Location		
East of England	3	2.9

Midlands	13	12.5
North East England & Yorkshire	36	34.6
North West of England	5	4.8
Northern Ireland	2	1.9
Scotland	7	6.7
South East of England	21	20.2
South England	7	6.7
South West of England	6	5.8
Wales	3	2.9
Did not disclose	1	1.0
Place primary health qualification awarded		
UK	91	87.5
IMG	6	5.8
EEU	5	4.8
Did not disclose	2	1.9

Qualitative interview findings

Interview data broadly pertained to eight major themes: Identity, motivation to pursue, enablers, barriers, prescriptive and descriptive biases, advice and top tips, myths, and interventions. Graphical representation of (1) the themes, and of (2) the themes with selected associated sub-themes are presented below.

Figure 2: Overview of main themes

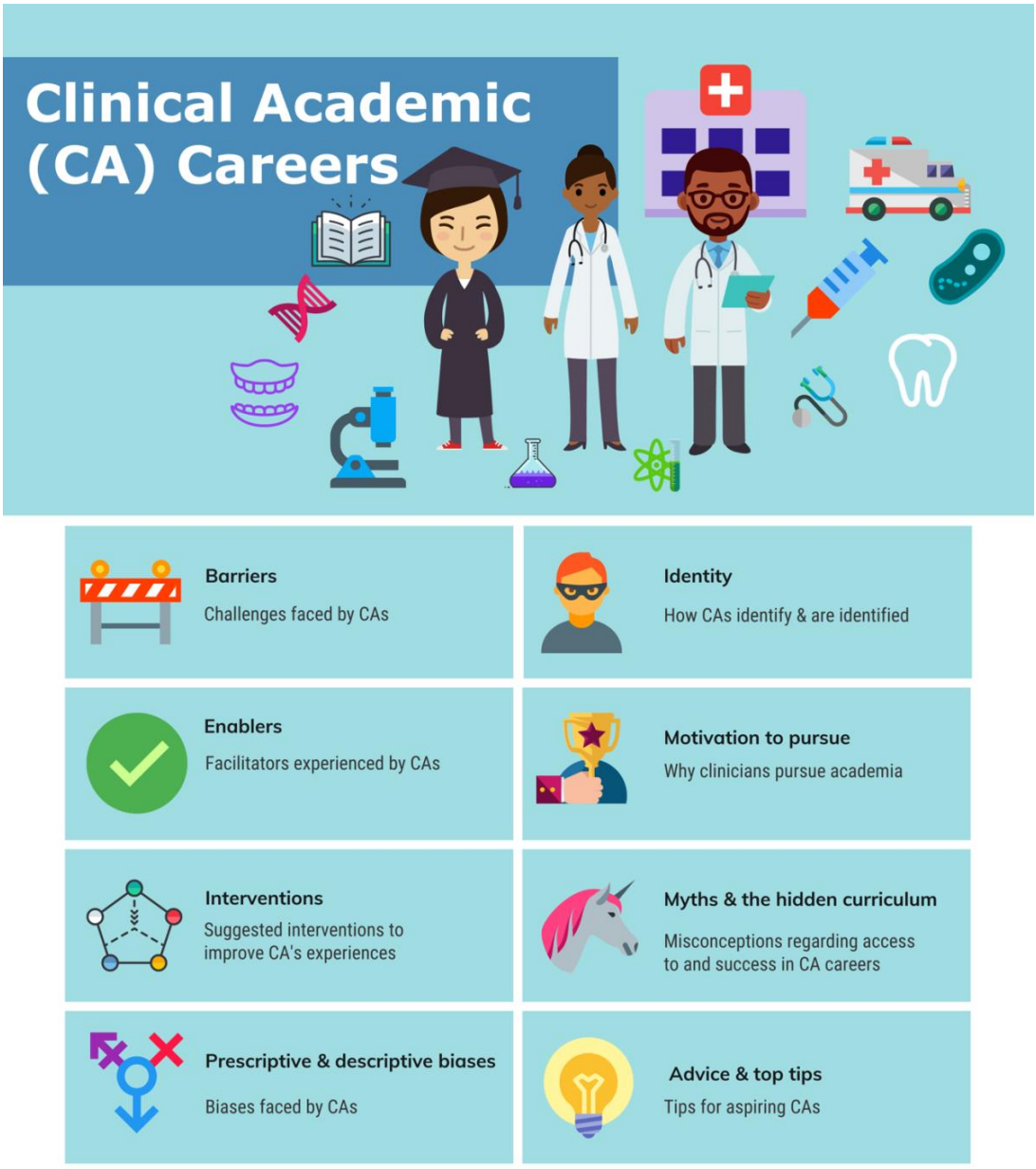


Figure 3: A visual overview of the themes identified from interviews

Theme: Identity (What is a Clinical Academic?)

Before considering individual motivation to become a CA and the barriers and enablers faced, it is important to appreciate how CAs define their profession.

Defining a Clinical Academic

CAs articulated how they identified as a professional. CAs described their multi-faceted roles and identities.

"I mean my experience and what I've seen in my field, being a CA means being somebody who basically bridges two, different fields, so you have the scientific research and then you have the clinical application and you have to somehow make them communicate and collaborate with each other." (Interview 10, Female, Medic)

It was noted that being a CA could involve working independently or under the auspices of someone else as part of a training programme.

"I guess to me being a CA, formally it would mean that you have an appointment that gives you some clinical time and some research time at whatever level, whatever that's as trainee, as a consultant, you have a clinical practice and you have a related research domain and programme, whether that's Independent or whether that's under the auspices of someone else." (Interview 32, Male, Medic)

The overlap between research and clinical practice was evident in the participant narratives.

"I think it's that overlap between the two, when you're doing your clinical work, I think it's utilising that aspect of you that's an academic, that help inform your clinical practice…" (Interview 26, Female, Dentist)

CAs acknowledged teaching as part of their remit but identified as researchers first and foremost.

"A clinician that is actively engaged in research…" (Interview 97, Female, Medic)

"…put simply, it's someone who is a clinician, that is also involved, typically with a university or a research institute in, in some sort of capacity, be it, research, whether that's patient-led or kind of very basic science or teaching." (Interview 78, Male, Dentist)

Definition section summary
The role of a CA was seen as someone who held a clinical role alongside teaching and/or research activities. At first, participants struggled to clearly articulate their understandings but then gave examples of the types of activities in which a CA would be involved. The involvement in research spans from those who were leading teams as principal investigators, or on formal training pathways to those who were undertaking small local studies on an informal basis.
Take-home message: • CAs identify as clinicians and researchers first and foremost - teaching is a subsidiary activity undertaken by few.

Theme: Motivation to pursue

It was crucial to understand what attracted CAs to their chosen career path in the first instance. It was hoped that this may provide us with crucial insight that could help funders to attract and retain more CAs in the future. Motivation to pursue is split into the following seven subthemes: 1) passion for research and teaching, 2) wanting to make a difference, 3) flexibility, 4) job security, 5) role models and mentors, 6) following the path of least resistance, and 7) makes for a better clinician. Each is discussed in turn below.

Passion for research and teaching

The participants shared a variety of reasons about the motivations to pursue CA careers. There was an overwhelming sense that many were passionate about their research areas and were motivated by their own curiosity. Similarly, for teaching, participants expressed a passion for this activity. A combination of participants' personal determination as well as desire to help others was evident.

"I love translational research; I love bringing research to people who are working on the ground floor." (Interview 90, Female, Medic)

"I was always someone who was quite curious, when we were taught at Dental School, you were taught do this because of this and, and then you think well actually why? So, I think I was always a questioning type." (Interview 78, Female, Dentist)

"I really love teaching, If I'm in a bad mood and I teach a load of medical students, at the end of it I've really lifted my mood, it's amazing, it's one of the most enjoyable things that I do but it doesn't give you any street cred in the department, the amount of teaching that you do." (Interview 64, Female, Medic)

Enjoyment was often a key affective driver in relation to pursuing research and teaching. A natural urge to ask the 'why' questions and challenge themselves on a variety of topics was discussed. The CAs typically relished the opportunity to be involved with something they love alongside their other commitments. Again, for both research and teaching aspects, this provided an ideal key way for participants to become involved and stimulated their interest. The space provided within academic roles allowed participants time to pursue and generate further interest in the topics. People felt research was often better suited to their own skill sets. Furthermore, there was frustration expressed and vented in relation to the necessarily lengthy time investment and pressures associated with clinical roles and patient management which impacted on meaningful, deep exploration of clinically relevant issues.

"There were lots of things I wanted to look into and pursue in greater depth but didn't feel that I had the time available to do that and so I wanted to do a programme where I had some sort of dedicated academic time where I'd be able to have time to think and to actually conduct some research and write things up." (Interview 81, Female, Medic)

"I really enjoy teaching. I had feedback at the time, just informal feedback that I was a good teacher and it's something that I enjoyed doing and I knew that academia and teaching were strongly interlinked with one another and that's another reason why I thought this would be a good career type for me." (Interview 77, Male, Dentist)

"I was interested in more clinical research and kind of research that changes practice directly, partly because of timing and I guess partly because I wanted to get my teeth into a project and learn the skills that you just don't get to do clinically." (Interview 21, Male, Medic)

Often early experiences were influential in shaping later drivers. Many had undertaken intercalating degrees and had early formative experiences of academia. Whether it was through a masters or PhD, the sense of enjoyment over time seemed to invigorate further drivers to stay and pursue clinical academia.

"After getting a bit of experience doing F2 I did think at that point well I'm really interested in doing research, when I did my PhD I was originally just doing a year's Masters and because I thought if I just take a year out, do a year of Masters then that will help me prepare for a research career but then I started to do my research project and I enjoyed it so much that I then extended it to doing a PhD because I think at that point I'd decided that I really wanted to do research alongside clinical practice and that I loved doing research. That's really what got me into it." (Interview 83, Male, Medic)

"By the end of the PhD I was completely wedded to academia, I just love it, love the fact you can have an idea in the shower and then you go and make it happen." (Interview 88, Female, Medic)

"I think mainly because I really enjoy the science and I have done since I was trained at [university] and where, we all did a BMed Sci so intercalated project, and I absolutely loved doing that." (Interview 98, Female, Medic)

Whereas for others, the passion and enthusiasm were already there from earlier stages. The career was also seen as a 'Plan B' in some cases if the medical or dental career did not come to fruition.

"I mean I think I'm in a slightly fortunate position that I've always wanted to do academia, I've always been interested in research and academia, even as an undergraduate." (Interview 45, Male, Dentist)

"I probably felt like I had a natural aptitude for it. So, in clinical practice probably less so. I think I'm a competent clinician, but I think when I actually started doing research was when I realised, I almost felt like I was born to do it…I was preparing a plan B for if I didn't get into medical school and I was probably going to do a year of Masters and from there likely pursued a research career in biology." (Interview 83, Male, Medic)

Wanting to make a difference

The participants spoke candidly about their motivations in regard to wanting to undertake research which helped to address systemic issues across healthcare to improve outcomes for patients. Ultimately, there was an awareness that although being a clinician is rewarding on an individual patient basis, without research there is a missed opportunity to enhance care on a wider scale. This altruistic factor was emotively discussed by many of the participants within their respective topic areas as it mapped to their own intellectual and creative desires to tackle problems. Participants wanted to stretch knowledge boundaries on the topics and tackle the 'big questions'.

"I feel like it's an area where clinically we don't really have effective therapies…so it really is in need of a lot more research and I found it a very intellectually rewarding area to work in…" (Interview 93, Female, Medic)

"I'm being able to rescue people from the water but I'm not being able to stop them falling in and that's kind of the analogy, whereas for me research is contributing to the big picture, I mean my interest is...health protection I guess and promotion, so vaccination and things like that and I'd much rather stop people getting sick then necessarily treat them when they are sick…" (Interview 95, Female, Medic)

"I really enjoy the time to think and to work on something bigger and longer term… that makes an impact in a different way, like clinical work is very on the individual making a big difference to one person, whereas the research life is more about making a small different but to lots of people..." (Interview 1, Female, Medic)

"The other things is that research is like an escape for me personally from clinical medicine so I did not enjoy like the patient interactions because I got very frustrated by the very short term thinking…you're not really trying to improve anything, you're just like firefighting because you've only got like five or ten minutes with that person and they might have like domestic violence or they might be really poor, they might be homeless and you can't do anything about it, so that's why research for me was like oh my gosh, I can actually like do research on women who've experienced domestic violence." (Interview 60, Female, Medic)

The opportunity to be able to tackle key issues across the NHS was recognised. In this vein it seemed apparent the participants were often those who were striving to tackle the status quo within healthcare in regards to equal opportunities and other key issues. The participants emerged as leaders in their subjects looking to expand knowledge and help to address a range of issues. Examples across medicine and dentistry were cited.

"There's so much research that needs to be done in dentistry that will improve the oral health of children, will improve oral health of adults but not only that will improve the general wellbeing of people and actually impact what dental disease has on the general health and wellbeing, there's lots of crossovers between dental health and diabetes, cardiology… if we can start to look and improve outcomes for our patients, particularly NIHR kind of hat on, if we can improve patient benefit from oral health point of view, that will undoubtedly improve everything else." (Interview 45, Male, Dentist)

"You don't know which bits of science are going to be important in the future, therefore in a sense anything scientific is good because you're building up knowledge in areas that we don't know about so this kind of coral reef idea that we learn more and more about the world but we don't quite know which bits of it are going to be useful." (Interview 49, Male, Medic)

Flexibility

The potential flexibility afforded by a CA role was discussed as an important motivator helping to lure participants into academic roles. The sense of independence was also viewed as attractive. Comparisons were often made between academic and clinical roles; clinical roles appearing much more regimented and leaving less scope for flexibility in terms of work patterns and work within the environment.

"The variety of a CA career appeals to me…when I'm doing my PhD that I am kind of more my own boss a lot more, that I can plan my own day, whereas when you're in a hospital your work in a team which is great but at the end of the day it's quite regimented and you're carrying a bleep, it's nine to five, so there's less flexibility and I guess it's chance to be more creative." (Interview 85, Female, Medic)

"Flexibility, I know it sounds weird but, in anaesthetics, you sort of have to be there at seven, and definitely finish at six and so we can't do anything else but since I have kids and things,

it gives a bit of flexibility the research because you can, you know, go in when you want to, you can go home early, you can work in the evenings or whatever but you don't, it's not as fixed." (Interview 86, Female, Medic)

Some types of research were also seen to suit more flexible working through their formulation. For example, office-based research could be conducted in many locations and off site. Lab-based research could be managed by the individuals for when time fitted into other activities. For those wanting to excel in careers, the scope of academia was also regarded as being more flexible in the way progression and creativity is rewarded.

"In the academic side you can, you're more autonomous earlier I suppose and you're giving leadership roles maybe slightly earlier. I feel like it's more of a meritocracy in some respects, like if you work hard and you perform well you kind of get more reward in the academic world." (Interview 93, Female, Medic)

"I am quite an impatient person and I quite like, lots going on at one time and I think clinical medicine, I think if you haven't found your exact niche, you know, when you're on the wards every day I think it can become a little bit samey, whereas with research you can do exactly what you want and there's always something going on and I find it very, very exciting." (Interview 94, Female, Medic)

For some, obtaining an academic post was extremely appealing as it was almost seen as having a 'break' from clinical work.

"I've actually had people saying I like the academic side because it gives you like a break from the mad rush." (Interview 43, Female, Medic)

"I think especially in surgical specialties, I think academia gives you a bit of downtime, it's quite nice to sometimes just sit, collect your thoughts and then if you're writing a paper, find that quite therapeutic sometimes." (Interview 77, Male, Dentist)

Job security

Similarly to flexibility, another job design feature was the security of long-term employment. This security related to motivators to stay within clinical roles over academic roles. However, in some cases participants acknowledged that if the CA role did not work out they could always go back to the clinical role.

"At the end of the day it's where the jobs are, if you've got clinical training and you can't get an academic job but you can get a clinical job then you go for the clinical job." (Interview 45, Male, Dentist)

"Full-time clinical work would have been fine. I guess in the NHS you're really lucky that you can just fall back into a job and I know that...I know my other research colleagues don't have that luxury so it does feel like a luxury." (Interview 53, Female, Medic)

"The clinical job basically provides stability and it provides a means by which to pay a mortgage and/or other bills." (Interview 58, Male, Medic)

Role models and mentors

As a motivator, role models gave implicit and explicit encouragement to pursue careers in clinical academia. Role models helped to display what a future career could entail and the types of positions that participants could aspire to achieve. Role models often displayed

enthusiasm and vigour for academic careers which helped to inspire the next generation. Personal connections were also mentioned in some cases as those close in the family held CA positions.

"I started to work with one of our professors locally who was absolutely fantastic and she kind of got me interested in research." (Interview 90, Female, Medic)

"I think notably mentors that I've met along the way as well and certainly some of the academics I've met with have been very inspiring in terms of how they've balanced clinical and academic work across a long period of time... I'm quite inspired by the way that they work, the way they think about clinical problems and put them into an academic question and the way they balance sort of clinical and academic commitments." (Interview 81, Female, Medic)

Having specific mentorship and guidance was highlighted as key to being able to begin a CA career. For many, mentors provided much needed information, development and were essential in helping them get a foot in the door of the academic world.

"...she was very encouraging and she said look...you can do this, we need academic GPs, you can bring your skillset with you. So that was very encouraging and then I touched base with the Unit I'm at the moment, and they were really encouraging as well and said look, I think you can make this, we'll support you." (Interview 8, Male, Medic)

"They'll kind of encourage you certainly and say, you're good enough and I think sometimes you need a little bit of a push in order to be able to pursue an academic career because there's a bit of a risk involved and you don't fully know what it's like and so I think, it's really helpful to have people encouraging you. I think that's an enabler, I think most people will have a mentor somewhere." (Interview 13, Male, Medic)

In terms of protected characteristics, role models which looked similar to themselves were identified to demonstrate that it is possible to reach higher positions despite being in the minority.

"I think [university] has been really, really, really good in terms of having lots of people, you know, women academics at very high levels…That sort of serve as kind of inspiration and just like a role model that you can see yourself being one of them, they're kind of human and they have had family, you feel that it's attainable when you see people in the positions that you aspire to be in…if you can see someone who looks like you, senior leadership position, that's obviously helpful, like visually and I guess subconsciously you think ah gosh, you associate that someone like you can be a PI." (Interview 85, Female, Medic)

Following the path of least resistance

Participants described their motivation as being opportunistic in the sense of openness to the roles in which they found themselves. It was not necessarily through design that they ended up on a CA pathway but rather the opportunities, which emerged throughout their careers. In some ways it was regarded as being in the right place at the right time and having the supportive mechanisms at their disposal which fuelled their motivation. Many participants often spoke of 'luck' and the serendipitous nature of how they ended up pursuing a CA career.

"Almost kind of stumbled into it but really, really enjoying it now… it opened up a whole new business for me which I hadn't realised beforehand, so I did come to it relatively late I think." (Interview 27, Female, Medic)

"It's something you have to be motivated to do and then it kind of comes down to a bit of luck and opportunity." (Interview 42, Female, Medic)

"I think partly, it was right place and right time, so, you know, I had the interest, I had a supervisor that would help me, I was being supported sort of financially." (Interview 37, Male, Medic)

"It was something I saw and it was something that I thought I'd take the opportunity rather than something that I'd specifically aim for, and in a way you could say it just worked, it worked out well." (Interview 77, Male, Dentist)

Makes for a better clinician

The ways in which biomedical knowledge, research and enhancing patient care fuse together was identified by participants as a driver for their reasons to take-up clinical academia. There was an acknowledgement that having extra insight through academic activities complemented clinical roles and ultimately lead to being a better clinician. The ability to be able to implement findings and understanding the science behind what was occurring in practice was key to this insight.

"It makes you a better clinician, having that aspect to it and I think the reverse as well for academia, I think actually working in clinical practice you can see areas where there perhaps isn't a lot of evidence in, or you might do something in a particular way or see that it works well for you and then that can then inspire your academic work to go forth and study that or see if there's any evidence for what you're actually doing." (Interview 83, Male, Medic)

"I think it's motivating, especially if, you know, often your research marries with your clinical practice so you, it kind of keeps that fresh as well because you're thinking on a different level from the day to day clinical stuff when you're thinking about research and I think that's a really, I think that's a really great combination." (Interview 43, Female, Medic)

"For me it all links together and if you can link the clinical and the research …I'm definitely not being deskilled in my specialist areas, in fact if anything I'm getting better at them." (Interview 49, Male, Medic)

Motivation to pursue section summary
Many reasons were cited by participants which helped to drive their motivation towards becoming or continuing as a CA. At its core, many focused on the ability to be able to make a difference to patient care on a broader scale than individual care, and so ultimately to enhance patient outcomes. Personal motivation, enthusiasm and curiosity for topics helped individuals to see the bigger picture as well as enhance their desire to advance knowledge and understanding. Other individual level reasons included the flexibility afforded by a CA role and the ability to be more autonomous in day-to-day work activities. The opportunistic nature of being in the right place at the right time was also influential and in some cases the perception of 'luck' arose in their ability to continue in CA roles. Role models were also discussed, particularly in relation to protected characteristics and seeing those from minority groups in successful leadership roles.
Take-home message: • Early exposure to research, typically during intercalation, was highly influential as a motivator for aspiring or potential CAs. • A passion for research and wanting to make a difference to patient care were also stronger drivers in the continuous CA career pursuit

Theme: Enablers

Participants discussed a range of enablers and opportunities that allowed them to both initially become a CA and then later maintain this career. Under the theme of enablers and opportunities, there were eight subthemes; 1) support, 2) mentorship and guidance, 3) protected time, 4) flexible working and autonomy, 5) successful career progression, 6) emotional resilience and creating opportunities, 7) geography, and 8) being male and white male privilege. These will each be discussed in-turn.

Support

The subtheme of support was highlighted as essential to both initiate and maintain a CA career. The subtheme has been broken down into four further sub-themes: supportive clinical and academic environment, peer support, family support and financial support.

Supportive culture within both clinical and academic environment

Support from both the clinical and academic environment was crucial to success for CAs. In terms of the clinical side, CAs noted that having support from their seniors and work team was essential for them to have the space to engage with their research.

"…so [place] has been very supportive to my academic side, when I've needed to go on courses, they've just put me on courses and I've not really had to go and ask them with any great enthusiasm that I need time off, so I think I've had quite a supportive organisation in terms of my academic time." (Interview 83, Male, Medic)

Having a supportive work environment was also key in CAs getting follow-on positions and feeling the desire to carry on their academic career.

"…you're only successful academic training if you're happy to do it and the place that you're willing to do it in is going to help you. I think that is the key enabler, because if I had a very negative training here, I would have just dropped off at the end of my three years. I'm very, very fortunate, they've also said to me that they will create the next stage of my training for me at that time." (Interview 45, Male, Dentist)

Support and understanding from deaneries and programme directors ensured that CAs were able to take time out of clinic to manage their academic activities. This support meant there was less stress and less pressure placed on them when managing both clinical and academic work.

"I've got some great programme directors, who are very supportive and do try to let me navigate things in a very bespoke manner, they really are trying to enable those things, it's just at different hospitals you come up against different things." (Interview 93, Female, Medic)

"I needed to do some NHS work but they said oh you kind of just need to do like just enough, so you can focus on your academic pathway. So the training structure that I've had has been quite supportive of me doing both…because I've kind of passed all my competencies with regard to my NHS work and left very much to kind of plan my own time…so I can build in time to do my research and kind of respond to any kind of grant deadlines…and that's what's kind of led me to continue on this path." (Interview 27, Female, Medic)

"…very importantly a supportive clinical TPD who could release me for those days so that I can go and do research without putting me into the clinical or hold me ransom really." (Interview 38, Male, Medic)

"I was very fortunate because at that point I was training in the London Deanery and my impression of London there's so much research activity around there, it was pretty easy to get time out of training, I was really well supported in that but I know colleagues up here in Scotland and elsewhere in the country it's virtually impossible to get time out of training to do research and I think that's really important and people have to be enabled to do that as well." (Interview 95, Female, Medic)

Having this essential dedicated time for research activity was facilitated through the support of rota co-ordinators.

"I genuinely don't really understand how anyone did it before you kind of had these placements for dedicated time out and there was more of a structured pathway, like through the NIHR programme, I found that really helpful and supportive." (Interview 93, Female, Medic)

"My rota coordinators have been very good, kind of sent me out draft rotas and said are those okay? So actually, I've never been rota'd for an academic day after a night shift, or if I've had to be called in last minute to cover a shift then I've had those days given back to me, kind of on the understanding that I was working but not in clinical work." (Interview 11, Male, Medic).

In terms of the academic side, participants noted the importance of having specific academic support throughout, from the initial application stage and grant writing, through to the end of their research programme. Resources were available where needed.

"…there's a lot of support in the process of applying for the grant because of everyone's experiences and everyone is supportive, and no-one is in competition with everyone, that is the beauty of it, everyone wants to see you succeed, the environment is quite supportive environment." (Interview 84, Male, Medic)

It became evident that there were some academic institutions that were much more research active than others, some being highly reputable and successful, which was particularly important in enabling CAs to conduct research. These institutions were also more likely to push individuals towards conducting more research, particularly following PhD level.

"…when I first applied for my first grant I was working within the [name], which is a very well-established unit and when I joined was already a highly successful unit and so we'd got people who could take me through it…I went to the MRC for a trial and my director at the time said I think this is a good idea, you think this is a good idea, you just need to persist at it and try again so we did. I was discouraged but I tried again, this was something like two million pounds and I was a very junior researcher and I got it… it was a very, very successful." (Interview 76, Male, Medic)

Participants noted the importance of having other researchers around them who could support them. A key enabler for CAs was being part of a supportive culture that went above and beyond to help their CAs.

"…so institution, culture of trying to help CAs…they have this kind of specially set up unit, they put up events, they make it easy for us to attend them, so there are webinars, they're all at different times and different locations…they've thought about things, there's like a newsletter that tells you what's going on…you really feel like they're trying to help you in this

career path, which like I said can be quite lonely. You're not seen as annoying, having to kind of interrupt and stop and start." (Interview 85, Female, Medic).

"…the people who sort of been supportive of each stage of my training and what I was going to do next, I think that has been crucial." (Interview 33, Male, Medic)

This support enabled CAs to feel confident enough to apply for funding opportunities, also noting the importance of having supervisors support them through each stage of the process.

"Enabler wise, I think probably just kind of supportive people that I've worked with in the past, kind of supportive supervisors, that have helped like prepare me for interviews or kind of answer questions as they came up or kind of pushed me to go for things and kind of help build my confidence." (Interview 96, Female, Medic)

Support from individual supervisors was also crucial to enable CAs to manage life events such as having children during their research programme.

"My PhD supervisor was also fantastic person, she was a female academic, she had originally started out in clinical medicine, but she'd been in full-time research for about twenty-five years. One of the reasons I think she was such an enabler was because she was an experienced supervisor and she let you be very independent, we were let sort of, run by ourselves, which was good but with appropriate level of supervision. I know a lot of people in different situations have a very bad experience if they have kids or if they go on maternity leave, whereas my experience of that was very good…my supervisor was incredibly supportive on that, I think that's one of the reasons I would say that having kids hasn't necessarily been a barrier to me, is because I've been so well supported through that, so I suppose that was enabling." (Interview 95, Female, Medic)

Support within the academic environment was also specifically noted by those with protected characteristics and mid-career researchers, which inevitably meant that these individuals were more likely to stay within academia.

"I think it is institutions that have this responsibility to help their staff, if they want their staff to be successful, they need to support them. The Institute Director has set up a group of mid-career researchers where they meet once a month to share their ideas… the mid-career researchers love it, they're getting the support that they feel they need and they're absorbing all this experience from the seniors, it's led by the Institute Director who attends every one of these meetings so it's seen to be really important." (Interview 76, Male, Medic)

"As a medical student in the early nineties and junior doctor in the NHS, did I witness, experience homophobia? Yeah, I did. Moving into the University, I found myself in a much more supportive environment and that, you know, in terms of coming out, being out with colleagues and all the rest of it, that was much, much easier in the University environment than it had been in the NHS. So actually for me, being a CA, or an academic, it's an easier environment to work in than the NHS." (Interview 74, Male, Medic)

Those with mental health issues were also positively impacted by this supportive culture.

"I think what was quite helpful as well was not being in a clinical research group, I was surrounded by people who didn't have the same stigma about mental health that we have in medicine, nobody batted an eyelid, it just wasn't seen as something you didn't talk about, it was just there, whereas the clinical world is very much about, you don't mention it, you never talk about it, it never happened." (Interview 79, Female, Medic)

"I also have a long long history of mental health problems so that kind of took its, it had quite an impact on my PhD as well, and they've been, they were really great about that, just very, very flexible about things like time and bits and pieces, things like that." (Interview 10, Female, Medic)

Ultimately, having a supportive institution and support network can be the reason why many CAs remain in academia.

"…what's helped me was when [academic institution] treated me as they did, I was incredibly fortunate to have two or three people who, I mean I had one of the people off the interview panel ring me up, the, the night afterwards and say I need to talk to you because I think you're going to leave academia. [laughs] And she was right I, I nearly did, so support really, really matters but it matters at the pinch points…" (Interview 2, Female, Medic).

"Without [Name] holding my hand and without her I wouldn't have got the [Funder name] funding, I wouldn't even have known how to go about starting it." (Interview 24, Female, Dentist)

"Having an inspirational team to work with who support each other, so one of our senior lecturers, she's been a massive ally and advocate over the years, she's a massive pull factor, when I was deciding about a year ago, do I go for a grant so I can stay? I really wrestled with leaving, lovely colleagues who I respect, who are my friends but also really respect what they do and work that they do, so having that team around you to keep you going when you are feeling a bit burnt out is really important." (Interview 71, Female, Medic)

Support not only came from the work setting but also from funding bodies, such as NIHR and the Wellcome Trust, providing support, guidance and connection details if CAs needed to discuss anything they were struggling with in-line with their research.

"…if you look at the NIHR HTA guidance or the EME guidance, it's pretty comprehensive and I think it does give pretty clear pointers about what they're expecting to see…" (Interview 76, Male, Medic)

Funders also supported life events such as having children.

"I was quite surprised when they say we don't have a policy, we deal with it on a case by case basis, I think I had something like that an eight month extension, they were like absolutely no problem and I kind of anticipated oh there might be an issue there but they were really, really accommodating and really positive about the fact that I was taking maternity leave, so I actually felt like really supported by the funder in that respect." (Interview 27, Female, Medic)

Support networks locally, nationally and internationally within the research community meant that individuals felt they were always readily supported, could speak to anyone about their work for guidance, and meant that new links and collaborations could be made so that advancements in the healthcare sector could be made. Participants expressed how having a key support network meant it was easier for them to stay motivated and for them to be inspired with the work they were doing.

Peer support

Support also came from work colleagues who had similar aspirations to further their career prospects or working in similar areas of expertise or specialities. This kept CAs motivated and determined with the work they were doing.

"…they kind of were sort of motivating I guess, you know, they were constantly going to conferences…helping you to get published and keeping you going." (Interview 51, Female, Medic)

"I think I'm quite fortunate that there have been four people prior to me getting my fellowship who'd been successful in getting NIHR DRF, so there's a little bit precedent already set in terms of how things were done, from the very get go. When I started, they were saying well the main area of this academic ACF post is to get a fellowship through your PhD and here's how, here's how it's done, here's how you do it. My experience of getting to that point was there is very structured guidance. I've worked with my peers, I've asked them their advice, they've kind of gone through, so they're supporting me going through it so as a result I will support the next group, building that supportive culture it then builds itself." (Interview 45, Male, Dentist)

Peer support was also essential during the application process.

"I've got a couple of colleagues who've recently gone for a fellowship and both got funding for their PhD, and they've been really helpful at sort of discussing the process, talking me through things." (Interview 26, Female, Dentist)

Peer support helped to overcome feelings of isolation.

"Me being able to kind of call on my supervisors and colleagues, students who I know who are also doing PhDs, I would literally be on my own and the consultants who've done PhDs have gone oh I've heard that you're doing a really good job and we really respect you, that's a really big boost for me." (Interview 18, Female, Medic).

Peer support groups for specific groups of individuals was also noted as an important resource, for example 'Academic Mums'.

"So there's a group particularly that I'm a member of, Physician Mums Group UK Academic Mums, so it's basically an online forum on Facebook for people who are doctors who are also academics, CAs who are also mums and that's quite a good source of advice." (Interview 64, Female, Medic).

Family support

Support outside the work environment, particularly family support, was also an enabler for many CAs. In order to progress along a CA pathway, many mentioned the need for a supportive family or partner at home, particularly to help with looking after children so that they have the much-needed time to undertake academic work, particularly outside working hours.

"You need to have a partner who is both engaged in, can look after the children, who's happy to kind of put their life second to yours in some respects, she's very supportive." (Interview 49, Male, Medic)

"The biggest thing is my mother, hundred percent, being around to do the childcare for me... She takes the kids to school but honestly without her doing that I just don't know how I would do it. I went to the American Society of Nephrology in November, that was six nights in Washington, my husband was working away, so she had to just basically come and stay with the kids and do everything, if I hadn't been able to do that, I wouldn't have been able to

present my work there. I don't feel like I've missed out because I've got that support." (Interview 66, Female, Medic)

Partners and families of CAs also have to deal with the time pressures and workload associated with this career choice. This support was crucial for CA success. Often, partners of CAs were also academics or in the same profession, which added another layer of encouragement and advice. Partners also had to support and manage financial cuts which often come with beginning an academic career.

"I mean I've been married for most of my qualified life, so I have a wife who's been extremely supportive of me being able to develop my career in this way, which I think has helped me hugely, again these are the things you don't ever factor in…has experienced a period of three and a half years of me as a PhD student and then probably another year or so cobbling together some income from various bits and pieces of part-time work." (Interview 57, Male, Medic)

"It's interesting that my partner who is also a senior doctor, medical director, could understand what I was going through…it was really important to overcome that lack of social capital and to overcome those issues and be able to mutually support each other as we went through our careers… the support that you get at home and being able to manage that was for me really important. When I did my Masters I effectively went from being a fully paid doctor to a stipend of about four thousand pounds for the year. I was financially supported by my partner during that year, which allowed me to do it. I don't think I'd have made that decision if I'd have been single because I couldn't have afforded it with the mortgage." (Interview 76, Female, Medic)

The advantage of having a partner at home who was not in the same profession was also noted, allowing head space away from work and often much needed childcare.

"They said I couldn't have done this without my supportive husband and a lot of people that have a high-flying CA career have a husband who is a primary school teacher or some sort of job where they can be around for the kids and where they can do quite a bit of childcare, they're around in the evening." (Interview 64, Female, Medic)

Although having a supportive family was key, some individuals actually felt that being single or not having a family to worry about was an enabler in itself.

"… even without me having to worry about kids and family, just my partner, there have been times when it's probably got close to being too unbalanced, representing a bit of a threat to the relationship. How I would have done it if I had kids, I mean I couldn't." (Interview 74, Female, Medic)

"I still live with my parents so I don't have any financial commitment, I'm not married, I don't have any children, but I know that's not the case for a lot of people." (Interview 77, Male, Dentist)

Financial support

Inevitably, having financial support in place was an enabler for CAs to remain in academia and not to have to return to full-time clinical posts.

"It's the financial support, like backing and support I have, so I know I won't be out on the street if this grant ended and that is the bottom line… As you know of course, the NHS is

under huge pressure so they can't just dig into their pockets and find the money for a consultant's salary." (Interview 35, Female, Medic)

Many felt that obtaining funding from funders, such as NIHR, gave them more security and allowed them specific time to do the research.

"I think probably the NIHR ones are better because you get fifty percent of time for research…the very fact that those exist is, is very important I think…that would influence me a bit because if I didn't get paid as I am it would be tricky, I mean it always comes down to money and time these things don't they?" (Interview 95, Female, Medic)

Being successful in obtaining research grants and academic posts was key. Financial support came from a variety of sources, not just through the set CA pathways. Many CAs had to regularly apply for separate pots of funding, both locally and nationally. Others were fortunate enough to have support at the Trust level in terms of funding their research.

"So the Trust paid for the last two years and that was because of my education, involved in teaching medical students. The fellowships, which are protected and my salary during my PhD, my postdoc and now, they were all completely funding streams, so I mean I've had experience with MRC, Wellcome and CRUK. My experience with them has been always pretty good, basically all three of them were quite supportive. It's important to engage them and at very early stage. I found them obviously approachable, supportive, good, I mean they're easy to navigate." (Interview 13, Male, Medic)

"I have to say I self-funded my PhD, I got bits and pieces here and there, so Health Education England would put out a bursary every year and I would apply for it and get it so I've managed to offset half my costs." (Interview 80, Female, Medic)

"…fortunately, very fortunately, my department were able to just support me, they happened to have the spare money and they supported me…that's really the only reason I managed to do my PhD." (Interview 32, Male, Medic).

Mentorship and guidance

Mentorship was highlighted as key for CAs to progress further in their career, providing guidance, building up confidence, and highlighting opportunities.

"I mean if you asked me what is the single most important attribute to my success so far, I would say it's mentorship…invested in developing you…it's these people who encourage you, who tell you what opportunities there are, show you the way I suppose…there is someone I can approach if I need advice about the next step, and I think this is critical because even now I speak to colleagues who may be more senior than me and I'm surprised they're not aware of what opportunities are available and I think the reason why they were not aware is because they didn't have the right mentorship to get them…mentorship is key." (Interview 38, Male, Medic)

"…if there's a certain senior person who is obstructing me or not allowing me to progress then I've been seeking mentorship to iron this out and again, this is where mentorship becomes important…these guys would have gone through a similar situation as me." (Interview 38, Male, Medic)

"I remember going to a networking event quite early on and I remember someone saying get yourself a mentor and I was like oh yeah, what's that? ….I did get him as a mentor and that was very, very helpful, just to be able to talk about stuff because I think when you've worked

so hard to get your foot in the door, because it is so competitive to get one of those fellowships and then as you're going along you're thinking oh I'm not sure this is for me. Then you start to have a lot of doubts and you're thinking well hang on a minute…there's a sense of failure comes in. I've put all this on the line. I think having mentor is really helpful because it sort of heaves you, he said to me…it will lead to other things, it definitely has, I've massively gained from doing it." (Interview 47, Female, Medic)

Many participants described the connections they made with mentors and the positive relationships that were forged. Mentors were often referred to as role models. It was important for these mentoring relationships to be built organically so that there was a shared interest and motivation to ensure that the CA succeeded.

"I think they probably need to have mentors who have absolutely bought into their ability and capability and they're in exactly the right niche because you have to have somebody on your side to, to make things happen." (Interview 3, Female, Medic)

"I don't think you can necessarily force mentorship, there needs to be enthusiasm on both sides and you need to have rapport with the person, I always wonder like if they're pairing it with someone how invested either party would be, if it was just a stranger who you didn't know that well…most of the mentors I've met because they are in the same specialty as me or I've met them at a conference or something, or a collaboration or something." (Interview 13, Male, Medic)

"I suppose you could say I'm from an ethnic background, but I've not had difficulties and I think the reason why I haven't is because of the mentorship I've had… I find an informal relationship, sometimes even bumping into someone at a meeting and then catching up for an hour about certain issues, we may feel are in common or they can guide me to navigating, I find these most useful mentorship sessions." (Interview 38, Male, Medic)

This support was particularly important for those facing challenges. Support from mentors was considered to be essential by international medical graduates, it being particularly helpful if mentors too had faced similar challenges and were able to guide them through the process.

"I'd made about a hundred applications [for GP jobs] without success and I was pretty desperate, and when [XX] heard that I couldn't get a job and we had a young baby, he immediately arranged for something to be done, that's quite something in terms of human contact and I think that matters." (Interview 59, Male, Medic)

For most female academics, being mentored by other females and having female role models around them was seen as important, particularly in male dominant specialties.

"I think I have had some really positive female role models. So through our local CA society, there's a mentoring scheme that's just organised locally and I got allocated to a mentor who is a woman, who's very successful academically and has a family and has some degree of work life balance and I think that that's been hugely helpful really." (Interview 5, Female, Medic)

"Within my own research group it's been very female dominated and so that's something which is, I see plenty of female professors that are role models." (Interview 31, Female, Medic)

"I think definitely within kind of the dental restorative specialties and the surgical specialties, they're definitely male dominated. I think it's lucky being in the speciality that I do have these kind of female role models." (Interview 39, Female, Dentist)

Having a mentor who was of the same gender was not always seen as crucial, so long as they were supportive and understood the difficulties that CAs may face, particularly females.

"So I don't have a particular mentor or sort of role model that is female if I'm honest but the male CAs that I have, the three of them are all very, very family orientated and they really do understand the challenges that I have and they are very, very accepting of that and I do wonder subconsciously whether I've chosen them because they are more like that because I know in certain fields you just wouldn't get that kind of level of support, I'm very, very lucky." (Interview 94, Female, Medic)

Mentors who held senior positions helped to facilitate CA careers, often acting as role-models and instilling confidence through reflecting on their own academic career path.

"I only realised this when I left my last job, how important it is to have role models in senior positions to make others believe that they can…the number of tributes, may I say, emails and stuff I got from trainees and trainers who said I, I applied for the Training Programme Director job because you were in a high position and you made me believe I could. I've got trainees that say you made me believe I could be a working mum, with kids and do this and I just thought I didn't realise that was the ramification of what I was doing but if it did that then brilliant." (Interview 80, Female, Medic)

"I think one of the things I have missed most is someone like a champion, someone senior who enables your career basically, who gives you opportunities to participate in projects, who help publish papers to help get you on the right path and advise and mentor you." (Interview 86, Female, Medic)

"…obviously having role models, not only your own immediate circle…like snapshots of these like really big shot professors talking about personal challenges in their life and how they balance work life balance, it was very, very inspiring…" (Interview 85, Female, Medic)

Those with protected characteristics noted the importance of having role-models and mentorship, for example how to deal with the sensitive topic of being a successful openly gay male within the NHS.

"I do quite a lot of mentoring now for the Academy of Medical Sciences because I put that I support LGBT issues in my university, I get the few young early career researchers who are gay or lesbian and some of those are really desperately trying to hide their sexuality because they're so afraid of what it will mean to their academic careers, this is 2019 and 2020…I act as a mentor so I talk through what it would mean to be able to come out but they're clearly torn about not being able to be more open at work and it is alienating. I don't want to go around with a rainbow tie on all the time but at the same time I want people to know that I've been successful, I've got to where I've got, I am gay and I haven't hidden that… being visible enough to be a role model for other young gay men to be able to say, or lesbian women, to be able to say oh look, he's made it and wasn't disadvantaged by this so I should be able to do it too." (Interview 76, Male, Medic)

Protected time

Having protected time in order to conduct research activities, alongside clinical work, was a major enabling factor noted by participants. Many participants chose specific career pathways for this reason. Ensuring protected time for research was in place was particularly important for those who were passionate about maintaining their clinical work whilst ensuring they were not deskilling.

"I'm extremely grateful to NIHR for allowing clinicians like me to have that kind of forty sixty balance of research and clinical because a lot are forced into either only clinical or only research. I'm extremely, extremely grateful that NIHR recognised that people who want to do a lot of clinic, substantial bit of clinical work, can still make a contribution, a good contribution to research and to respect that there are people who that kind of balance of work…that is just so valuable because otherwise senior clinicians who want research, it would be a real shame if people like us were not allowed." (Interview 35, Female, Medic)

Depending on specialty, getting protected time was much easier for some than others.

"I think the main reason is because then you get protected research time, so you get your protected clinical and research time and what I was saying before about wanting to combine both clinical and academic stuff because your clinical week is so heavy, in paediatrics there is absolutely no time in your working days to do any research work and then because you're working all sorts of shift patterns and things, I think it would be very hard to actually do any meaningful research without having any protected time." (Interview 5, Female, Medic)

"…part of the reason I chose public health instead of like cardiology, or being a surgeon or something like that is because public health you are able to do your clinical work Monday to Friday, so you don't have all the on-calls and that, because I know that gives me more time to do the research because I think I'm maybe more likely to be successful because I don't have all those clinical pressures." (Interview 60, Female, Medic).

"…the commitments are not necessarily as fixed and I guess also I could spend three years out doing my PhD and I wasn't having to keep my hand in as much as I might have done if I was sort of in a very hands-on kind of specialty, so that's been easier and also not having a really horrible on-call rota has definitely helped." (Interview 31, Female, Medic)

Individuals had to be strict with themselves and their employers to ensure they were not doing too much clinical work or working during their academic time.

"You do have to distance yourself from your clinical work because before I could do an extra day if things were like really busy, or spend more time being pulled into clinical work and you can't, you have to be very clear about your days and your time. One of my colleagues he will not do anything else on a study day than study because the problem is if he then opens it up, people will think he's free so you have to be very, very clear about which days are study days and which days are work days and keep the boundaries very clear." (Interview 18, Female, Medic)

"…part of the clinical lectureship was fifty-fifty, doctors often say they work part-time when actually they're working much more than thirty eight hours, which would be a normal full-time job…a normal GP in the places I work is twelve to fourteen hours, so I suppose I've managed that relatively well, I have tried to think of things in hours rather than sessions, I think some people fall in the trap of doing way too much clinical work, it has been one of the ways I've sort of coped with it, and things like time for appraisal and doing all the paperwork, clinical appraisal and going to safeguarding meetings, all the things that GPs do extra, I've tried to include that in my hours, otherwise it just becomes completely overwhelming, the job you just can't do it." (Interview 71, Female, Medic)

This was also linked to employers and colleagues having an awareness about CAs academic role and the need to be away from the ward on certain days, as mentioned earlier. Others also commented on the need for university employers also being sympathetic to their limited academic time.

"I mean things that would help were, I suppose sympathetic university. So when you get your fellowship they don't suddenly find lots of other things for you to do as well because I always tell people never to do a fellowship full-time because the University that employs you will not let you do it full-time, they'll find lots of other interesting things for you to do, so sympathetic university employer is one thing I think." (Interview 57, Male, Medic)

Flexible working and autonomy

Participants enjoyed the flexibility that a career in clinical academia has. Many noted having the freedom to choose the days they worked within the academic setting and the ability to work from home.

"…I don't necessarily have to work fixed days, so I can change my days every week and I know that's not the case for everybody, so I do like two days, three days, two days, three days, two days, three days, and I tell my boss every week which days I'm going to be in, so if there's a conference that comes up, I can move my day." (Interview 18, Female, Medic)

"…my research time most of the time I can do it all from home, which is attractive in the sense of it is flexible so if you've got a day where you want to, you've got something else planned you can do that and just rearrange whatever you were going to be doing for another time because it generally isn't time dependent, you can do it at any point really." (Interview, 83, Male, Medic)

This flexibility meant academia fit much better with family life than clinical work. The independence of how they split their hours was often with the individual. Therefore, it was much easier for the work-life balance to be sustained.

"…in terms of family life and academia…you can shape that around your family much more than you can clinical work. I could do my academic work at ten or eleven at night, when the kids are in bed and then use the eight until nine slot to do drop-off, you can move your day to fit round stuff." (Interview 43, Female, Medic)

"…Academia is a really good flexible thing to do, much more so than clinical because no-one's going to die if you don't come, if your child's sick and you need to have the day off, actually if you have to cancel a few meetings and not do the analysis you've planned, that's not the end of the world." (Interview 66, Female, Medic)

"I did speak to my professor about this who had also done her PhD while she had small children and she said although it can sound so crazy to do your PhD with small children, the flexibility is something you cannot get from shifts where you're being sent all over the place and all this sort of thing and even with my husband, it's the key thing, because my husband was also doing shifts and all over the place." (Interview 90, Female, Medic)

Career breaks and working less than full-time was not seen as unusual within academia, with funding bodies supporting this.

"I know that the funding bodies make kind of allowances for working less than full-time and for career breaks and stuff." (Interview 98, Female, Medic)

"I've had my first NIHR post, I changed my working time equivalent from a hundred percent to nought point eight and that was just because of family reasons. NIHR were really accommodating on that. I went down to four days a week with a day off with one of my children. I've had no discrimination at all going less than full-time in the fellowship…with the commuting to [place] and children and clinical work or family, if I carried on I would have

probably burnt out or something, but I always knew that that was the opportunity to go less than full-time." (Interview 63, Male, Medic)

Being able to spend time in both clinical and academic work, also added a dynamic element to CA careers. Many CAs discussed the increased autonomy that they obtained from doing their academic work.

"I think one of the main things I would say is the fact that you get to have more autonomy real time, so you tend to be able to organise yourself and your work around yourself…in clinical roles sometimes the job is already defined for you. For instance, if I go for clinical session and I am meant to see fifteen patients, it's set for me, those patients have their set agendas, problems, they are coming to me regardless, I can't determine that, I can't define that, so sometimes it can be a bit daunting when it comes to clinical. The CA part, you decide what your interest is, you tend to gravitate towards things that interest you and tend to have the potential to be an expert, say in the particular topic, because you have spent time researching it. You can do that in clinical but it is a bit different and a bit difficult." (Interview 84, Male, Medic)

"I absolutely love it, if I had my time again I wouldn't change it because I really, really enjoy the mix between research and clinical. I think it provides opportunities for me to use my brain in different ways which I wouldn't get just doing clinical medicine, it gives me more flexibility and more autonomy." (Interview 94, Female, Medic)

Successful career progression through pathway and milestones

Beginning a career as a CA is not an easy process, however many commented that overcoming the initial step and obtaining their first post was an enabler in itself, particularly if that post then led onto other opportunities.

"I think that, for me, was the biggest stepping stone, getting that initial fellowship application succeeding." (Interview 94, Female, Medic)

"That first post I did was in itself a very much an enabling post, I had a bit of research experience, I think I maybe had one publication, but they were taking people who didn't have much research background and within a year you had built up your CV really well so posts like that were very much, very enabling." (Interview 95, Female, Medic)

"…when I applied for the CA post that I got, the requirement was that this would include a PhD in dental education so the University, although they weren't completely obliged to let me do it, they somewhat were because it was part of my post I guess, so the application process for the PhD, I still had to go through, but it was almost lined up because of the job that I had been appointed to." (Interview 55, Female, Dentist)

Many CAs noted a positive experience during the application process for obtaining these posts, noting how funders, such as NIHR, have made many changes in recent years to ensure a fair process.

"I think they've done a lot recently, you know, the application forms a lot shorter, they've broadened their remits, they seem to have, certainly from medical education, got a way to get panels to understand that education is different and looks different and to judge them kind of appropriately." (Interview 32, Male, Medic)

The fact that these set pathways have been put in place by funders were seen as an enabler for many.

"I think we're very lucky that we have that path that didn't really exist for our predecessors…if you get in the door, you are in there, in the whole NIHR thing, so there's career progression pathway that they've got… it continues for you…" (Interview 84, Male, Medic)

A positive for many was being able to choose the percentage split of clinical and academic work.

"I was quite lucky because they offered the doctoral fellowship at one hundred percent, seventy five percent and sixty percent. The NIHR bit was easy actually, I was able to say I just want to take it at sixty percent and then the Dental School who kind of employ me the rest of the time were quite supportive that they were happy for me then just to do sort of twenty percent with them, rather than forty percent with them." (Interview 52, Female, Dentist)

Certain milestones along the career pathway, for example obtaining a PhD, have been highlighted as a necessity and enabler for CAs to maintain their academic careers.

"...if I hadn't got my PhD I probably would have given up academia, it's opened a gate for me that's allowed me to continue actually. I've just been appointed a clinical lecturer in primary care…" (Interview 10, Female, Medic)

"So I was first exposed to NIHR…would have been my first Academic Clinical Fellowship so obviously that was going through the application process, I was successful in that and that was genuinely relatively positive and reasonably straightforward, so having already had a PhD awarded which I think made it a bit easier to get the job and I think there's generally not that many CAs in my specialty, so there wasn't much competition I don't think for the first one. The one I did recently as well was just a similar experience to the first one, so it was relatively straightforward I found the process was fine, I didn't have any issues with the process and I was successful in that one as well." (Interview 83, Male, Medic)

Emotional resilience and creating opportunities

Although many labelled their success in clinical academia as being down to luck and opportunities being handed to them, often being in 'the right place at the right time', this does not take away the fact that to pursue a career in clinical academia, it takes a great deal of hard work and persistence.

"…maybe people would get through it just because they're individually brilliant but I think for me it's been a mixture of ability, hard work and luck." (Interview 32, Male, Medic)

"Probably my strongest quality is persistence, I just keep going…it's not been difficult for me because I've enjoyed it, the bits that I don't like about it I've assimilated or I talk to other people or I get help with…a few things just kind of fell my way at the right time, I got a really good publication towards the end of my PhD and it just had this like transformational effect." (Interview 49, Male, Medic)

Undoubtedly, positive outcomes would likely lead to CAs further pursuing more funding opportunities. The hardest part for CAs was overcoming challenges and set-backs. The majority of participants were fully aware of the knockbacks that they were likely to face from the beginning, most having already faced many themselves, whether that be applying for grants, posts or publishing papers, yet they still had the motivation to continue. Many had built up a resilience to the 'high rejection rates', enabling them to continue to pursue their

chosen pathway. Many used these ‘failures’ as a learning curve as it enabled them to develop their applications and research further.

“There has to be an element of self-motivation and self-determination because there's lots of knockbacks in things, the process can take a bit of a side throughout but actually to continue to have that drive because it is tough, it is, undoubtedly it's different to NHS this clinical training pathway but it is really hard because the rejection rate's high and the kind of success rate's low, so as a result you have to keep chipping away at it and I think definitely an enabler, undoubtedly, is yourself, I think you have to be able to enable yourself to do the work by having that additional drive and self-motivation.” (Interview 45, Male, Dentist)

“The first few are brutal but you learn very quickly that actually they're invaluable to then rewrite the next one and so I was told that before I even started the process, so I sort of had a warning that I, no-one really expected me to get funding to start with, which is great because you sort of think okay, fine, this is what the process is like.” (Interview 53, Female, Medic)

“All of the application processes for each stage have brought with them new challenges but I think overall, I still see it as a really valuable thing to pursue, none of the barriers have been big enough to stop me yet.” (Interview 5, Female, Medic)

Geography

Another enabler that arose from the data was that of being geographically flexible. Many CAs were only able to pursue their CA career if they were able to move to where posts and funding were available.

“I think if you want to be a really successful academic, most academics need to be able to move because it's very unlikely that you're going to be able to train in one place. That's why I moved to Wales, I actually moved to follow the job, the academic job. Some of my colleagues may not be as fortunate to be able to do, relocate.” (Interview 42, Female, Medic)

For some, moving location was an enabler in terms of helping to develop a broader network and more opportunities were likely to arise.

“As a CA you are expected to move centres, acquire expertise in different places and that again can be a problem for some people. I think it is a good thing to do if you can, I did it and that was very beneficial in building your networks and see different things in different places.” (Interview 100, Male, Medic)

Being male and white male privilege (positive discrimination)

Some senior male participants were aware of their privilege and the positive impact that their ethnicity and age have had on their careers. This contrasts with the negativity that young females may face. One individual shared an example of how he was more likely to be listened to in meetings than his female colleagues.

“I am frequently listened to and looked to because I am an oldish white bloke with a clear English accent and people sort of have this instinctive positive bias towards me and I can see that in rooms where female colleagues have said exactly the same thing and not been heard. So, if I repeat them and then go yeah, so and so just said that, then they get heard. So that's definitely the case and it allows me to do things that others wouldn't be able to get away with. I can stand on a platform and wander round and make jokes and take the micky out of myself, and get away with that and if I was a twenty something female researcher I don't think I would be able to. I am aware that my gender, my expression of that, makes me easy, and race, you

know, how I look and how I sound, those elements make it very easy for me to fit into situations, walk into rooms, sit down and be taken notice of." (Interview 6. Male, Medic)

As illustrated above, these male CAs could also be an enabler for their female colleagues when they are not being acknowledged, taking on the role of an 'ally'. This bystander support has been important for many female CAs allowing them to be heard. This was particularly true for some female academics that had male supervisors or mentors who were viewed as 'powerful' in the academic world and supported them in their career progression.

Being a male of white ethnicity was reported as being most advantageous. The male participants openly acknowledged their white male privilege.

"…It is very different being a, big guy who comes in and says stop doing that, you know, you can't get away from the fact that that will happen… I've got a neutral accent, British, white, male, I'm the least diverse person in any diversity panel." (Interview 11, Male, Medic)

Enablers section summary

A host of enablers were identified across organisational, team and individual levels which enabled CAs to overcome the challenges that they experienced and provided support to those who continued their academic roles. The supportive culture of the organisations facilitated pivotal types of support such as workload, financial, pastoral and peer. The importance of supervisors, role models and mentorship were highlighted. An appreciative understanding of the CA demands helped to provide protected time and allow CAs to undertake their required roles. Once participants obtained their first CA post, it was felt that the role formed a strong backbone in their careers and helped to drive future success. Advice and guidance experienced through processes such as applications for funding, and career moves, helped to build relationships and forge stronger networks in academic fields. Organisational support from both clinical and academic environments for individual circumstance issues including maternity and paternity, mental health and job rotation was especially effective in providing reassurance. In addition, funder support and flexibility of funding arrangements helped to alleviate pressures. An increase in autonomy and flexibility of the CA role was another factor that helped to maintain CAs, along with a great deal of resilience from the individual. White male privilege was openly acknowledged by participants and many used it for advocacy of their female colleagues.

Take-home message:

- A supportive culture in both the academic and clinical workplace is essential to ensure CAs continue to progress in their career, including the use of mentorship and role models. This support was particularly important for those with protected characteristics.
- CAs themselves, employers and even CA family members need to be understanding of the high demands facing CAs in this role and protected time needs to be in place to ensure they can both complete their work and progress up the pathway.

Theme: Barriers

Several barriers were highlighted by CAs as responsible for negatively impacting on their experience and chosen career path. For some, these barriers led them to leave Clinical Academia. Sixteen barriers were identified; 1) Clinical Academic culture, 2) experiencing microaggression, 3) lack of career guidance, mentorship and role models, 4) lack of clarity of

pathways, 5) lack of funding for academic work, 6) financial loss, 7) geography, 8) childcare responsibilities and family commitments, 9) research specialty, 10) road to nowhere, 11) lack of process and duplication, 12) process and pipelines, 13) gender inequality, 14) riding two horses, 15) tacit messaging, and 16) deskilling. Reasons for attrition, linked to these barriers, are also discussed in further detail.

Clinical Academic culture

Negative aspects of the CA culture were reported by some participants as potentially posing barriers to them pursuing a career as a CA and also leading to the attrition observed in Clinical Academia. These aspects were reported to be deeply embedded in the culture and extremely hard to change. One of the most frequently cited aspects of the CA culture is that it is predominantly older, white, middle-class male dominated.

"I think sometimes there's been instances I've been in where it's been quite male dominated both in numbers and attitude within the research group…I've worked with a lot of that." (Interview 83, Male, Medic)

This was also the case in dentistry where committees and panels were described to be *"quite white and quite male and quite not long until retirement" (Interview 24, Female, Dentist)* and *"horrendously dominated by males" (Interview 55, Female, Dentist).*

Panels were also reported by female academics to be male dominated and strategic academic decisions were said to often be made in environments where men were more likely to commune such as urinals or pubs. This meant that women were left out of key decision making.

[speaking about her mentor] "[She] started to realise that some of the key conversations that moved the research forward or were had when strategic decisions were made were often made in the men's urinals or in the pub when men were drinking on their own, so she just started walking to the men's urinals, if people were talking about research and she got this terrible reputation…[she said] 'I'll stop doing this if you start having conversations outside of this environment and involve me in them." (Interview 53, Female, Medic)

Another cultural barrier reported by participants was the lack of value for research in areas, particularly paediatrics, medical and dental education and dental primary care.

"I think there are cultural barriers within paediatrics where research is not really valued or understood and I think the point I'm at right now, feels like a very difficult point, it feels like a point where it would be very easy to drop out of academia." (Interview 95, Female, Medic)

"It's not within the culture of dentistry to do research in primary care, so we're just starting to move that forward. Each area, each NIHR area has just been asked to identify a lead for general dental practice research and in some of the areas they've had a real difficulty because they, they almost don't understand the question which is interesting, they're like 'well we haven't got a dental school in this area." (Interview 24, Female, Dentist)

Furthermore, some participants felt that the cultural issue within Clinical Academia is the idea that there is only one way of conducting research and therefore research that involved *"engaging partners…impact and doing the messy research that isn't going to publish [in high impact journals like] The Lancet" (Interview 2, Female, Medic)* is not valued. As a result, participants believed that CAs who conducted such research or had an interest in these research areas were not promoted or valued in the same way. Participants also stated that regardless of their research quality, they were more likely to succeed within an established

research group or with an experienced supervisor who has a good track record of getting funding as well as conducting and publishing research. This culture was felt to be detrimental to their progress and personal development in the sense that in a bid to meet publication demands, they often neglected research that they were interested in.

"For instance, ACF, I've spoken to maybe ten people, before I applied and then now, I'm speaking to people who are doing PhDs because I'm obviously thinking of applying and everybody's saying to me 'you need to make sure you've got publications, you know, publish, publish, publish' and I think it's a big problem where you don't really think about the quality of the work you're doing or why you're doing it, it's just 'get it published' and that's a very stressful thing. I think that's a barrier in a sense...it's not good for your development." (Interview 60, Female, Medic)

Another salient aspect of the CA culture, specifically the academic culture, that was reported as a barrier by participants was the competitive environment. Participants found that in the pressurised world of academia, they had to remain extremely competitive by publishing in high impact journals, presenting at top conferences, building connections with the 'right' people and bringing in research funding. In addition, the application process for the Academic Clinical Fellowships and Lectureships was also described as daunting and demotivating. This competitive and performance-driven atmosphere according to participants was responsible for the dropouts and high attrition rates observed within Clinical Academia.

"I guess just like I think probably a reason that a lot of people like drop out is that it's sort of pretty competitive and sort of getting to the next like stage means you have to kind of have all of this many publications in high up journals and you need to have presented at all these conferences…I think that's kind of the two things that might make me most likely to drop out at some point in my career going forwards, probably either a lack of flexibility and a sense that I have to just work all the time because I want to succeed in this...if I have to apply like five times for a fellowship then I might really struggle with my mental health…" (Interview 96, Female, Medic)

"I was put off academic work because in my intercalated year as an undergrad the only thing that the other people in the lab who were doing their PhDs were all getting dead hung up about papers and grants, I could see it from then. I was like well I don't want to be part of the competitive world and, because I think that's the other element of it, it's all about competition and standing on everyone else, that's not going to change." (Interview 2, Female, Medic)

Participants reported a distinction between academic and clinical culture. The academic culture was generally described as *"ruthless"*, *"aggressive"* and being very isolated when compared to clinical culture (*Interview 49, Male, Medic*). Participants reported that CAs who were able to bring in funding into the institution were more likely to be supported. They felt that this was in some ways akin to a capitalist model.

"People are very supportive when things are going well and you're bringing the money in but if you're not, I think that's generally seen as the litmus test, if you're not bringing in grants and you're not doing lots of papers they're not particularly going to support you, they see that almost as I suppose a kind of capitalist model." (Interview 49, Male, Medic)

"Academic careers are really hard, clinical careers are not easy but it's easier to do it, because you just carry on as you are, whereas if you want an academic career you have to write grants, you have to publish well, you know, and be competitive." (Interview 13, Male, Medic)

Compared to the clinical culture, the academic culture was reported to be very difficult because of high rejection rates and low success rates.

"There's lots of knockbacks...the process can take a bit of a side throughout but actually to continue to have that drive because it is tough...it's different to NHS this clinical training pathway but it is really hard because there is, the rejection rate's high and the kind of success rate's low." (Interview 45, Female, Dentist)

Another barrier mentioned by the participants to be intrinsically part of the CA culture was what we refer to as 'blocks by trailblazers'. Trailblazers were more likely to be senior CAs that had reached the peak of their careers. Participants often experienced blocks by these individuals who were reported to make it difficult for them to get to the top of their career. Female CAs with caring responsibilities and young children often experienced these blocks from older senior female CAs who had worked through the same broken system and come out successful.

"But a lot of the women that I've come across in senior academic positions don't have children [and] have had to fight their way in a man's world and they don't really understand what it is to be a young female that doesn't come from a very well-off background that has decided to have family...i mean absolutely my lifestyle is more important to me than my job and that just doesn't seem to compute with a lot of senior female academics, that they've almost sacrificed everything to get this so they feel that you should too." (Interview 55, Female, Dentist)

"I think also to some extent, and this is obviously completely anecdotal, that the people who, let's just say for women, I do know some senior females who are older than me who are weirdly a bit, they're not feminists for instance, they think, you know, they got to the top with the old system that clearly was biased and so they don't think it's actually that broken and I do know people of colour, senior academics, who perhaps hide or, or try and minimise their cultural aspects and perhaps don't want to be seen as a beacon for BME change...I just think sometimes even the people who make it, they've got there by ignoring that side of them." (Interview 49, Male, Medic)

Younger female CAs planning to start their families and build a career were often questioned about their suitability and ability to have a career within CA.

"I'm married and I would love to have a baby around that age, but then I know that that's the point when all these big fellowships come up and I have been asked actually, not by, like NIHR or anything but by professors in research saying 'oh well how are you going to do this research career if you're a woman?' And 'now do you think you'll do it if you have a baby?' And 'don't you think that will affect your ability to do this like, you know, in the long term?" (Interview 60, Female, Medic)

Many also report more overt scaremongering from senior colleagues, particularly with regards to the practicalities and requirements of the application processes for CA awards.

"I've got a couple of colleagues who've recently gone for a fellowship and both got funding for their PhD, and they've been really helpful at sort of discussing the process and talking me through things. Obviously, I don't know if everything that they've said is correct, but I've certainly not noticed any scaremongering about what's needed and sort of hoops they have to go through other than the requirement for the, for the fellowship." (Interview 58, Male, Medic)

The CA culture was also reported to be often unsupportive. On the academic side, participants reported being under-supervised and unsupported by their departments with NIHR applications. There was a sense that these CAs would be familiar with academic jargon and way of working and this was not always the case.

"The process of applying for things online, the language is not very friendly for CAs...people applying who are not CAs but who've been in academia all their lives are probably more familiar with a lot of the language and how the structures work and what sort of things need signing off and it's more difficult as a CA where you've had less time in an academic setting to work all of that out...they take a lot of work and a lot of support to try and get everything together and when you don't really know what you're doing and the University, you know, they try and help but they don't have dedicated people to help you with them." (Interview 31, Female, Medic)

"Definitely more support with the finance section I think that might be institution-based as opposed to, kind of the NIHR or Wellcome." (Interview 42, Female, Medic)

On the clinical side, participants reported a lack of support and understanding of their academic work by their clinical colleagues. With some participants, clinical departments were not being sympathetic or sufficiently flexible to accommodate their academic demands such as attending training and workshops.

"My clinical TPD says that I am here to train clinical cardiologists, I'm not here to train academics, which goes against everything that's been published by the Academy of Medical Royal Colleges and Academy of Medical Sciences which says that we need to marry up the activity of the NHS in the University because they both improve patient care, etcetera, so the TPD has said to me that they want me to be a clinical cardiologist, so they're not going to be flexible for me to pursue an academic career. It is hierarchical, so it's very difficult to challenge that view…One of the difficulties I had is I said to them if I'm doing one session a week of clinical time during my PhD could you count this towards my clinical training? And they said absolutely not." (Interview 38, Male, Medic)

"I think people that you work with clinically think that you just work part-time." (Interview 71, Female, Medic)

"So certainly, where I am, my experience is that the clinical placements don't really understand the research side of things and they don't really understand that you're being paid, they, they sort of see, almost see the research as a kind of optional extra, they don't quite understand that your salary is being paid to do the research as well." (Interview 95, Female, Medic)

As demonstrated by the following quote, this unsupportive environment often put CAs off a career in Clinical Academia.

"An extremely formative experience for me was having a terrible director, somebody who was not supportive, who put everybody, including me, down, who almost, almost made me leave the academic world, because they were so unpleasant and difficult to work… it taught me how not to be a line manager, it taught me how not to be a director… I felt extremely demoralised by that and certainly contemplated leaving." (Interview 76, Male, Medic)

Experiencing microaggression

Though some CAs had not directly experienced any form of discrimination, microaggression or bullying, they were aware of other CAs who had had these experiences. CAs who

identified as homosexual, were female, or had young children reported experiencing forms of exclusion or bullying, sometimes in subtle forms as a result of their protected characteristics.

"I think the only thing that I've sort of noticed and this is a very soft thing within the lab there is certain kind of informal social gatherings that happen and the female scientists and the female CAs are not invited, and I don't think it's an active decision not to include us, but I am sure that discussions about science go on at those gatherings and therefore we're excluded from those discussions but it's something that myself and one of the other scientists have both noticed and commented on." (Interview 98, Female, Medic)

Participants also reported a culture of bullying, neglect and homophobic behaviour that existed within sections of their institutions.

"If you don't appear straight, if you don't appear heterosexual then I think it can be problematic and that people can treat you differently. Again, I think that isn't a funders issue as such, I think that is an issue that people in society, broadly speaking, are not, do not have an equal view of those who are partnered with someone of the opposite sex..." (Interview 6, Male, Medic)

Other CAs raised the issue of discrimination based on their geographical backgrounds, class and accents.

"I think we need to, again continue to fight against that discrimination around perceived class and so on and so forth, that is still there, it absolutely is still there. I was on a teleconference, now we're all working from home at the Academy of Medical Sciences yesterday, gosh there was some posh accents in that room…and it shouldn't be, they shouldn't be any different from, you know, a broader spectrum of the population…because it's about getting the best minds, not the best accents, you can still be a very, very good communicator and have a great mind regardless of your geographical background but it still seems to play a role." (Interview 76, Male, Medic)

Female CAs reported discrimination based on gender and stated that it was a result of the male-dominated culture within clinical academia. Their accounts were corroborated by accounts from male CAs particularly those who fit the stereotype of the typical CA.

"It allows me to do things that others wouldn't be able to get away with. I can stand on a platform and wander round and make jokes and take the micky out of myself and get away with that and if I was a twenty something female researcher, I don't think I would be able to. I've never been propositioned by anybody for career advancement, but I know that that has happened to female colleagues, I don't know of it happening to any of my male colleagues. I am aware that my gender, my expression of that, makes me easy and race, you know, how I look and how I sound, race isn't quite the right word for that but, but those elements, make it very easy for me to fit into situations, walk into rooms, sit down and be taken notice of." (Interview 6, Male, Medic)

They also felt restricted in their careers and discriminated against as a result of having babies or young children.

"I would say it was really positive up until the point that I had a baby...people used to talk about feminism and they used to talk about women in academia and all the challenges and I used to think this is ridiculous, I've never been held back because of being a woman and then since I've had a baby I've suddenly discovered all of the ways that you're discriminated against, which is inadvertent. So for example, people will plan something in the department, you know, a new project but they won't invite me to it and then you'll discover that

something's been going on and you'll say oh I would have quite liked to have been involved in that and they'll say oh, well I know you've got so much on and you're so busy with the children, you know, so busy with, with your daughter… it is extremely difficult to go, particularly if they hold that meeting outside of normal hours, you've got to sort of move mountains to go because for me to go to a dinner that's arranged it's really quite difficult...seminars often tend to be in the evenings which make it challenging and also the other way that you're inadvertently discriminated against is that it's then much harder to get to conferences so you lose that networking." (Interview 64, Female, Medic)

Lack of career guidance, mentorship and role models

CAs felt that the academic institutions they were a part of often failed to provide the necessary career guidance required to progress in their careers. They also reported that there was no clear channel for seeking guidance about their careers in their academic institutions. This was not only the case for CAs within medical specialties but also for those within dental specialties. Particularly within dentistry, CAs reported being given knowledge of the 'end game' but not how to reach it.

"I think it's less NIHR than the organisation. I think it would be very helpful if there was somebody within organisations, within a university in the research grant management staff that have a specialism in CA and maybe trainee CAs and really understood the issues between trying to balance your NHS or your other commitments to various contracts that you need, and that I guess was able to advise you." (Interview 31, Female, Medic)

Participants reported the lack of a central point or any signposting to information about applying for funding for Fellowships and Lectureships. In some cases, valuable information was discovered only after they had entered the CA pathway.

"When I was applying for the ACF to find anything about it you really had to want it to find any kind of useful information. So, something along the lines of a central, I don't know what you'd call it, a hub, an information point, something that's easily discoverable for a Google search of ACF UK…And you kind of go through NIHR, you have a look through the person specifications, you'll go on different deaneries. But there's no one central point I don't think where you can find out information or at least be signposted to it… I've definitely found with my ACF, I was finding six months in stuff that I should have been able to google in two minutes and find that out…I found out about the RDS about eight months into my ACF." (Interview 11, Male, Medic)

As a result of the lack of career guidance, some CAs reported not knowing the next steps to take after their PhDs, Academic Clinical Lecturer or Fellowship posts and how to go about looking for academic jobs and funding. In some cases, they took on jobs that were not necessarily in the CA pathway or went into full-time clinical practice.

"Just in that period where you're making that transition at finishing your training and because I think that's the point, I have a colleague actually and she just didn't know what really to do at the end of her ACL, she didn't know how to go about looking for a proper academic job because there wasn't really anything coming up or any real advice and she ended up being offered a job in the local CAMHS, which was pretty much full-time, the Child Adolescent Mental Health Service and she just took it and they were meant to give her a day a week, or half a day a week, of academic time so that she could continue to liaise with the University but of course it's not ended up like that and so she's sort of been lost from clinical academia." (Interview 31, Female, Medic)

"I think the biggest barrier I faced was sort of what do I do? You know, in a sense, it's one thing to say I like science and I like the idea of advancing our medical understanding but then it's quite a different thing to say this is what I want to study, or this is I what I want to build a career in and I think that was my biggest barrier post ACF…I couldn't see a future working with that supervisor and then a three month project in a different institution with a different supervisor looking at the neonatal brain development by MRIs, which scientifically was much more up my street, I mean it was quantitative, it was big data, it was computational, it was fancy statistics...I loved it, it was great, however, not in my clinical area…I learnt a lot but I couldn't see a future, for me in that field specifically so essentially I left the ACF." (Interview 101, Male, Medic)

Generally, participants felt that NIHR and their academic institutions could provide better signposting and guidance in order to make the application process clearer and progression through the CA career pathway smoother.

CAs in various medical specialties such as general practice and paediatrics reported that they lacked realistic role models and mentors who had similar experiences and backgrounds to them. They found this not only to be a barrier to starting a career in Clinical Academia but also when already in Clinical Academia.

"I think the first big barrier is getting into any sort of CA stuff. I kind of tried a lot at the very start of my training, again in somewhere like paediatrics where, where you don't have very many role models and you don't have people who are doing research and you're not in centres where people are saying 'oh well do you want to just help me out with this project?' So, there was difficultly to get into it and the way I found round that was by applying for a sort of standalone research post. So, I think that probably stops people getting in, not having role models" (Interview 95, Female, Medic)

The lack of visible role models meant that they often did not have anyone to turn to for career advice or guidance.

"I certainly have more than once looked around my institution and gone there is nobody here that I could turn to for advice because they just don't exist or if they do exist they're not very visible, but I think it then becomes quite tricky if you're in the minority, that people are kind of turning to for advice and you're being asked to be a mentor to lots of other people then again it goes in circles and that takes up loads of your time and probably impairs your career progression, so I think it's a really difficult balance to kind of find and make visible those role models without it being a big burden on them subsequently." (Interview 98, Female, Medic)

CAs reported that a paucity of good role models and adequate mentorship made progressing in their careers difficult.

"That's what I've kind of realised and I sort of think that about my PhD, it was really great but while I was doing it at no point was I thinking ooh, where could this possibly lead to? What skills should I acquire during my PhD to lead on to something else? And unless you have a good senior mentor or support person, sort of signposting that for you, I think that, that becomes quite difficult and it becomes quite easy then to just say well I'm not going to go any further." (Interview 43, Female, Medic)

CAs, particularly those who were female and had young children, LGBTQ, BAME or were intersectional felt that there was not enough representation of senior CAs who looked like them or shared similar experiences.

"There's very few senior female CAs that I look at and think I'd like to be like you. For a start they're few in number and those that are there, a lot of them behave in a very aggressive

way to have got to where they have got to and I don't want to be anything like that." (Interview 46, Female, Medic)

"Representation or me finding a mentor within my university is nigh on impossible because there aren't any and it isn't just BME, it's age as well. A lot of the young career researchers, the issue of intersectionality comes in because for me I need a young Asian male in a Cinderella subspecialty. I'm the only one, so how I can find anybody? So, it isn't just looking at the lens of the protected characteristics in silo, it's about what happens when you've got someone with four protected characteristics?... what is fair to say is that I can't find anybody who I can look up to or I feel can understand some of my challenges because they don't look like me, feel like me, have come from. I don't need someone who's published twenty million papers or this, that and the other, don't need someone who's at the end of their career, I need someone who is facing real life challenges of having a young family and starting as a new consultant, who is in a new specialty, all of those things." (Interview 48, Male, Medic)

As with the medical specialty, CAs in the dental specialty also experienced a lack of role models and felt the need to develop themselves so they could take on the responsibility of role models to future CAs.

"I mean hopefully, say if I did carry on or there's like a generation of the few of us that are doing it, in like ten years or so we can act as mentors for people but because there's no-one who's done it already, there's no-one really to properly mentor us." (Interview 61, Female, Dentist)

Lack of clarity of pathways

Many participants commented that there was a lack of clarity of the CA pathway. The consensus was that the pathway and the next steps to take at critical points in their CA careers were often difficult to understand.

"I think barriers, I've been doing prep for my interview and even being interested in it, being involved, sort of in the pathway and in joint academic and clinical work, it's quite difficult to sort of really understand the pathway and where you can go, where you can take it, erm. So, I think initially, or certainly at first glance, that can, can be prohibitive sometimes." (Interview 18, Female, Medic)

This was particularly the case in certain medical specialities such as paediatrics and public health where CAs felt there was no formal pathway.

"Certainly, in my speciality paediatrics I don't think there's a kind of formal pathway to do research and it's a bit serendipitous… I don't know if in other specialities whether it's more streamlined and I don't know if you did an ACF and then you applied for a PhD and you got an ACL and that will be much more structured." (Interview 51, Female, Medic)

"I think kind of in terms of barriers I think I would say that in public health not, it's not that well-established as a kind of career path and maybe partly because public health careers are inherently really quite diverse, it kind of just seems to be kind of almost left up to people to find routes that do enable them to sort of straddle both fears. So, I think i it's, it's not quite like if I wanted to become an academic consultant cardiologist and I can kind of see quite a lot of people that are sort of working as a cardiologist and also doing academic work x days a week, like that doesn't necessarily seem to exist so much in public health, and I guess it comes down to kind of creating the portfolio career for yourself, but I guess it's a bit less clear." (Interview 95, Female, Medic)

As alluded to in the quote above, it was the case that a lot of CAs were not on the 'traditional' pathway and often felt stuck whenever they reached the next stage in their career. This lack of clarity of pathway meant that some participants, who would normally have considered a career in Clinical Academia but were on a non-traditional pathway, ended-up deciding against it.

"People may have an interest but they think oh well there's this separate pathway and I'm not on that pathway, and it's too late for me and that's not for me or thinking that, that there's no, possibility to move on to that, on to that pathway, so I think those are, those are risks." (Interview 28, Male, Medic)

"The CA pathway, I still think that's a massive issue. I think if you're not on an ACF, ACL treadmill, then how you get in and out of academia is just really unclear." (Interview 13, Male, Medic)

The lack of clarity also existed within the dentistry specialty where CAs felt the pathway was not as clear-cut when compared to medicine, and there was no recognised pathway for general dental practitioners to have an academic career.

"The issue you may or may not be aware is that in medical primary care it's a specialty and so there are proper clinical training pathways which involve research as a component part and in dentistry, general dental practice is not a specialty. So, when you graduate you are fully fledged as a dentist to go off and treat patients, you have to do foundation training to work in the NHS but you don't have to do that to work in private practice...everyone qualifies as a general dentist, so therefore there is no recognised pathway for general dental practitioners to go and have an academic career." (Interview 24, Female, Dentist)

"When I came into a more formalised academic training role as in the ACF post, in dentistry it's slightly different, there aren't really, the academic training pathways are not as prolific in dentistry yet compared to medicine, so there's a lot of academic opportunities at kind of each stage in medicine with Foundation Training...it's just very much in its infancy in dentistry." (Interview 45, Male, Dentist)

Many CAs experienced difficulty during their career paths due to unclear career pathways and reached a point where they felt they could easily drop out and pursue a purely clinical career.

"I think the point I'm at right now, feels like a very difficult point, it feels like a point where it would be very easy to drop out of academia because you finished your PhD that you've been working on for four years and there's not necessarily a very clear cut, plus only for me because I was doing lab-based PhD and given that I'm only able to have twenty percent of my time for research so one day a week I can't carry on the similar type of work I was doing before, it's just not physically possible and so trying to figure out how to change direction is a bit of a barrier." (Interview 95, Female, Medic)

Lack of funding for academic work and bridge funding

A barrier encountered by CAs was a lack of funding to carry out research in the initial stage of their fellowships or when they wanted to progress after delivering a project.

"You can't take up an ACL role in the University unless you've got a PhD, so it was very important to me to find that funding. I knew that, you know, sort of soft funding, as it were, for an MD project or anything wasn't going to be enough, so that was the big barrier for me to start with. I was able to find lots of sort of fellowship type jobs where I could get research

experience but none of those were going to fund my salary to do a PhD as well and so that, that was a huge barrier… I don't have funding for actual research, so I suppose in a way that's a barrier. I don't have any funding for any research that I do myself, so I have my first salary but that's it." (Interview 94, Female, Medic)

Some CAs mentioned that getting funding for the types of research they were involved in such as applied clinical, medical education, health services and dental research was unlikely when compared to surgery, cancer or lab-based research. They felt it was because these research specialties were of low priority to NIHR and other funding bodies, they were in a small specialty, and there were not a lot of charities that funded such research.

"Like paediatric dentistry does not attract funding, I mean even our conferences don't attract money, like you get a few bobs from Colgate or something but that's it, the sponsorship is very, very poor and I've been to things like the World Federation of Haemophilia and the money at a conference like that is just incredible, but paediatric dentistry is just, it's tiny speciality and there's no money to be made out for any potential sponsors so t's very difficult to attract the funding." (Interview 39, Female, Dentist)

"It would mean that we'd have a broader range of research being seen as important and valid and equally valuable, that would also be funded by people like NIHR because it's incredibly difficult to get the sort of work I do funded." (Interview 2, Female, Medic)

CAs stated that when funding was not forthcoming, they had to use their personal resources. However, there were some who expressed that they would not have been able to pursue an MSc or PhD without having financial support because they felt they were not financially viable. Some others left Clinical Academia altogether and went back to clinical practice or training because they had no funding to continue the projects they had been working on.

"When I came to the end of my research, we didn't have funding to continue the project I was working on so I've just gone back into training and carried on as I am and I've had various kind of involvement in little things but nothing major since then." (Interview 44, Female, Medic)

Financial loss

A major impediment to pursuing a CA career reported by many of the participants was the low salary they received compared to their colleagues who were in full-time clinical practice. CAs often had to add on an extra year or two to their training and during this time would take significant pay cuts. Participants also reported leaving academia to focus on clinical practice because of the drop in their salary. Many of these CAs had dependents and personal commitments such as mortgages and young children and sometimes had to adjust their lifestyle in order to cope.

"You can be quite disadvantaged by going into an academic career, financially, the fact it takes you longer to finish, all of the uncertainty, watching your peers kind of go past you because it takes longer." (Interview 31, Female, Medic)

"This is something I do think about quite a lot and I'd like to say I'll just go back into clinical medicine and just be happy doing that but I don't think I can, I think I've done academia for too long and I know that it's what makes me happy in my career, so I personally think I'll keep doing it, I hope but obviously it does depend on funding, but a lot of my colleagues have come, are coming to the end of their PhDs, are women in medicine and they're just going back into clinical medicine." (Interview 42, Female, Medic)

"For instance, for me to do this role, I am spending an extra year on a lower salary than if I would have finished, because it's four years, but I would have finished everything in three years if I didn't go for the ACF, so there's an extra year on a lower salary, that doesn't mean that when I finish I am going to be getting a far higher salary than when I finish in three years, I will still be earning all the same, so it, a one year hit that the family has to take, so I have to scratch for money, you're just on a lower salary for another year and just manage, not going for one holiday." (Interview 84, Male, Medic)

Geography

Many CAs begin their academic careers much later in life, when they are more likely to have started a family or obtained a mortgage. At this stage in their lives, they were often reluctant to relocate as that meant uprooting their families or leaving behind personal investments. The most important factor that influenced CAs' decision to move around the country for work was their family commitments. The majority of the CAs interviewed reported that they found it difficult and, in some cases, impossible to move to a different part of the country because their family was settled or they were planning on starting a family in their current geographical area. On the other hand, some participants reported moving away from their research base due to family circumstances. Some female CAs believed it was much more common for men to move around the country than women. The general consensus among participants was that there was an expectation in academia to be mobile and flexible and this did not always align with the priorities of the CAs (see Childcare Responsibilities and Family Commitments below). Furthermore, there were limited academic jobs being offered in either their geographical area or area of specialty, thereby creating a bottleneck.

"I just thought actually realistically I've only got my son at home for another eight years and I don't want to spend that time getting up at half four in the morning and getting trams and sort of practically I couldn't see how that would work around my family life at the moment." (Interview 71, Female, Medic)

"Family circumstances meant that I moved away from where my research base was, I guess was a bit of a barrier." (Interview 95, Female, Medic)

"I think that puts people off going into academia later because you have, you're more kind of set in where you, where you are and it's harder just to move." (Interview 42, Female, Medic)

"As a CA you are expected to move centres and to acquire expertise in different places and that again can be a problem for some people… because CAs tend to get to a career later, often at that point they already got family, they've already got like very small kids, so they are, basically moving and being flexible is obviously curtailed to an extent, right?" (Interview 100, Male, Medic)

Participants also reported national differences in the ACF posts in academic institutions and departments across various regions around the country. CAs reported that it took some time and was difficult to get settled whenever they moved to a different region, as they had to re-establish contacts and find new mentors. For some, being in a different region meant that they had to settle for less competitive and successful research centres.

"I had an ACF in the West Midlands but this is not at a cardiology unit, so I decided to take a leap of faith and jump across the region to do a cardiology academic foundation programme and my plan during the academic foundation programme was to prepare an application for an ACF after the foundation. So, during the academic foundation I have to say I found myself a bit lost because I moved regions and what I have come to realise is that every time

someone moves department or regions, you need a bit of time to settle down and find mentors and that was not always easy, in fact when I moved." (Interview 38, Male, Medic)

"I think that was very much my experience that I had to work really hard, and particularly when you're not in London you don't really have. I didn't get any experience of global health in Edinburgh because you don't have the big researchers here… looking at my friends who are still in Edinburgh, I think the barriers they have are that there are just less people doing this research it seems, and then also the people that do research are fewer and maybe less kind of competitive or maybe less successful, which means that maybe they have less funding for them to do research projects, so they get a lot less choice." (Interview 60, Female, Medic)

"Another barrier I think is, is being outside of one of the big cancer centres and I think in terms of a sort of funding perspective, it feels like that's an issue that I can't move because my husband is a doctor and has a consultant post where I am and I have small children who are at school, so realistically I'm not going to uproot them and move them out of the country but that does mean that I'm not in sort of one of the world leading cancer centres and I definitely feel that that's potentially an issue for me." (Interview 98, Female, Medic)

Childcare responsibilities and family commitments

CAs who have young children and caregiving responsibilities mentioned how their priorities had changed and that they quite often had to undertake academic work around the schedules of their young children. This often meant working at night-time when they had less distractions from their children or caring responsibilities. CAs who cared for family members who were unwell or had special needs often found it difficult to manage hospital appointments and activities as well as their academic work. Female CAs particularly reported difficulties associated with presenting at conferences and doing academic work because it was one more thing for them to juggle. Furthermore, they had to arrange and pay for childcare and did not like being away from their children for a long period of time.

"I think there's lots of things about academia that do make it difficult to go back into, if you're the primary caregiver for a child then I think there's, there's particular aspects about academia that would make it difficult in that, I do think the current model of clinical academia that I'm in, which is, you do your research three months out of twelve a year, is not really that practical because it sometimes doesn't work that way." (Interview 83, Male, Medic)

"I work full-time and if I'm not working a long day my priority is to get home and do bedtime with my [child], I've got a four-year-old and so I don't go to things after work and I don't do things in the evening, but I do wonder how much I miss out with that and I limit what I attend conference wise, saying I won't do something more than once a year, to not be away. I think if I didn't have a child, I would probably do more social things within academia, but I feel like I've reorganised my priorities and for me getting home for bedtime is the main thing I want to do." (Interview 91, Female, Medic)

"It has affected family life, as I'm doing emails late into the evenings, when I should just be concentrating on family and, reviewing a paper for the British Association of General Practice or reading something else or answering the four hundred emails in the inbox and I'm not sort of haphazardly and chaotically and flexibly is how I've managed it, I wouldn't say I've had a particular strategy for it…I want to invest that energy into my family really and my clinical work at the moment." (Interview 71, Female, Medic)

Research specialty

The research specialty of some participants posed a barrier to their CA careers in terms of the impact of their research and its implication for practice in the long-term. CAs particularly in paediatric, forensic psychiatry, primary care, medical education and dentistry specialties such as oral surgery, struggled because of the lack of a well-established research infrastructure and network, as well as due to the inability to attract as much funding as other more established specialties.

"I would say academia and anaesthetics isn't that well a trodden path, a few anaesthetists come out to do PhDs but it's quite a tiny proportion compared to other specialties, so you're often met with slight confusion by clinical training leads because they don't really understand how it works." (Interview 93, Female, Medic)

"I think as I said it was sort of the type of research that they did was difficult to continue." (Interview 51, Female, Medic)

"Not having the kind of oh do you want to get involved in this that we're already doing? And so that was a barrier definitely. So not being part of critical mass, is a barrier, and that's difficult with a small speciality because there aren't many places with critical mass." (Interview 32, Male, Medic)

"The bottom line is because no-one understands it, the infrastructure isn't here yet and probably won't be here for at least another five, ten years until people like me and other people have managed to sort of put that infrastructure in. At the moment the infrastructure isn't there and I don't think any one individual in any of the organisations, be it York, London, UCL, Nottingham, or any of them actually have got the perfect set-up or the full picture because part of the problem..." (Interview 48, Male, Medic)

Road to nowhere

For some CAs the fast-paced, performance-driven culture coupled with the uncertainty in academia left them feeling like they were on a road to nowhere. They reported questioning themselves about the point of publishing so many papers, applying and getting grants, acquiring the knowledge and sitting on committees just to enhance their CVs to get a short-term job. This was also the case in primary care dentistry where some CAs felt they did not actually have a specialty or role and did not fit in anywhere within a dental institute or school.

"I'm coming to the end of my In-Practice Fellowship and after talking to a lot of people and obviously it's taken me an awful lot of effort to get even my foot in the door to be honest with you, as a mid-career clinician, it took me a long time to get in and I had to do a lot of stuff off my own bat to get in, to sort of prove myself and I've been told the only option for me to stay in research really, to stay funded, is to do a PhD and I just can't do it. [laughs] I think I just realised that I'd have to do it part-time because I really enjoy my clinical work and therefore that could be like a four-stroke five-year programme of work, again on my own, completely, pretty much and I mean I'm nearly fifty now, so I'm not young and I have got teenage children… So actually, done lots of stuff but the pure research and getting funding for a PhD I think it's just a bridge too far for clinicians." (Interview 47, Female, Medic)

"One of my other colleagues had said when does it end? [laughs] This sort of constant treadmill of getting grants and publishing, getting grants and publishing, getting grants and publishing and constantly sitting on committees and fluffing your CV basically, so that you can get that next job but that next job is actually the same as the last job, it may be just for

two years rather than six months and it's brutal, it's utterly brutal." (Interview 58, Male, Medic)

"I'd love to do more research stuff and that if this becomes more positive but then it's difficult being primary care because I don't have a specialty, there's no like role or anything for me to go for in the dental hospital… I almost like don't fit in anywhere if you like, because it's not like really clinical primary dental care stuff…it's not making it easy to do and it's making me think is it really worth it?" (Interview 61, Female, Dentist)

Lack of process and duplication of effort

CAs have also commented on the lack of clear processes within their roles, particularly concerning appraisal and revalidation. This has often led to further duplication of effort.

"The problem is the academic revalidation and appraisal and for myself there was nobody who was able to do it once I stopped seeing patients because they didn't know how to handle me. I mean I contacted the GMC and they said I could go privately and have an appraisal and revalidation done privately but the cost of that is...there are professionals out there who will do it for you but they charge eight hundred pounds a shot. So, there is a hole here and I think that the Department of Health and the GMC have not sorted it out as well as they should. The GMC keeps sending you from pillar to post and Department of Health needs to sit down with the GMC and say look we've got to clarify the way CAs are appraised." (Interview 41, Female, Medic)

The duplication of effort with respect to replicated activities in the clinical and academic environments was repeatedly quoted as a barrier. This is particularly important given the fact that most participants have commented on the vast amount of work that is required to maintain both clinical and academic posts alongside each other.

"...useless paperwork...it really annoys me that it's not streamlined...like that the University won't take the NHS paperwork and the NHS won't take the University paperwork, just drives me nuts." (Interview 1, Female, Medic)

"I think CA trainees should follow an alternative curriculum to standard trainees with respect to audits and QI projects. Some of us have undertaken leading research which may inform evidence and guidelines. Yet any research outputs obtained, however prestigious, seem to be ignored with a focus at ARCP time on the mundane more low-brow activities necessary for sign-off! I think peer-reviewed original research should 'trump' audit and there should be better understanding of the hierarchy of evidence by ARCP panels." (Interview 7, Male, Medic)

Process and pipelines

Within the subtheme of process and pipelines, three sub-themes will be discussed; individual circumstances not taken into consideration, contracts and stepping off the pathway.

Individual circumstances not taken into consideration

Another important barrier that has arisen from the data is the fact that funders do not seem to take individual circumstances into consideration, particularly career breaks due to maternity or sickness leave. Individuals feel that these career breaks have negatively impacted upon their CVs and overall career success.

"I guess the other thing that's come up is that it [mental health issues] has affected how much output I've had from my PhD. So initially I didn't publish very much because I was trying to get, I was effectively kind of working part-time doing my clinical stuff and working part-time doing a PhD, it's not really two part-time jobs at all. Once I'd finished my PhD my mental health really took a hammering and I ended up being off work for about six months… there's then a gap in like my publishing history and again it's something that applying for CA jobs or kind of those jobs that have got a fifty-fifty split research and clinical work. So, things that we need to get rid of, or at least amend, are any kind of age limits on grants, awards, prizes, distinctions, whatever it is, so any organisation that still says that you have to be under thirty-five to be an early careers researcher or to be eligible for a prize or whatever it is needs to have it pointed out to them quite clearly that discriminates against people. And it specifically discriminates against anyone who's had a career break for whatever reason." (Interview 10, Female, Medic)

A lack of structure and inflexibility within certain specialties also needs to be addressed. Individual circumstances and previous training are not always taken into consideration by funders.

"There is a very poor career structure in general practice. If you do one of the fellowships and then you decide you want to do a PhD or an MD, you know, it's easy for hospital doctors because they become registrars and they get, specialist training and they're heading towards a consultant post, but what do you do with GPs? We just lack an academic career structure." (Interview 59, Male, Medic)

"So normally the rules state that you pick up a lecturer's job and you have to complete it, I think it's four years full-time or your CCT, whichever is sooner and that's what is said in hospital medicine but general practice is different, you can't pick a lecturer' s job up until you've got your CCT. Which kind of didn't make sense because I've been kept back at an ACF level when in fact I could have been at lecturer's level, it doesn't matter, it's just taken more time...what they haven't allowed for in that is the fact that sometimes GPs are a group that do do things in a roundabout way, and they do sometimes get people that have come from other specialties and therefore have their PhDs. So that's one thing that would be quite good for them to look at I think." (Interview 4, Female, Medic)

Contracts

Many participants commented on the fact that organisations and funders do not think about the negative impact that a change in contract (from NHS to academic institution) can have on individuals, particularly in terms of pay and rights.

"I took time out to do my PhD, at that point I think my contract moved from being an NHS one to a university one. I got pregnant at the beginning of that contract, so I hadn't been in employment for a whole year by the time I went on maternity leave, by the University. What that meant is that I missed out on maternity pay, so I got the normal statutory maternity pay but I didn't get the University maternity pay, which had I continued just doing clinical work, because I'd have had a continuous employer, I would have got maternity pay. But, yeah, I lost out on quite a bit of money at that stage and again that seems a bit unfair because the CA pathway is a pathway. And you have to get a PhD. So, it seems a bit unfair to, and actually I timed my family in a way because I knew that actually when I was in academic work full-time was a time where I might be able to balance having a young family and it did work really well but it just seemed a bit unfair again that I was slightly penalised for doing that." (Interview 4, Female, Medic)

"We still can't get a standardised contract for CA within the NIHR. So, if you're an NIHR funded clinical lecturer, you're not guaranteed the same protections as your clinical colleagues, so you don't have things like whistleblowing protection, you might not have the same protections about continuity of service. So, I've had two colleagues in the past year, who were assured at interview that when they took up their CL posts that they would retain continuity of service and that they would have pay parity for maternity leave with their NHS colleagues and then it's only after they've become pregnant, they've found out that's not true, ...that's two women who are not coming back into academia, because they just say they can't risk it anymore...we need to be much clearer about, availability of less than full-time posts, and again, most places when you challenge them will say yes, you can do this less than full-time, but it doesn't help if they don't advertise them as such and the same thing goes for fellowship awards, prizes, anything like that, needs to recognise less than full-time working." (Interview 10, Female, Medic)

Stepping off the pathway

A recurrent theme that seems to have arisen relates to the perception that CA careers can only be successful if the CA follows a certain pathway. There is a perception that if you step off this pathway, for example for a career break, it is impossible to get back on.

"So you're stuck in this vicious circle where you can't apply for funding because you haven't got a contract with somebody and you can't get a contract with somebody because you haven't got the funding, , and it's one of those things that perpetuates people who are already in the system, so if you're on this nice straightforward career trajectory with no career breaks and you've got your sponsors in place and you've got nice mentors and everything else, great, you are sorted, the grants will keep coming in, if you step off that pathway for whatever reason, you have no way back, that's a huge barrier, and it's not just for funding, it applies to all sorts of things, so mentorship schemes, you can't get on a mentorship scheme unless you have a grant awarded to you, which seems slightly pointless because if you've already got funding then presumably you're less in need of mentoring then somebody who's applying." (Interview 10, Female, Medic)

Gender inequality

Within the subtheme of gender inequality, a focus will be placed on two themes; reproductive decision making and reverse discrimination.

Reproductive Decision Making

Several participants have commented on gender inequality having been an issue during their CA career, having faced this directly or observed this towards their colleagues. Relating to women and their perceived role, participants noted that other academics had preconceived ideas about their ability (or inability) to become CAs with women often noting that they were made to feel that they have to choose whether to become a CA or have a family. Some women also noted that other successful women often appeared to choose their career over starting a family.

"...a very unconscious gender bias, which manifests itself in the way that women are not listened to in meetings, women's contribution is ignored, when they post something on the electronic communication that they have the list servers, women will often not be responded to and then a man will make the same point, two or three posts later and people will respond to it. Women are not chosen to speak first in meetings. If you said to someone coming out of a meeting, do you think there was any gender inequality in that meeting? They'd say no. It wouldn't have occurred, particularly to male colleagues, that there was any issue, and that

extends from, from those kinds of things, to things like, you know, a female colleague who's on maternity leave. She lives in London, they have decided to have an away day for her colleagues, her immediate team, and they are doing it outside London. So, she wanted to go, she's got a young baby, but she thought well if it's where it normally is then I could probably make arrangements, you know, go for a few hours and they've decided to do it further away and when she's raised it and said but actually, you know that can't come if it's that far, can we move it? They've said oh no, it's...people say that they don't see it as an issue that there are one or two women in a room and there are eighteen men, and they don't see that as an issue and if you challenge them and say do you think we're unequal here, in our gender balance? They'll say oh well I mean yes, obviously but I can represent women, I can speak for women; I know what the issues are for women. Actually, you don't." (Interview 9, Female, Medic)

"...things changed when I had children I suppose, as they often do, and probably changed for me more than they did my husband I think, and we trained together...he's now a consultant in a tertiary centre...I think the professor I was working for was a little surprised when I decided I wanted to completely retrain and his comments at the time were well I suppose you've got a family, haven't you? I wonder if he, he thought that I'd changed to general practice because of being a mother." (Interview 4, Female, Medic)

The below example refers to a culture that is reflective of the gender inequality issues that have been discussed above.

"Initially it begins being a stereotypical older male doctor, who often has grown ups, they qualified in a time when the man who was the GP and the woman was either a stay-at-home housewife or nurse and therefore subordinate, in some way and for the concept of having representatives who are women as married to men who have their own career, you know, or same sex couples, where the other partner is not a stay-at-home carer, they have their own career, is alien. So, it begins with that but then because they are the people who have been there for decades and who have the experience and have the knowledge and they're part of the furniture, people coming in, particularly younger male colleagues, see that behaviour and that is acceptable within that culture and then you start to see it in younger male colleagues and you start to see it in some women as well. You start to see that if you're going to fit in with that cohort, with that core group then you have to be like them, you have to put that lifestyle and that aspect of your role first...it is so subtle, it's much harder to call it out, it's much harder to say let me stop you there. I've seen that in the criticism of colleagues, you know, rolling eyes...when I called that out...it is greeted with blank looks as though there's nothing wrong, with the inferred criticism and also then the implied fact, this is a woman who's probably a bit hysterical, she's obviously got some issues, that kind of hormonal, almost insane that is often implied to, quite feisty, she's a bit of a bitch isn't she? She's quite bossy, she likes being in charge, all that kind of language...you think would they talk to a bloke like that? They wouldn't, they'd say oh he's great, you know, he's really clear what he wants, you know, he knows how to get it, you know, it would be praised, it would be a positive thing." (Interview 9, Female, Medic)

Reverse Discrimination

CAs reported that in an attempt to be non-discriminatory, inclusive and representative of individuals with protected characteristics, there was often the risk of reverse discrimination. Some CAs felt that they were at risk of being excluded if they did not fall into one of the protected characteristic categories, even if they were better qualified than the other applicants. A number of male participants were vocal with regards to how they felt that the equality pendulum had swung too far the other way.

"I think we've all become aware of the need to ensure that we have wider representation in terms of gender. I think that there are situations where I might have considered but I have not gone for because I've been aware of who the other applicants are and I've been aware of the gender bias that might exist in that setting, in other words I think there's a positive gender bias now...In terms of gender I think all academic departments, all organisations are very conscious. I mean when I arrange a meeting, I try to make sure that at least a third of the panel is female, if not fifty percent and this sometimes means leaving out someone who might be slightly better." (Interview 59, Male, Medic)

"There's lots of pictures of spot the woman, spot the Asian person or the black person or whatever in this, you know, well, yeah, but what if none of them happen to be experts in that?" (Interview 11, Male, Medic)

Initiatives such as Athena SWAN and those seeking greater representation of women on panels, were viewed as discriminatory towards men.

"…you almost feel bad for being a white guy but, but equally I, and, you know, I, I see, see quite a lot on Twitter on, on things like this of, encouraging female speakers at conferences and that sort of thing which I'm all for but equally you look at it and go well why should I not go and present at this if I'm the expert on it? It doesn't, I just happen to be a white guy but if that's my specialist field why should I, why should I not go and talk about that?" (Interview 11, Male, Medic)

"…obviously I know about Athena SWAN and things, I think it does on some level, you know, as a, as a white male you can feel a little bit excluded by that because…it's promoting women isn't it? But at the same time it's basically saying there's too many men in research…" (Interview 13, Male, Medic)

Riding two horses

CAs hold positions which encompass both clinical and academic activity with multiple employers. For some, academic activity is further divided into research and teaching. The dichotomy of working simultaneously in two camps has been cited as being advantageous; there are some benefits to having multiple employers and the variety in workload. CAs reported that they struggled with working across the NHS and academic institutions. An analogy of 'riding two horses' was used by participants to describe the balance of being in two environments simultaneously, frequently pulled in opposite directions. Some of the challenges related specifically to: competing demands and priorities; Conflicting work schedules; Sub-optimal contracts, pensions, annual leave and benefits; Unrealistic workload expectations and allocations; Duplication of effort; Tacit messaging - observing burnout and fatigue in CA colleagues, and; Consequential identity crises

Having a foot in both camps resulted in CAs grappling with the competing identities of clinician and academic.

"As a CA you're always viewed as not a true academic and not a true clinician so that can take a toll on people's personal relationships and mental health, so that can be an element that can be addressed as well. I am fortunate that I haven't experienced this but some of my colleagues have and that makes them resort to a drop in one of the activities." (Interview 38, Male, Medic)

This lack of clarity and understanding is cited directly as being detrimental when CAs apply for promotion.

"...people just don't understand our training pathway and they don't understand our status. So, when I went to my current post the Human Resources Department kept calling me a Registrar and I was last a Registrar in 2006 and it's now 2020 and that was in 2017." (Interview 104, Male, Medic)

Tacit messaging

Junior colleagues reported witnessing the negative aspects of a CA's workload through observing role-models and tacit messaging. The risk of burnout was a major red flag to aspiring CAs.

"I also acknowledge that I look around at many, you know, who are ahead of me, you know, registrars when I was a junior SHO, who were very keen on research and, you see that, you know, it's not that they're burnout, it's not that they're bitter but, you know, they, they did it and they ultimately decided to just focus on a clinical career and possibly a better life quality." (Interview 101, Male, Medic)

Deskilling

A further issue that has arisen concerns the fact that CAs need to maintain a certain amount of clinical work to ensure they are able to maintain their skills. This is particularly the case in craft specialties such as surgery. This can be challenging as the academic side of their posts can often feel like full-time work in itself and they are usually not given enough time of their clinical work.

"I'm a firm believer that if you do less than three days a week of clinical work your skill base begins to diminish and also the lack of continuity means that holes develop in the patient's care and I became aware of that when I had my RCGP Fellowship when I was working about three, three and a half days a week. I also began to realise, very strongly, there were areas where I was getting slightly deskilled." (Interview 59, Male, Medic)

"…that's too much time to deskill because what I feel like other young specialists, this is not the time I think, to stop operating and go and do academia, whereas you should concentrate on finishing your CCST, see patients..." (Interview 26, Female, Dentist)

Attrition linked to barriers

Attrition has been noted throughout, however CAs explicitly attributed the high rate of attrition observed in Clinical Academia to the following reasons below.

Mentorship, support and guidance

The importance of mentorship, support and guidance to the success of a CA career was explicitly stressed by CAs in this study. Many CAs reported that they would have dropped out without adequate mentoring and guidance especially when the process got difficult.

"I mean there is mentorship available and I've got a mentor through the Academy of Medical Sciences and to be honest if I didn't have that mentor I would probably have quit by now, but I know that those mentors are not available until you get to an ACL level and actually I had a really difficult period just before I got my ACL post where I could really, really have valued a mentor and there wasn't like a scheme like that available to me, so I think expanding those kind of mentorship schemes to a more junior level of researchers would be really valuable and actually kind of once people have secured an ACL post they're over one of the hurdles

and actually I think there's a lot of attrition before that maybe wouldn't happen if people were better supported." (Interview 98, Female, Medic)

"I sort of think that about my PhD, it was really great but while I was doing it at no point was, I thinking ooh, where could this possibly lead to? What skills should I acquire during my PhD to lead on to something else? And unless you have a good, senior mentor or support person, sort of signposting that for you, I think that that becomes quite difficult and it becomes quite easy then to just say well I'm not going to go any further." (Interview 43, Female, Medic)

Lack of longer contracts, bridge contracts and career succession plans

Many of the CAs stated that one of the reasons for the high attrition rate observed within clinical academia was the length of the job contracts. They felt job contracts were often too short and did not allow for career and personal development.

"I think the main thing is longer contracts, contracts are too short…people who are jumping from one clinical, academic clinical lectureship role to another, after every three, four years you're thinking of applying again or getting a grant and that does take a lot of personal time, energy as well and it can actually just change. For instance, one of the applicants, his role is far away so he comes, if I have a clinic academic role here in [place] for five years and after that five years he's not sure that he's going to do that role again, it's either have a gap and not have any CA roles and go purely clinical and then switch back on again, when I can only get one, so that is not a sign of progression, that is not a sign of something that you want people to make the best of their time. When the person is researching something, they invest their time and energy into it for a sustained amount of time before you're experiencing very large output but if you have short contracts, you're going to have people who are just going to come, give you work you can do in that short period of time and a quick one or two brief papers in some journals but then when you want to find people that would bring up high impact journal studies, people who have gained experience in one thing over years and then their output become stronger and stronger, but if after three years you bring a very strong output, might not be very possible and by then I've been to the end of my contract which might be four year contracts or a five year contracts and that opportunity might be lost. So yeah, I think contracts are the main, the main problem." (Interview 84, Male, Medic)

Lack of CA positions available (supply does not meet demand)

CAs mentioned that a main reason for attrition is the limited number of CA positions available. This was mainly due to the competitive culture within Clinical Academia. It was stated that creating more positions could potentially reduce attrition within Clinical Academia.

"I think the main thing to do that is I just think you need to, I mean it depends how many CAs they want really, but I think that you need to expand the number of places there are for CAs because I think a lot of the barriers that I've spoken about and a lot of the barriers that would keep people within certain geographical areas or within certain specialties, you could fold a lot of that if you had more CA decisions, so I certainly think that you need to do that because that would then encourage more people to be in it because I think it's fairly self-intuitive that if somebody's got a particular barrier to getting into clinical academia or particular barriers to carrying on within that career, those could be partly solved by having a lot more positions, so I think that's certainly one way of doing it because if you increase the supply of jobs then that will, by definition make it easier for people to get in and easier to stay in clinical academia." (Interview 83, Male, Medic)

Inability to secure research funding

The inability to secure funding was another reason given for attrition in Clinical Academia. Some CAs reported that they went into full-time clinical practice when they were unable to secure funding to start or complete their PhD or post-doctoral research.

"In our specialty the main attrition comes from, sort of PhDs not getting postdoc funding, so, there should be more, availability within the NHS jobs I think to do like a few, maybe one session or two sessions of research as part of an NHS job." (Interview 86, Female, Medic)

Failure to secure CA jobs

Closely related to the lack of CA positions available is the failure to secure CA jobs. CAs reported that this was indeed a cause of attrition. CAs who could not secure a job often abandoned their career in Clinical Academia for full-time clinical practice, where it was much easier to secure a position.

"I think if they've had a previous bad experience with it, then I think that would make them less likely to return to it, if they did it and found that they didn't enjoy it, I could definitely see if they've been knocked back from applying for a clinical job, CA jobs then you would begin to think, you'd begin to feel negative about it and then might discourage you from applying in the future." (Interview 83, Male, Medic)

Inability to keep up with the demands of CA (see barrier: culture)

CAs complained about burn-out that resulted from juggling conferences, doing lectures, publishing papers, bidding for grants and clinical work. Both academic and clinical demands of a CA career put a lot of pressure on participants and often led to attrition.

"When the clinical work goes really wrong that's really, really stressful, when bad things happen between partners, that's really stressful but generally now I find most days, the clinical work, although it's a long day, twelve to fourteen hours, when I go home, I can sort of relax after it whereas the academic side of things it's pretty relentless and constant… I think academic work is really stressful and very personally stressful...going to conferences and doing lecturers or keynotes and it's something that I've really worked on and kind of enjoy after the event but I do find that difficult and stressful and time-consuming preparing. probably a little bit burnt out to be honest, with the academic side of things, I'm just ready for a break from it." (Interview 71, Female, Medic)

"If I'd drop one or the other, I'd just drop the research because that's what's untenable, I mean just doing ten sessions a week for the NHS is a walk in the park really isn't it? You just work and do the job and go home." (Interview 33, Male, Medic)

Lack of opportunities to sample Clinical Academia

One important cause of attrition that was reported was the lack of opportunity to sample Clinical Academia. Many CAs leave Clinical Academia due to the high stress, lack of time and workload, alongside the many other factors reported. Giving CAs an opportunity to see what Clinical Academia is like first-hand, before fully investing in a certain pathway, would allow individuals to decide early on if the career is right for them. CAs also generally believed that having opportunities for junior colleagues with less experience to sample Clinical Academia may increase their confidence in their research abilities and result in reduced attrition rates.

"I think you need to make opportunities there for people who don't necessarily have as much experience but who actually just want to sample what a CA career is like because you never know, sometimes people who haven't had lots of previous experience in it, may actually be some of the best ones who actually go and do it long term and I think you only start realising that in CT1, CT2 and you apply for these academic clinical fellowships then you're going to come up against people who have just had a lot of experience and it's hard to overcome that no matter how good you are as an academic." (Interview 83, Male, Medic)

Barriers section summary
In mirror contrast to the enablers, the barriers highlighted many similar factors such as unsupportive organisational environment and culture, lack of mentorship and role models, inflexibility of responsibilities, lack of financial and funder support and lack of understanding of CA roles. Within both academic and clinical environments there were significant misunderstandings from peers and colleagues about the roles and lack of affordance given to CAs to fulfil their roles. In addition, there were specialty specific barriers such as focusing research on unpopular and lower priority topic areas which seemed to make applications for funding even more of a challenge. A range of discriminatory behaviours were encountered spanning from protected characteristics abuses, microaggressions and stereotyping in blocking pathways. The importance of supervisors, managers and senior figures in the field was highlighted as the potential to cause longer term damage due to blocks from trailblazers and an emphasis on ensuring future generations should similarly struggle in their academic journeys. Difficulties around reproductive decision making, maternity and childcare responsibilities created much anxiety and contributed to difficulties in continuing CA careers over time. Male participants reported the impact of perceived reverse discrimination, particularly towards white males.
Take-home message: • The current CA culture, described as unsupportive and competitive coupled with a lack of adequate mentoring and role models, is a barrier to progression in Clinical Academia. Clinical Academia has also been described as being male-dominated, and discriminatory behaviour towards those with protected characteristics has been reported. Female CAs and others with caring responsibilities are particularly negatively affected as a result. • Additionally, a lack of support for unpopular research topic areas, which leads to the inability to secure funding and a lack of clarity of pathways, deter intending CAs from pursuing a career in Clinical Academia. It is imperative that these barriers are addressed in order to prevent further attrition and keep CAs progressing smoothly through the pathway

Theme: Identity

Identity was a significant factor associated with the experiences and successes of CAs. A lack of clear identity, particularly in the eyes of others, was a hindrance to CAs as they navigated their respective career pathways.

It is important to note that identity consists of the beliefs, personality and qualities that a group or person identifies with. Identity can be regarded as positive or negative and can relate to self-esteem.

CAs discourse centred around their identity, misconceptions about the role and identity of a CA within the clinical and academic workforces, and the prevalence of imposter syndrome. For some, being a CA instilled a sense of pride but for some there was an ambivalence towards being a CA.

Imposter syndrome

Many participants were conflicted about their identity as CAs and often experienced 'imposter syndrome'. Imposter syndrome refers to the persistent inability to believe that one's success is deserved or has been legitimately achieved as a result of one's own efforts or skills.

Participants described feeling that they were not adequately qualified to identify as CAs. Even in those at the pinnacle of their career, imposter syndrome was heavily cited.

"...obviously links into the whole imposter syndrome thing because no-one tells you well done, you've done well, you only get this one-year publication gets accepted or your PhD gets awarded but in between you don't get any of that, and of course that takes its toll on imposter syndrome, motivation, self-identity as well." (Interview 38, Male, Medic)

"I often relate this story [career path] when I give lectures because I was never and I still don't consider myself an academic." (Interview 80, Female, Medic)

Women reported lower self-confidence than their male colleagues, specifically doubting their credentials in relation to their research expertise.

"I think it's probably been more about like needing to work harder to be listened to and doubting myself and kind of not feeling I have the same level of confidence as like otherwise similar men." (Interview 96, Female, Medic)

"I couldn't help but feel an element of 'imposter syndrome' - Is my input/expertise really that useful to what they are planning to do? Can I deliver on what I said could be done? I really wanted to avoid any future embarrassment." (Interview 69, Male, Dentist)

Protected characteristics and identity

Participants described their intersectionality when discussing their protected characteristics and the impact they have upon their perception of personal and professional identities. Additionally, geographical location, including employing institutions, also significantly influenced how CAs regarded themselves and their professional identity.

*"Some funny contract with *name of University* now, so I kind of work for two universities and got two Masters plus my clinical work, which makes life slightly complicated, as no-one quite ever knows what I'm doing, who I am, and where, where I am." (Interview 90, Female, Medic)*

There were also gendered associations with experiences such as imposter syndrome.

"...obviously imposter syndrome is often spoken about in terms of being a female, maybe it's not imposter syndrome but I, I still don't consider myself academic, you know, I don't." (Interview 17, Male, Medic)

Self-fulfilling prophecy

Participants remarked that awareness of their own intersectionality and discrimination related to protected characteristics, was a motivator for them to succeed. Learning of metrics made some participants fear that there was a danger of the expectation becoming a self-fulfilling prophecy.

"...it was only last year that I learnt about intersectionality and thought oh my god, I'm an intersectional, in many ways, female, Muslim, coloured. I've got an intersectional score, apparently, you can do these tables where you can work out your intersectional scores and if you look upon my score it's really low, apparently I should get nowhere in life and I just thought I did not want that to be a self-fulfilling prophecy, yet there will be trainees, there will be young people who will take it onboard and it will almost become a self-fulfilling prophecy and that shouldn't happen and so it's a double edged sword really, it's addressing a big problem and there's clearly data out there but it's also about the people who are BAME, intersectional or whatever, believing that they can and not feeling defeated by statistics." (Interview 80, Female, Medic)

Misunderstood roles, skills and identities

The role and identity of CAs is frequently misunderstood by institutions, clinical and academic colleagues.

"So, we turn up for an ARCP [Annual Review of Competency Progression] for example and nobody knows what I'm doing, where I've come from, I mean it's literally like I have to explain my situation every single time." (Interview 66, Female, Medic)

"Colleagues [don't understand] because it's not the traditional career pathway." (Interview 1, Female, Medic)

In addition, CAs experience a lack of appreciation for their skill-sets and the training they have undertaken.

"When I came back to clinical practice in August people just couldn't understand why would you take all that time out of clinical training to do research? What, it doesn't make sense to them and, and they'll, so don't quite have an appreciation of what a PhD involves." (Interview 95, Female, Medic)

Competing identities

Identifying two divergent identities of clinician and academic respectively resulted in CAs grappling with the competing identities.

"As a CA you're always viewed as a, not a true academic and not a true clinician so that can take a toll on people's personal relationships and mental health, so that can be an element that can be addressed as well. I am fortunate that I haven't experienced this but some of my colleagues have and that makes them resort to a drop in one of the activities." (Interview 38, Male, Medic)

Participants described problems experienced with negotiating both their clinical and academic identities.

"*Trying to tussle where you fit between [the] university and clinical world at the moment is also hard*." *(Interview 100, Male, Medic)*

Promotion prospects inhibited by lack of understanding of the Clinical Academic role

The lack of clarity and understanding of the CA role is cited directly as being detrimental when CAs apply for promotion.

"...people just don't understand our training pathway and they don't understand our status. So when I went to my current post the Human Resources Department kept calling me a Registrar and I was last a Registrar in 2006 and it's now 2020 and that was in 2017." (Interview 104, Male, Medic)

Identity section summary
The constructions of participants' personal and professional identities as CAs provided a fascinating insight into the experiences of participants which would often help to explain the ways in which barriers and enablers were perceived. Imposter syndrome was frequently exhibited in the form of participants not feeling like a 'real clinical academic' in the sense that (a) they were split and didn't fully adhere to either identity or (b) felt inferior to other CAs and were thus reluctant to identify as 'proper researchers'. Participants cited multiple reasons such as not producing the same level of outputs, feeling like they belonged or being able to provide support to others in such a role. Within the analysis we identified that females struggled with imposter syndrome in the CA role as they particularly grappled with the fear of not being a 'proper' academic. Intersectionality factors such as gender, race and ethnicity were identified which impacted on the ways in which individuals attributed factors to their success and/or failures. Whilst one individual may have experienced positive affirmations in relation to their characteristics, others may have been challenged in different environments, subject to local institutional and organisational biases. Furthermore, academic work is often associated with quantifiable indicators and without reaching such expectations it may provide a false economy in the perception of what a CA actually is. The competing nature of not being one or the other was highlighted and the lack of understanding from colleagues.
Take-home message: • CAs grapple with their identity, often due to their intersectionality and the presence of imposter syndrome.

Theme: Prescriptive and descriptive biases

There are a number of prescriptive and descriptive biases experienced by women in the workplace, as previously described (see theoretical considerations). Within the data, the maternal wall bias was the most commonly encountered by women. Women recounted experiences where they had been actively passed over for promotion, been the victim of microaggressions based upon their maternal status or were advised to not pursue Clinical Academia due to perceptions that their children would be a distraction.

Maternal wall bias

Women experienced blatant discrimination based on their maternal status. Maternal wall bias also impacts women without children.

"I lost my only position of seniority when I returned from maternity leave as the powers that be presumed it would be too much for me." (Interview 55, Female, Dentist)

“It was suggested I wouldn't want promotion as I was busy with kids. Presumptions that if not at my desk I am with the kids, not leading a new research initiative etc. It is rife.” (Interview 46, Female, Medic)

“Presumptions that my priorities are not work related, that I have no aspirations, that all females just want babies and to stay at home. I don’t want to be a house-wife. I work hard, I have clear career goals but there has never been a conversation about them. The men get mentored and their next position is always lined up. You see adverts on [staff news bulletin] for internal positions available and you can tell which male the advert has been written for in an instant. The perception is that men don’t have to worry themselves with family issues or children and are therefore in a better position to take on additional roles.” (Interview 24, Female, Dentist)

Prove-it-again bias

The prove-it-again bias was also encountered by women, whereby in order to prove their competency they had to repeatedly achieve. In contrast, men were deemed competent after a single display of achievement or expertise.

“I would say that it's quite noticeable in meetings and things, particularly with other CAs, there can sometimes be a difference in the, personalities of sometimes male and female trainees and certainly the feeling that you need to prove yourself or kind of hold your ground a bit more.” (Interview 26, Female, Dentist)

“Men get one big grant and they get promoted. Women get told that they are on the right track but need to prove their worth and that it's not a fluke.” (Interview 102, Female, Dentist)

“...needing to work harder to be listened to.” (Interview 96, Female, Medic)

Theme: Advice and top tips

The participant demographic of this study included those who have fallen off the CA pathway, those who failed to become CAs and those on or who have successfully navigated the pathway. There were many universal themes that participants detailed as being useful advice for those negotiating the terrain of clinical academia.

Find your niche

CAs advocate for finding your research niche and embracing it.

“...it's about finding a niche for yourself, so you'll always have competition but making sure that you've got an angle that not many other people are doing [so] that you will have at least a reasonable chance often of getting grants or decent papers published.” (Interview 7, Male, Medic)

Find a mentor, take advice and be proactive

The value of a mentor was reiterated. Aspiring CAs are advised to seek advice from role models and engage with departments that have cemented positive reputations.

"...I would say having role models who can give good advice and there's nothing like getting a bit of good advice early on, I think, and so I guess when I get people coming to me who are interested in CA careers I try and give them that good advice that maybe I never got, about things like, finding a good department, finding a good supervisor, even if it's not quite, quite the thing you want to do, not trying to set off with your own research without a good supervisor, finding a productive department, by productive, I mean ones that write good papers and bring in external funding, and finding a productive department and then joining in, if it looks reasonably fun." (Interview 7, Male, Medic)

Seek out academic socialisation, forming networks

CAs report the importance of making time for academic socialisation. Success and motivation come from surrounding yourself with like-minded people according to the interviewees.

"...we don't have sufficient capacity in academic socialisation, and academic socialisation means meeting with fellow [CAs] who are like-minded in order to feel that what you're doing is really worthwhile and you're not just a splinter group doing your half-crazy thing because you want to scratch an itch... If you belong to a group of ten people who are determined to make a difference, those ten friendships which are usually outside of your own geographical locality, sustain you all the time and that's, that's factor number one." (Interview 59, Male, Medic)

Make research a lights-on activity

CAs encourage colleagues to be proud of their researcher status and ensure that research is celebrated and is a lights-on activity otherwise they risk losing capacity.

"...making research a kind of a legitimate activity with the lights switched on, as opposed to something that's hidden away in a crevice and everyone else looks at you and says oh look, he's doing research…" (Interview 59, Male, Medic)

Top tips

Using the research project Twitter page, @GenderClinical, CAs provided additional top tips for those aspiring in the field. These are presented diagrammatically in the figure.

Figure 4: Advice from clinical academics

Theme: Myths and the hidden curriculum

Myths were particularly prominent with the culture of Clinical Academia. Those who were in the midst of making funding applications and those who had not been successful in accessing CA training schemes were able to recount numerous myths that perpetuated with regards to securing funding, work-life balance and expectations of CAs. The most common myths are visually represented diagrammatically.

Misconceptions included that CAs must work all hours of the day and be prepared to travel at a moment's notice. Other fallacies pertained to the number of publications expected of prospective applicants and deliberate bias on the part of funders with regards to where funding is geographically and institutionally awarded. In addition, the hidden curriculum and tacit messaging resulted in negative stereotyping relating to CAs work ethic and myths regarding a funder desired one-size-fits-all mould that applicants must model themselves on. These myths were corroborated by funders, policy makers and senior academics (see qualitative data triangulation).

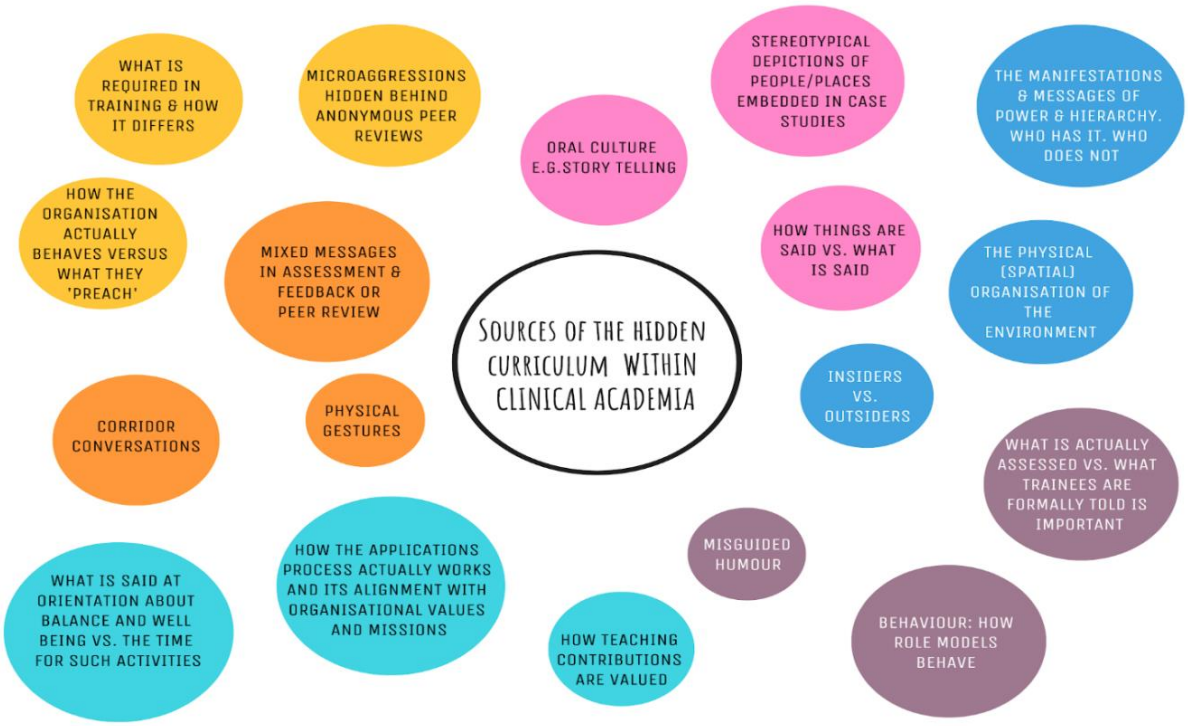
The hidden curriculum refers to the tacit, implied, unwritten, unofficial, and often unintended behaviours, lessons, values, and perspectives that people learn during their training. The impact of implied or tacit messaging should not be undermined, especially when considering the recruitment and retention of CAs.

Participants provided a plethora of examples of observations that pertained to the hidden curriculum of Clinical Academia, from within their clinical and academic environments. These are conceptualised diagrammatically. The following quote helps to illustrate the ways in which myths and the hidden curriculum merge together to provide insights into the potential damaging implications of misinformation.

“I didn't understand why people were telling this but, but what, what everybody advised me at that point was choose a disease, and develop a body of research in that disease, so, and, and I didn't. I, I did a piece of research on why don't we do person-centred care effectively? And, and it sort of, it goes into whole sort of arguments about epistemology and how we understand knowledge and practice and, so people who, who criticise what I do, one of the, one of the things, so my, particularly my clinical colleagues but also academic clinical colleagues as well, who criticise what I do, say that's a very cerebral argument isn't it? And I, and I, that's, that's their ultimate putdown. In GP, in GP world particularly, that's a real putdown. And, and I, my argument back is no, it is a difficult conversation to have and difficult thing to think about but it's an incredibly practical pragmatic area of work because the way we, the way we understand evidence, knowledge and, and research as a, as a process, as well as research as an output, is completely influencing, defining, the way we do healthcare.” (Interview 2, Female, Medic)

Figure 5: Myths surrounding Clinical Academic careers

Figure 6: Sources of the hidden curriculum within clinical academia



Theme: Interventions

A number of interventions were suggested by CAs themselves as a means to reducing CA attrition. These included: mentorship, making more funding available, providing flexible and longer contracts and providing bridging funding. The main interventions that were suggested are discussed in-turn below. These have been added to the in-depth intervention plan presented later in the report.

Mentorship

Mentorship was suggested by participants as a key way to reduce attrition and encourage the continuation of CA careers. The transitions between the different stages of academia were described in the barriers as difficult to navigate, therefore, the support and guidance from a mentor may help to ease the process and facilitate movement across posts. Mentors were seen as being able to balance the clinical and academic side and understanding of what being a CA really entails. Mentorship needs to be tailored to the appropriate level to provide the right type of information at relevant time points, for example in relation to applying for funding, dealing with failure and networking.

"A crucial bit of your CA trajectory is supervision and finding the right supervisor and projects that, you know, I, that are right for you and I guess when you're applying for things like academic clinical fellowships because you're so early in your clinical career it's hard to know what academic project to go for." (Interview 5, Female, Medic)

"Part of it would be around the flexibility between the clinical and academic posts, so making sure, I think better cross-talk between the academic and clinical supervisors, so each know what you're doing in each context." (Interview 81, Female, Medic)

There were discussions over whether a mentor scheme should be formalised or informally lead by an individual themselves. The underlying factor was that the mentor needs to have relevance and purpose and not be a tick box position to fulfil the role. In this manner, the capability of the mentor was important and their relevant experience. Cross-funder mentorship schemes were suggested as this would help to increase funds available, demonstrate a commitment to the issues, and help with the transitions between the levels of CA careers.

"Access to mentoring would, would be really valuable, like in kind of some more structured way of, of trying to help people because it feels like people can kind of reach out and try and find their own mentors at the moment, if they like think of doing that and if they have the confidence to do that and the networks, but in a way I think having a bit more of that, a little bit more formalised, that would be really helpful and it might enable some people that otherwise like wouldn't just set it up for themselves to, to kind of benefit." (Interview 96, Female, Medic)

"Having an actual mentor, not just as lip service but actually someone that you can confide in and offer advice, I think that…doesn't come easily." (Interview 85, Female, Medic)

"One other…thing that I think... would be fantastic would be…whether NIHR or other organisations would consider developing a wider mentorship programme... particularly if you're perhaps in that clinical training pathway and you have an interest in pursuing, you know, academic experience but, you know, you're not sure how to make that leap, you know, who, who to speak to or you're having difficulty developing your ideas or, or even that you're just, you're feeling that you're, you're losing the motivation, it would be fantastic if, you

know, there was a, there was a programme of, you know, senior academic mentors who were prepared to take on people under those kind of circumstances and signpost them, provide encouragement, you know, perhaps, perhaps help to, to shape... proposals for funding... that would be extremely helpful." (Interview 28, Male, Medic)

"Some sort of mentoring role or, or mentor person is good, but I think they are probably better independent and it, and it may be that what the funders can do is fund people to do that, you know, as in a pot. So NIHR put in twenty percent, MRC put in twenty percent, Wellcome put in sixty percent because they've got pots of money hanging around for no reason, you know, but, but it's that sort of thing that then goes to, to allocate someone half a day a week that they can do it." (Interview 6, Male, Medic)

For underrepresented groups, mentorship and role models were also seen as an intervention to help encourage and tackle inequality, for example through identifying with others in successful positions.

"Clear mentorship just think would be great. You know, you tend to, you know, you, that can't see it, can't be it, it, but similarly, you know, monkey see, monkey do, you know. So, I mean you tend, I presume that people say that they tend to follow a similar path to the person who trains them the most." (Interview 39, Female, Dentist)

"I think having good role models, supervise, both male and female but for, but female I guess particularly and it, and that actually applies to kind of other things, you know, ethnicity, sexuality and things like that, if there are people who are visible and, you know, not necessarily shouting about their characteristics at every point but just visibly there I think is very important." (Interview 95, Female, Medic)

Availability of funding

Interventions frequently involved monetary implications aimed at supporting, enabling and mediating the impacts on taking time to work on academic careers. The suggestions ranged from bridge funding between the levels of CA roles, supporting out-of-training needs, and protecting time to work up applications for future roles.

"I think having support, yeah, support for taking time out of academic research…either for statutory reasons or just for career break reasons and then being supported to return and I think sometimes people need not just to know that they can return but also to be kind of actively encouraged to return because I think you take time out of anything, you can feel quite nervous coming back." (Interview 81, Female, Medic)

"I think there's a little bit of money you can use, I can't remember that they call it but you, if there'd been something like that when I finished I would, that would have been great because it would have given me, some time to apply for some to get some further kind of funding to go on some courses and to learn some stuff and to take kind of what my PhD was to where we wanted it, where I wanted it to go." (Interview 67, Female, Medic)

Targeted funding for particular underrepresented groups was suggested. There was an acknowledgement of the time needed, but also the confidence lost when stepping away from academic careers.

"For CAs I think you tend to maybe come to the, you know, the, your research slightly older, you know, people doing their PhDs are more at a stage where they're thinking having kids, so I think, maybe ability to have paid maternity, and paternity leave, share parental leave

and also the ability to work less than full-time afterwards I think is very important." (Interview 95, Female, Medic)

"I think support for women who need to take time out of work research,…both making sure they know that's an option early on… and that they'll be supported to come back as well… I know in clinical context, there's things like the support each year, running the support programme, which is like a supported return to work scheme and I think certainly something similar should be offered in academia for people who've been out for a short time… also to recognise that you've taken time out for sort of statutory leave, that your academic accomplishments on paper in that time, you won't have published the papers and presented at the conferences that other colleagues will have done." (Interview 81, Female, Medic)

Provision of flexible, longer contracts and bridge funding

The availability of funding was specifically mentioned in relation to bridging the gap between different CA levels, particularly post-PhD to lecturer. There seemed to be an apparent lack of funding at this particular level across funders. Incidentally, the participants at this stage were frequently looking for less than full-time arrangements due to childcare and suggested that even a small amount to keep the foot in the door would be a welcome addition. Childcare was linked to isolation and neglect from the CA pathway and with extra support through this period it was seen to help retain roles. The longer-term outcomes (i.e. future large grants, leadership) were highlighted as needing to be prioritised rather than short term outputs (e.g. papers, small grants).

"More postdoctoral funding, I think there's enough funding for AFPs, five percent of the jobs are for IFPs, there's three hundred and fifty ACF programmes run by the NIHR and for someone who wants to do one of them you will find one of them, you may not find them in the region that you're in but you will find them. There's enough CRFs, you know, mid-grade type standalone jobs set up by hospital, where you're doing fifty percent clinical, fifty percent research and that will strengthen your CV for an ACF or a, or a PhD and there's also a significant number of PhD fellowships around although they are more difficult than some of the earlier jobs but there is a difficulty, there is a gap, certainly I view that there is a gap between finishing the PhD and becoming an independent investigator, and that gap is the ACL and there are very few pots of money that are on offer for ACLs, so I can only think of two or three really." (Interview 38, Male, Medic)

"I think the, the kind of that, that also potential, like kind of job afterwards… once you've got on, you're on that academic pathway…there has to be an element of protection for kind of long term jobs, I think there has to be a, there has to be the support and there has to be the framework in place…that what you can do is that if you start that journey, there should be a natural progression to get you to the point of senior lecturer consultant, substantive role." (Interview 45, Male, Dentist)

"Children are not small forever, I would love to be able to have a ten percent time contract which would, you know, for example, for five years, where I kept my department email address, I kept, you know, on the department mailing list, I stayed peripherally involved in some projects but where there wasn't the pressure to win large grants and to manage large…so those with caring responsibilities where it's a five year, we will fund you in order to invest in you in, you know, invest in you in the future and then the idea is at the end of the five year period you then, you know, you then apply for more substantive things again…because it's minimal time they wouldn't even cost that much, you know, because it's only, it would only be like ten or twenty percent salary, rather than having at the moment, which I think the NIHR have that it's minimum fifty percent which then." (Interview 64, Female, Medic)

Longer and flexible contracts were also seen as key to sustaining this level of involvement. Gaps in between posts where there is less pressure to deliver academic outputs, yet keeping the local networks, have been established from earlier CA roles. Bridge funding was a strong element which again would help to overcome such issues. Additionally, the ability to move to less-than-full posts as required and later resume full time training was deemed beneficial.

"I suppose funding has to be flexible enough to accommodate for people who are taking breaks which are, you know, justified. So, I suppose what comes to mind is obviously maternity breaks." (Interview 100, Male, Medic)

"I think the main thing is longer contracts, contracts are too short, contracts are too short." (Interview 84, Male, Medic)

"I would really like to see but I, I guess this is a really big ask, would be some way of giving a small number of centres, just flexible money that they can use on individuals who aren't yet ready to write an application but who they think will be in time." (Interview 32, Male, Medic)

"Being able to get bridging funding, while you prepare a big application." (Interview 6, Male, Medic)

Pastoral and academic support related to funding decisions would also be beneficial in helping to retain academics. Facilitation of funding and support in relation to protected characteristics such as gender were highlighted and how policy-specific interventions may help to tackle issues of time away from roles. Accessibility of opportunities was another avenue in which interventions could privilege financial resources to ensure equity, for example from BAME minority groups.

"You almost want someone to be emailing those people and saying, you know, we, we want you to return when you feel ready and these are the support measures we'll put in place to help you to do so, I think would be really useful, in terms of support, support networks I guess and peer support as well….recognising there will be points where it's very difficult for them to combine the two [clinical and academic] and giving, making sure they have the support and someone to speak to about that and that they don't feel pressured to take on too much, clinically and academically at the same time." (Interview 81, Female, Medic)

"I think from a gender point of view then I think the schemes that will… pay maternity leave and that will support less than full-time work are very important… particularly as, certainly for CAs, I think you tend to maybe come to…your research slightly older…people doing their PhDs are more at a stage where they're thinking having kids, so I think,…ability to have paid maternity, and paternity leave, share parental leave and also the ability to work less than full-time afterwards I think is very important." (Interview 95, Female, Medic)

The following quote from a medical CA married to a dentist helps to articulate the key issues faced and the interventions needed to alleviate pressures. Although funding underpins the intervention, the funding bodies themselves need to be able to consider the reasoning behind decisions and be open to the challenges faced by CAs. Specific and individual considerations are required over blanket policy changes and implications.

"I think one size fits all just doesn't work, you know, by the time I'm at my stage in my career, I'm forty-three and I have a wife who's a clinical, NHS clinician in a very under-served specialty of dentistry, she always wants to continue her academic work. I have children, I have parent who's got her health problems and my in-laws who have their health problems, we live in different places from our parents, so all of that means that my situation is entirely

unique and it almost requires some sort of panel or committee to be sympathetic to my requirements and my journey as an academic and to understand the trajectory of my research ideas and where I'm heading for." (Interview 104, Male, Medic)

Protected time for research activities within clinical posts was suggested to allow CAs to focus on their work and balance the time across clinical and academic roles. As discussed in the earlier sections, the privileging of clinical over academic work had detrimental impacts.

"I think the way forward is just maybe having clinical posts where you can have some protected research time, because that's, you know, ultimately to do anything meaningful you have to have some protected time and it's not impossible to see that happening in the future." (Interview 5, Female, Medic)

Intervention section summary

The interventions suggested by participants focused mainly on individual level interventions in order to provide more support within and between CA levels and roles. Mentorship and guidance were identified as critical components of any intervention, yet it needed to be carefully considered and not simply a tick box exercise. The mentor role was suggested to be carefully aligned to individual CAs to give them the appropriate insights needed at the right time, and to navigate the multiple challenges of the roles. A need to ensure mentors were present to support the academic, clinical and pastoral side of the role as well as decision making along the pathway was highlighted. The gaps in between posts were often where CAs fell off the pathways, hence support during this time would help to bridge the gap. In terms of contracts, there were many calls for more funding to be available at appropriate points with the pathways, for example by ensuring bridge funding in between times. Tied into this need, was the need for flexible and longer contracts which focused on the individual as a future CA leader and not just on the present requirement to complete a research project and get a specific number of publications. The acknowledgement and tailoring of interventions to underrepresented groups was observed and ensuring that those who took time away from work were well supported to return when desired. Within clinical organisations a greater awareness of the CA roles is required and the need for protected research time.

Take-home message:

- Mentorship was suggested to support individuals within posts but also as they transition from one level to the next
- More financial support for long-term, returning, and flexible work patterns were suggested, especially to facilitate equity in the CA workforce

Findings: Phase 3- Audio-diaries

Phase 3 Demographic summary

Table 4 provides an overview of the descriptive statistics of the participant sample and the data collected for the audio-diaries. Over the period of data collection, 134 diary entries were received. The range was between one and 12 entries, with a mean of four entries. Recordings ranged from one minute to 15 minutes, the mean was five minutes. 30 academics participated. There were 23 participants who had been part of the interviews and seven who only participated in the audio-diary phase.

Table 4: Summary of participant demographics and data collected for audio-diaries

Profession	**Total (n=30)**	**%**
Medicine	24	80.0
Dentistry	6	20.0
Mean Age	39	
Age Range	27 - 74	
Gender		
Male	10	33.3
Female	20	66.6
Predominant Clinical Work Area		
Primary	7	23.3
Secondary	11	36.7
Tertiary	12	40.0
Employment Status (overall)		
Full Time	24	80.0
<Full Time	6	20.0
% of hours spent on academic work		
100%	5	16.7
50%	19	63.3
<50%	6	20.0
Out of programme for research		
No	19	63.3
Yes	5	16.7
Not applicable	6	20.0
Ethnicity		
Asian	2	6.7
Indian	2	6.7
Middle Eastern	1	3.3
White Caucasian	24	80.0
Did not disclose	1	3.3
Marital Status		
Divorced	2	7.0
Long-term relationship (not married)	2	7.0
Married	23	77.0
Single	3	10.0
Sexuality		
Bisexual	1	3.3

Heterosexual	25	83.3
Did not disclose	4	13.3
Disability		
No	28	93.3
Yes	2	6.7
Number of Children/Dependents		
0	7	23.3
1	6	20.0
2	11	36.7
3	4	13.3
4	2	6.7
Pregnant		
Did not disclose	1	3.3
No	29	96.7
Current Clinical Academic Career Level		
Doctoral Fellow/ PhD student	10	33.3
Academic Clinical Fellow	6	20.0
Academic Clinical Lecturer	6	20.0
Senior Clinical Lecturer and above (including Deans and Programme Directors)	6	20.0
Did not disclose	2	6.7
Current grade within Clinical Role		
Clinical Fellow	3	10.0
Registrar (Medical / Dental)	16	53.3
General Practitioner (Medical / Dental)	4	13.3
Medical / Dental consultant	6	20.0
Medical researcher	1	3.3
Location		
East of England	1	3.3
Midlands	4	13.3
North East England & Yorkshire	11	36.7
North West of England	2	6.7
South East of England	6	20
South England	4	13.3
Wales	2	6.7
Place primary health qualification awarded		
UK	30	100
Total Number of Diary Entries	134	
Number of Written Entries	26	

Audio-diary findings

The analysis revealed four major themes, each with subthemes (Table 5) relating to the initial impact of COVID-19 on CA careers; (1) opportunities, (2) barriers, (3) personal characteristics and social identity and (4) fears and uncertainty. Intersectionality and the differential impact of ethnicity and gender on the experiences were noted across all themes. COVID-19 presented opportunities for new avenues of research. Barriers included access to resources to conduct research and the increasing teaching demands. The most disquieting sub-theme within 'personal characteristics' was that of the perceived negative impact of the pandemic on the work of female CAs. This was attributed to inequalities experienced in relation to childcare provision and research capacity. Participants described differential experiences based upon their gender and ethnicity, noting intersectional identities.

Due to the extensive dataset, only selective themes are presented in continuous prose; these have been chosen due to their pertinence to the research. The analysis found the COVID-19 experiences of medical and dental CAs relatively homogenous.

Table 5: Audio-diary themes and subthemes

Opportunities	Barriers	Personal characteristics and social identity	Fears and Uncertainty
⇐⇐⇐ **Intersectionality** ⇒⇒⇒ The impact of gender, ethnicity and associated intersectional identities were pertinent across all themes			
New emerging opportunities • New research avenues • New collaborations • COVID offers a new lens through which to think about existing research • Increased capacity & opportunity to write • Maintenance of normality	**Lockdown** • Working at home with children • Work life balance • Parenting responsibilities • Positive discrimination • Gender roles • Impact on physical & mental health from working at home • Difficulty maintaining momentum • Isolation • International work difficult • Physical barriers impacting on work (e.g PPE, remote consultations) • Demands from teaching responsibilities • Loss of resource	**Being a clinical academic** • Increased perceived importance of clinical academics • Sitting in neither camp	**Returning to the frontline** • Responding to the call to arms • Contracting COVID-19 • BAME ethnicities increased susceptibility • Anxiety • Appropriateness of skillset for return to clinical duty • Inability in short-term to conduct research • Impact on long-term research career
Support • Funder support (extensions & network) • Supportive networks (local, national, international) • Provision of childcare for keyworkers • Camaraderie		**Protected characteristics** • BAME • Maternal status • Gender stereotypes • Intersectionality	**Misconceptions and absence information** • Funding • Extensions • Lockdown restrictions being lifted • Fiscal impact and predicted recession • Portfolio development due to loss of research capacity

Theme: Enablers

The pandemic presented many opportunities and enablers. These spanned academic and clinical work as well as participants' personal lives. Subthemes broadly fell into three categories; 1) new opportunities for research, 2) support, and 3) maintenance of normality.

New Emerging Opportunities

Participants recognised the immediate opportunity to explore new avenues of research related to the pandemic.

"So, I've been asked to, and volunteered to, be part of the Research Ethics Committee Coronavirus Response which means that every week now I've had twenty-four-hour turnaround for a coronavirus study of some sort or another … I have been involved with developing two national and one international coronavirus studies over this time…an enormously exciting but terrifying roll out of research…" (Audio Diary, Male, Medic)

Associated with this was the need for rapid research dissemination, providing CAs with a chance to develop their portfolio. This resulted in the forging of new research collaborations supported by the quick turnaround of ethical approval in order to roll out impactful research. More senior CAs reported opportunities for career development such as being invited to serve on Research Ethics Committees. In addition to the new research territory, COVID-19 presented a new lens through which participants were able to think about their existing research. For some, salient amongst the opportunities was the free time which was created during the pandemic, particularly due to the absence of social commitments and commuting. Some CAs found this spare time to be an opportunity to focus on academic research activities and the production of impactful research. Others felt this was an opportunity to focus on clinical work, as well as family and household commitments.

"I guess it will give me a chance to focus on having a bit more time at home with family and, and just doing clinical work, which I think is what I wanted to focus on for the moment." (Audio diary, Female, Medic)

Support

The theme of support was multi-faceted. Participant discourse presented examples of the positive impact of support networks locally, nationally and internationally. The abrupt emergence of COVID-19 and subsequent lockdown in the UK meant that many CAs had to halt their academic work and return to clinical practice, full-time. This created an element of uncertainty, and in some cases anxiety about completing their academic work in the allocated time. However, a widely circulated statement from the UK's main funding bodies reassuring CAs that they would support the extension of research post-COVID was well received and provided a morale boost, as well as encouragement to continue with projects.

"The [funder] have said that they will support extensions if they're needed so I do have that to kind of fall back on." (Audio diary, Female, Medic)

An immense amount of support was provided by academic organisations at the beginning of the pandemic. Support from supervisors, departments and funding bodies was noted as

enabling and empowering for participants. Significant support was found within teams with camaraderie and the notion that ‘we’re all in this together’. More practically, support was found in the provision of nurseries for children of key workers, providing CAs with somewhere to take their children when they were required to return to full-time clinical practice.

Maintenance of Normality

‘Maintaining the status quo’ during the pandemic was an enabler for many. From the beginning of the pandemic many professions and sectors in the UK have seen large proportions of redundancy or furlough for staff. However, this so far, has not been the case for many of the CAs that participated in this study. CAs who have had the flexibility of undertaking either clinical or academic work during the pandemic, were grateful and felt generally lucky to have a job during the COVID-19 pandemic and one they could go back to post-COVID. Opportunities that strengthened the resolve of participants included the option to flex hours between roles. Specifically, it was also noted that going back to clinical practice full-time was perceived as being advantageous in that it was easier and offered more structure when compared to academic work. Additionally, the retainment of social interaction, structure and workload when other professionals have lost that during the crisis was seen as an opportunity.

“In these times of COVID-19 some people have kind of lost their structure and workload, so I feel grateful that hasn't happened to me.” (Audio diary, Male, Medic)

Theme: Barriers

During the emergence of the pandemic there were many barriers encountered by participants that reached into the multi-faceted areas of CA careers. There were barriers related to the direct consequences of the immediate impact, reactive and mid-term barriers, and longer-term implications. Three subthemes were identified; (1) lockdown, (2) demand of teaching responsibilities and, (3) loss of resource.

Lockdown

Most of the barriers described by participants related to the negative consequences of lockdown. A barrier evidenced by particularly emotive data was that of working at home. This entailed the need to balance the multiple commitments related to childcare, housekeeping, and productivity. There were far reaching consequences of the ways in which working from home impacted on participants’ roles. Childcare was not seen as compatible with a CA role. Both clinical (e.g. telephone clinics) and academic work was often taking place at home, leading to feelings of isolation and a lack of networking.

“I've spent a lot of time doing very intensive blocks of clinical work and very intensive blocks of research, research policy into practice work…I realised it's a Thursday today, I realised I had worked for three weeks solid and I'd not had a full day off in that time and most of those days were ten or twelve hour days…and I have now worked a further eleven days, with the last four days being fourteen hour days, without a break.” (Audio diary, Male, Medic)

Mental and physical health outcomes were described as a consequence of COVID, particularly due to the increased workload.

"Generally, the COVID experience has been exhausting on many levels; emotionally from the worry about the number of people who will die, worry about being redeployed, worry for my children's wellbeing." (Audio diary, Male, Medic)

"My anxiety is elevated due to being Asian, will I get sick and lose time for research?" (Audio diary, Female, Medic)

Concerns arose over how to effectively manage the competing time demands. Some also spoke about a loss of 'downtime' and feeling 'stuck in limbo'. The shifting in work time meant that participants had less time for out of work and recreational activities which impacted on their general and mental health.

Both males and females were affected by the move to home working and trying to balance childcare with full-time work. Examples were provided of how the disruptions impacted on their home environments. The time pressures were apparent in many situations where participants struggled to navigate competing demands. There were also concerns over positive discrimination in how gender roles were recognised, with a particular focus on senior positions.

"…the Pro Vice Chancellor had sent an email saying how exciting it was that there's a female President at the Medical School, a female Dean, a female Pro Vice Chancellor of Medicine and a female Vice Chancellor at University, and that made me reflect what would happen if I sent a similar email delighting the fact that there's males in all of those roles. I imagine there'd be some disdain… they're powerful and take revenge…I don't think that's appropriate." (Audio diary, Male, Medic)

Demands from teaching responsibilities

The data described the negative impact of the demand to rapidly produce teaching and assessment materials for online delivery, frequently citing a lack of support and appreciation, as well as the time consumed.

"As CAs we are scavenging time in between the clinical parts to crack on and do our academic work." (Audio diary, Male, Medic)

There was worry over a future lack of recognition within portfolios for teaching activities undertaken, and a frustration over negotiating the various new technologies required to deliver teaching.

Loss of resource

The impact of COVID has been significant for participants and extends from fiscal and time to human resource issues. There were concerns over the loss of time in relation to academic outputs and not fulfilling previously arranged activities. A lack of overall supervision was noted, including much needed pastoral support.

"There is an absence of pastoral support. Supervision is different, it's about skills and development not always about just how you feel. Sometimes you need a shoulder to cry on". (Audio diary, Female, Medic)

Given the measures in the academic field where outputs are often used as a productivity marker, the participants were unsure how they could compensate for loss of time and the ways in which their activities could be demonstrated and valued.
Tangible barriers were highlighted in the monetary implications for how loss of time could be compensated. Participants made calls for funders to extend time and funding for projects that otherwise may have been completed on time.

"It's bloody terrifying when it comes to applying for new stuff though because the deadlines haven't really moved much and there's no head space and there's no time to get the stuff really done properly and that's really scary but we've got to get the clinical work done first. It's the only way." (Audio diary, Male, Medic)

Many universities initiated a recruitment freeze which meant, in some cases, that methodological expertise was lost. As CAs are often on a set educational employment path for a discrete time period, this created disruption to long-term career plans.

Theme: Personal characteristics and social identity

A key theme revealed was the impact of COVID-19 on participants' personal characteristics and social identity. This theme specifically considers how individuals perceived themselves as being CAs and the issues associated with the label 'clinical academic'.

Ambivalence and identity of a Clinical Academic

Some participants were conflicted about their identity as CAs and often experienced 'imposter syndrome'. Imposter syndrome, as described by the participants, refers to a feeling that they were not adequately qualified to be called CAs. Others expressed pride in being classed as CAs; however, they expressed that their identity as CAs was misunderstood by clinical and academic colleagues. Participants described problems experienced with negotiating both clinical and academic identities during the pandemic.

"*Trying to tussle where you fit between university and clinical world at the moment is, is also hard*." (*Audio diary, Male, Medic)*

Participants highlighted that in their working life they do not sit neatly in either category, which makes it difficult to identify as either an academic and/or a clinician. This feeling has been intensified by the COVID-19 pandemic. Most professionals have an educational background where they have developed peer support and networks allowing for guidance, but for CAs, their varied pathways mean they often lack this important support network.

Protected characteristics

Protected characteristics of CAs, particularly the BAME community who have been more widely affected by COVID-19, was a key subtheme identified. Increased anxiety was highlighted and participants who were from BAME backgrounds expressed fear about returning to clinical work. Muslim CAs also expressed the difficulty they faced due to Ramadan taking place during the already difficult time. The focus was largely on physical wellbeing due to heavy workload alongside being unable to eat or drink.

Gendered differences were evident throughout this study, with female participants specifically expressing the struggles of maternal identity, highlighting problems faced with childcare responsibilities as well as having to share these with their partners alongside work commitments.

"I'm not formally planning to carry on with academia and that's a decision that's kind of come about because of, you know, childcare responsibilities and I just felt that I was going to be stretched too thin if I was trying to be a mum and be a GP and be an academic as well." (Audio diary, Female, Medic)

Female participants felt that due to gender stereotypes from partners and work colleagues, they were having to take a leading responsibility in childcare during this time.

"*I think that COVID has been a disaster for feminism...the disagreements that I've had with [husband] have been over feeling like a 1950s housewife suddenly then to suddenly home schooling children and trying to stay sane, stay safe, keep everybody okay, whereas he still is doing exactly what he does, work...*" *(Audio diary, Female, Medic)*

Whilst participants noted intersectionality, their narratives were mostly differentiating their experiences due to gender. Women explicitly stated that they became less tolerant of the gender issues raised as time in lockdown progressed.

Women reported the emotional turmoil associated with being primary caregivers.

"Yet another day of working from home while helping with young kids who are upset at the disruption to their lives. The most difficult thing is trying to calm my children's worry over COVID." (Audio diary, Female, Dentist)

Increased perceived importance of Clinical Academics

Despite the tensions that have been caused by the pandemic, some noted that the work and identity of CAs have actually been strengthened. COVID has required rapid research to be undertaken and CAs are perfectly suited to this opportunity. The fact that qualified CAs have a foot in both research and clinical practice has facilitated a renewed appreciation of their identity during this pandemic.

Theme: Future fears and uncertainty

This theme related to numerous unanswered questions of participants including their fears and anxieties. Returning to the clinical environment was one major cause of anxiety, as well as the future of their research and funding.

Returning to the frontline

Discourse regarding returning to clinical practice utilised many analogies to warfare. One source of internal conflict for participants was their inability to respond positively to the 'call to arms', particularly where they felt they had deskilled in some areas due to their focus on academia in recent years. Participants described requests to abandon research and assume clinical roles. Added to this anxiety was an inability to manage workload and family life.

"*Well all of the academic trainees have been pulled on to the full-time clinical work. As CAs we are scavenging time in between the clinical parts to crack on and do our academic work and certainly emotionally I'm finding it enormous strain, mainly because the clinical work*

itself has not so much increased in the intensity but the massive decrease in staff numbers, partly because of illness but a lot because if isolation and shielding requirements that have gone on, has hugely increased the amount of work that all of us that are at work are doing." *(Audio diary, Male, Medic)*

Additionally, the fear of contracting COVID-19 was expressed, with the majority of participants having to return to full clinical practice. CAs who expressed fear of contracting COVID-19 were those with predisposing factors and from BAME backgrounds. Additionally, knowing someone who had died on the frontline increased CAs' perception of their own risk.

Misconceptions and concerns about the future

From the onset of the COVID-19 pandemic, participants have reported concerns over their progression and future careers. Participants also aired concerns about the lockdown restrictions being lifted prematurely, stating that this could have further negative implications on their clinical and academic work. Uncertainty around COVID-19 has caused misconceptions and subsequently resulted in the absence of information. Amongst participants, there is a general fear and uncertainty about the fiscal impact on research funding and the future clinical academia.

"*Unfortunately, my grant holders haven't sort of committed themselves to being able to extend my funding due to various reasons, so yeah, so there's uncertainty with that as well*." *(Audio diary, Female, Medic)*

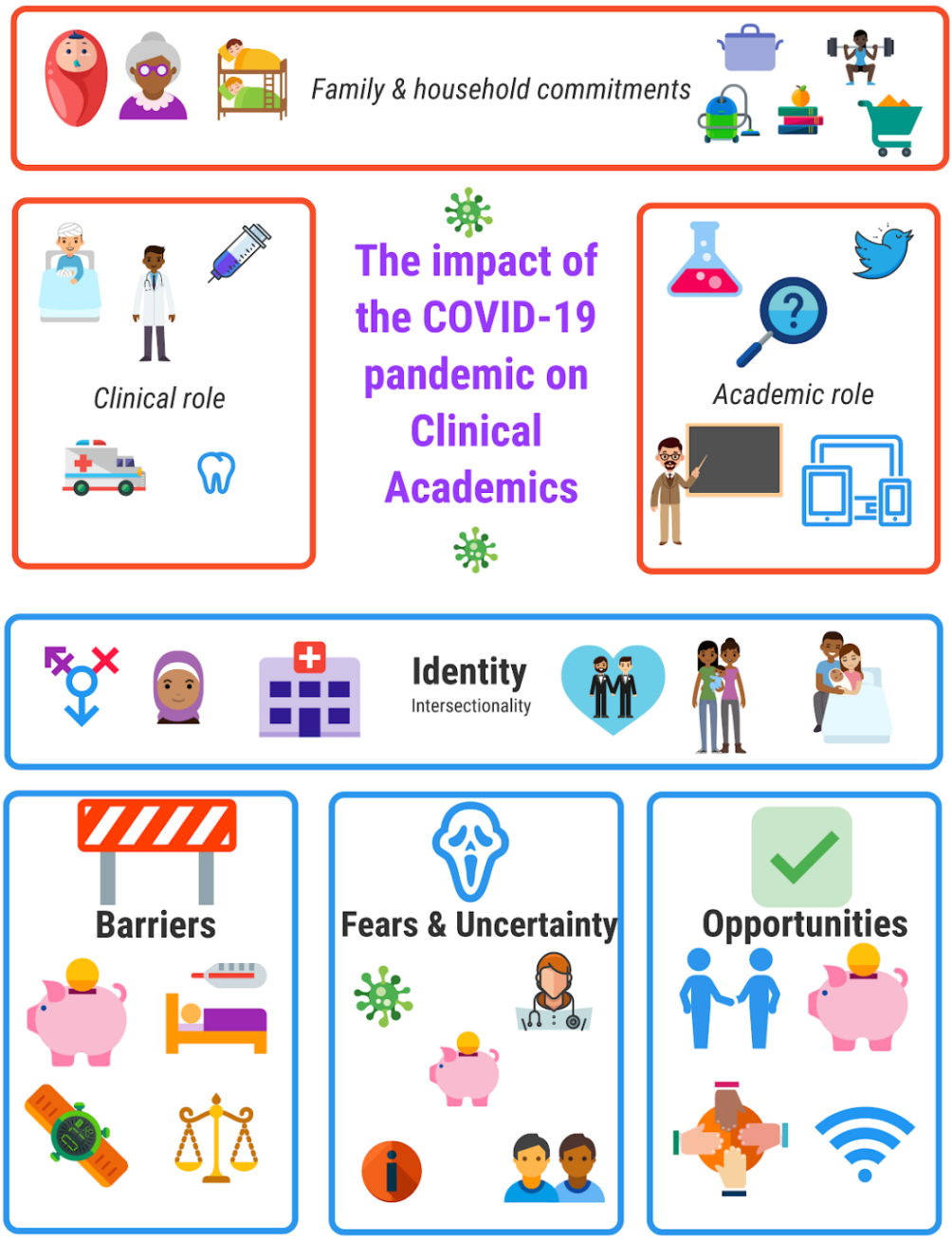
Issues such as pay cuts and a loss of staffing resources within departments caused further anxieties.

"The news on pay cuts is a bitter pill to swallow when working in a department where teaching commitments have increased, I have to say. Clinicians may decide to switch to clinical only in some cases." (Audio diary, Male, Medic)

These anxieties have been further intensified following a lack of professional and social networking opportunities, especially as the pandemic intensified and lockdowns progressed.

The themes described are visually represented in the figure below.

Figure 7: Visual representation of the themes from the audio-diary data



Following synthesis of the audio-diary data collected during the pandemic, it is recommended that:

- Supportive, flexible working arrangements are provided for CAs
- Recognition for teaching & additional clinical undertakings needs to be factored into applications for funding and promotion

- Funding extensions & bridge funding would be advantageous for CAs who have suffered reduced research capacity during the pandemic
- Flexibility in the scope of research should be promoted, providing CAs with the ability to include pandemic-related research
- Credit for accepted but now postponed/cancelled dissemination events should be afforded to CAs on forthcoming funding and promotion applications or within competency portfolios
- Workload reviews would be beneficial for parents and carers if lockdowns persist
- Institutions need to incentivise and support CAs to maintain academic work or risk an exodus back to clinical work.

Audio-diary section summary
The audio-diary data presents a unique and important cross-sectional insight into the national CA landscape during the COVID-19 pandemic. Participants pandemic-time clinical work, described how they felt disadvantaged in comparison to trainees who have been able to maintain research. This may be a source of future tensions between these groups. Perhaps our most prominent finding was the evidence that women in clinical academia were being disproportionately impacted by the pandemic. Female participants described barriers that directly related to their gender, as well as to their maternal status. This intersectionality of participants and associated discrimination experienced was a repeating pattern. This is highlighted by our findings relating to themes 2 and 3 (barriers and personal characteristics) and the relevant case studies.
Take-home message: • The clinical academia pipeline is at high risk of losing female CAs due to the impact of the pandemic and the inequities experienced.

Qualitative data triangulation

Data from phase 2 and 3 were triangulated by multiple mechanisms:

1. Researchers observed funding panels and the associated decisions making processes.
2. Policy makers and members of funding panels submitted lists of myths and applicant misconceptions surrounding the funding processes.
3. Case study exemplars of motivators, barriers and enablers (see later chapter)
4. Text mining analysis (see later chapter)

In addition, data from all phases were triangulated to inform the intervention plan (see later chapter).

Observation of funding panels

Researchers were invited to observe panels but ethnographic observation was outwith the remit of the ethical approval. Instead, researchers observed as a mechanism by which to fact check and inform their engagement with the data. It is the opinion of the researchers that panels and panelists did not display any discrimination towards participants. Researchers paid particular attention to protected characteristics, and there were no signs of bias shown towards any individuals. All discussions were recorded with minutes and the decision-making processes were transparent and robust.

Myth busting

Funders circulated an email to all panel members, panel chairs, and those involved in award policy or administration requesting written submission of myths or misconceptions that they had frequently encountered in relation to applications for funding for CAs. These submissions were collated and thematically analysed to produce broad groupings that could be compared to the themes identified within the interview and audio-diary data.

This process served to triangulate findings and ensure that researchers were appropriately interpreting data. The myths and misconceptions helped to inform the development of the subsequent implementation plan. A list of the most frequently cited myths is provided within Table 6. Myths were broadly classified into five categories: (1) Application/Interview Process, (2) Funder, (3) Personal, (4) Types of research, and (5) CA jobs.

Table 6: Myths surrounding funding applications corroborated by funders

Myths are grouped into five broad categories, based upon what they refer to e.g. personal circumstances.

	A. Application/Interview Process	B. Funder	C. Personal circumstances	D. Type of research	E. Clinical Academic Jobs
1	You can only apply if you have a certain number of years of post-PhD experience	You can't transfer between funders	You can't apply if pregnant	You must pick a disease and stick to it	There aren't really any clinical academic jobs for nurses or midwives
2	Panels only consider journal and impact factor when assessing track record	Funder isn't allowed to give advice in advance of the interview	You must have 30 + first author publications to apply for an advanced fellowship	Medical education research won't be funded	The system is set up for clinical academics to be doctors, and not allied health professionals
3	Interviews are designed to be as stressful as possible	Funders will only fund COVID-19 related research moving forward	You need to move to a different research organisation to demonstrate independence	You need a clinical trials unit to do data collection/pilot/feasibility trial	The challenge is on achieving a shared vision for the clinical academic in professions that have a less well-established research tradition e.g. nursing and midwifery

4	Getting to interview stage guarantees funding	NIHR is only interested in funding medics	Career breaks are not taken into account	At doctoral level - an assumption from some applicants and supervisors that PhD research is an isolated rather than a team activity	It is impossible to move sideways from a consultant post to a senior lecturer post
5	External reviewers do not take into account career breaks when reviewing applications as this gets forgotten due to the volume received	For doctoral fellowships it is incredibly difficult to get academics from different institutions to agree to work together as the PhD fee only goes to one institution. Yet the NIHR wants you to have the best team to support you	f you haven't had success early on then you won't be successful if you apply later in your career	In maternity care, research should be led by doctors	NHS managers can't see what job role a non-medic clinical academic will have in the NHS
6	Less likely to be successful if from an organisation outside the Golden Triangle/Russell group	Funders expect early career researchers to move as much as possible, and see any attempt to stay in the same organisation as a black mark which needs to be explained	You have to have held grants previously to get a grant	Dental research isn't funded	It is difficult moving between the NHS and HEI contractually
7	There is a limit to the number of supervisors that can be included on a fellowship		It is impossible to have a balanced clinical academic career	Academic time can’t be taken in blocks as a standard option	

8	You are never successful on the first go		Funding posts are short so you will need to relocate often		
9	Lack of understanding from some applicants around the ambition that the career trajectory is research leadership / professorship etc		You need to be early in your career do undertake a PhD and mid-career researchers can't start on the funding pathway		
10	Good reviews equate to shortlisting/success		You will not be successful as a clinical academic unless you have an academic department that is strongly linked to a clinical area (and vice versa)		
11	Rejection means I can't apply again and/or I am not good enough		To apply for an NIHR ICA Clinical Doctoral Research Fellowship you have to hold a first or 2:1 first degree		

Case studies

Intersectional case studies have been chosen from the interview and audio-diary participants. Cases have been chosen to provide insight into the complexities and interplay been the barriers, enablers and protected characteristics previously described. Pseudonyms have been used throughout and potentially identifiable details have been redacted to protect participant anonymity (e.g. locations).

Case 1: Krishna

Gender: Male	**Ethnicity:** Indian	**Professional role:** Medic

Krishna studied medicine as an international student in the UK but found his transition to the NHS difficult. He was subject to racial discrimination from colleagues and struggled to find employment. People would talk about his ethnicity, forgetting he was in the room, *"It was pretty clear what was happening, and sometimes, sometimes people would forget that I wasn't quite Anglo-Saxon and, and they would talk rather openly because they thought I was a, they'd forgotten because, you know…I used to get some amazing insights."* Krishna feels that working part-time is a barrier and leads to deskilling, *"*I'm a firm believer that if you do less than three days a week of clinical work your skill base begins to diminish and also the lack of continuity means that holes develop in the patient's care.*"* In later years, academic revalidation was problematic once he gave up clinical duties (but remained registered) as his research and seniority resulted in an extremely limited pool of those who could meaningfully assess him. He reported difficulties, *"Once I stopped seeing patients, because they didn't know how to handle me. I mean I contact, contacted the GMC and they said I could go privately and, and have an appraisal and revalidation done privately but the cost of that is, there are, there are professionals out there who will do it for you but they charge eight hundred pounds a shot…the Department of Health and the GMC have not sorted it out as well as they should. The GMC keeps sending you from pillar to post and so [the] Department of Health needs to sit down with the GMC and say look we've got to clarify the way CAs are appraised."*

Krishna successfully navigated the career path because of his drive: *"People who were successful within our network, was that they had, what I could call high internal orientation...internal orientation is when you're actually seeking to do something that's inside you wanting to tell you what it is you want to be and what you want to succeed in and where you want, you know, where you'll get your internal satisfaction from. So for many medical students and, and doctors, internal orientation is to do with achievement at a personal level. Internal orientation is very evident in successful [CA] researchers, you find that even at school that there were prefects or, you know, they had some sense of responsibility, that their internal drive was always one which, one which caused them to want to achieve something or they were driven by say ethical motives, they, they wanted to help the world very strongly. That internal orientation often gets, you know, kind of beaten out of you as you go through, your career, but, put people with strong orientations together and you've got a very explosive mixture of success."*

Krishna was embarrassed by the volume of opportunities afforded to him as a male researcher, and was motivated to level the playing field by encouraging women to take leadership roles, *"I think we've all become aware of the need, need to ensure that we have, wider representation in terms of gender, I think that there are situations where, for example, situations I might have considered but I have not gone for because I've been aware of who the other applicants are and I've been aware of the gender bias."*

Major barrier(s):	**Major enabler(s):**
• Racial discrimination • Revalidation processes	• Mentoring and support network • Internal motivation • Being male

Case 2: Abhirati

Gender: Female	**Ethnicity:** Indian	**Professional role:** Medic

Abhirati is a Medical Registrar and Academic Clinical Lecturer. Her career has always been limited by research funding being hard to come by. The struggle of working part-time has left her stretched thinly across her various clinical, academic and administrative workloads.

During the pandemic, she has been working at home where she is married to a clinical professor with two children. She has struggled with the balance of family and work commitments, stating that lockdown has reinforced sexist gender roles. Abhirati feels that her research has taken a backseat while her husband's work has been prioritised, *"I genuinely think he thinks his work is more important, I genuinely think that's what he believes*." She reports a decline in mental health due to the pressures of lockdown and family dynamics, *"I think that COVID has been a disaster for feminism...the disagreements that I've had with [husband] have been over feeling like a 1950s housewife suddenly, then to suddenly home schooling children and trying to stay sane, stay safe, keep everybody okay, whereas he still is doing exactly what he does [work]...so I think that, that, that's my big worry is that actually COVID's been a step back."*

A major enabler has been her ability to take her academic time in blocks, *"…so I've fought really, really hard to take my … academic time as two one-month chunks. Having a mentor opened doors, "When you somebody looks you in the eyes and goes okay, I'm taking a punt on you, I'm buying in on you and so, and that is so powerful."*

Unfortunately, Abhirati experienced so many barriers that she is considering giving up clinical academia, *"it's quite depressing…I think, I think I've proved to myself and I've proved to others that, you know, that I can do it, and, and the only, the only reason that I wouldn't do it is because it's just, it's just too much…it's too exhausting and it's too much of a pressure and I worry about the effect it would have on my family in the long run, is the reason, if I drop out that would be the reason, is because, it would be due to family guilt and exhaustion."* The lack of clarity regarding the CA career path has also been inhibitory, *"I think after your PhD because PhDs are so structured and then you go back into this wilderness of clinical medicine and academia and it's, it's pretty, and because it's unique for everybody there's no path."*

Major barrier(s):	**Major enabler(s):**
• Gendered division of labour • Exhaustion • Lack of clarity concerning career paths	• Research time being available in blocks • Mentorship

Case 3: Joe

Gender: Male	**Ethnicity:** White British	**Professional role:** Medic

Joe is a General Practitioner, who is also in the middle of his PhD. Joe is a homosexual male, currently married to his partner Fred. Joe had always been very open about his sexuality within his work environment, however this soon changed after he began to receive negative comments and feedback about his sexuality. It first began in the clinical environment, which ultimately had a negative impact on his career choice, feeling he had to change specialty. *"I was going to pursue a career in paediatrics, at least I thought I was at that moment in time, I had started doing some of my exams and was really very passionate about it, but I was put off by an experience where somebody said that people like me needed to be careful around some of the children that we had on the ward who were admitted under an emergency protection order. The insinuation involved there was, was really quite terrifying at the time."* This adverse behaviour has also occurred in his current practice. *"I remember when I started in general practice one of the senior partners said something like well do people like you need chaperones for everything?"*

These experiences now mean that Joe is very anxious about how he is perceived and as a result has changed his behaviour. *"I didn't talk about it at all to anybody. I openly talked about my life with my husband, but I stopped, I just stopped wearing pink shirts, I stopped doing anything that I thought could be construed as camp or conforming to that stereotyping at all. Yeah, it's horrible, I was very frightened."*

Joe's academic role also came with the same negativity, facing inappropriate remarks. He never felt he could speak out about such behaviour because he felt that this would have an adverse impact on his academic career. He noted that his career progression was based on the sign off of others around him that were more senior and so did not want to 'cross them'. *"When I started in my current [academic] role, I'd been going through a divorce and I was cautioned about who I spoke to about that and I needed to think about what sort of message I was sending and be careful and think about who my employers were now. That was on my very first day. I felt like a massive fraud having just finished my GP training and got a senior lecturer post, I thought I've got to count myself lucky and so at that particular time I just said yes sir, no sir, three bags full sir."*

Joe did not have any kind of mentor or role model that he could speak to about such issues, and in particular someone that may have faced similar issues. Thankfully Joe still remains in Clinical Academia and in actual fact is now using his experiences to help others who are facing similar challenges. He feels that those with protected characteristics are 'entitled' to such support. He has faced many challenges and as a result has struggled in his career. Joe realised through his own mentor work that support may have in fact been available, but he 'didn't know how to look for it'. He also felt it was unlikely to provide the correct support and networks that he needed.

Major barrier(s):	**Major enabler(s):**
• Microaggressions • Discrimination • Lack of support (particularly mentors and role models)	• Resilience

Case 4: Ade

Gender: Male	**Ethnicity:** Black African	**Professional role:** Medic

Ade is an SHO at the beginning of his GP training. He obtained his primary medical degree in Nigeria and his PhD in the UK. He has done a lot of teaching of medical students both in Nigeria and in the UK. He's always had an interest in the sciences and in many ways that spurred him to pursue a career in Clinical Academia. He believes that being a non-UK graduate, with overseas qualifications and skills, have impacted negatively on his chances to progress within Clinical Academia in the UK. According to him *"Minorities are disadvantaged in the way that some people will say it's unconscious bias… but there's nothing unconscious about bias."*

He has no role model or mentor who is an international medical graduate on the CA pathway to guide him. As a non-UK graduate, Ade's major barrier is the lack of recognition of overseas degrees, skills as well as non-traditional pathways, *"But there is a failure from the system to adequately recognise the available resources and I'm raising this because it applies to those that are migrants into United Kingdom, there are lots and lots of people that come into this country that are academics already…and are medical doctors, right? Medical doctors come into this country don't have, let's say the GMC licence to practice, so if you don't have the GMC licence to practice, then your skill is held up…and that skill that you have, nobody knows about it."*

Other barriers he experiences are the lack of cultural acceptance and financial independence to conduct independent research. Ade had no enablers and had dropped off the CA pathway because of all the barriers he had faced as a non-UK graduate.

Major Barrier(s):	**Major enabler(s):**
• Poor/Lack of recognition of overseas degrees, skills and non-traditional pathways • Lack of financial support for independent research • Cultural Acceptance	Not Applicable

Case 5: Louise

Gender: Female	**Ethnicity:** White British	**Professional role:** Medic

Louise is a busy working mother. Gender inequality has been a constant feature during her career. When discussing contracts with colleagues of the same career grade, *"the male colleague brought his contract along so we could have a look and…we realised that he was being paid five thousand pounds a year more than we [female clinicians] were... we had qualified at the same time and there was no difference in terms of our experience, there was no difference in terms of the job we were doing…"*

Louise has always been active in medical societies, associations and professional bodies. She reports, *"overtly sexist behaviour but actually to me that is separate from the gender inequality."* She has experienced *"inherent gender inequality and a very unconscious gender bias which manifests itself in the way that women are not listened to in meetings, women's contribution is ignored, women are, when they post something on the electronic communication that they have the list servers, women will often not be responded to and then a man will make the same point, you know, two or three posts later and people will respond to it. Women are not chosen to speak first in meetings, you know, so it's. If you said to someone coming out of a meeting, do you think there was any gender inequality in that meeting? They'd say no."*

Louise found that her maternal status was a barrier to being able to actively participate in research discussions, planning and associations. *"…what happens of course is that decisions about the following day's meeting are then made over dinner, or in the hotel bar, so by the time you turn up usually in a bit of a flap because you've had to come on the train at six o'clock in the morning, got your kids organised for school…and then you've been on the train, you've got there, you've had to walk really fast from the station because the meetings don't start at a time that fits in the fact people come down in the morning…so the whole thoughtlessness around it and actually pretty much the decisions have all been made and you are the sole dissenting voice in the room, and the tendency is to say oh no, no, no, no, you know, don't, you, you misunderstood, the issues are really about this and actually there's not an explanation of the issues because it's already been discussed over, you know, some wine and a couple of whiskies...."* Louise reports that when women try to speak they are greeted with attitudes and comments such as, *"I don't believe that what you're saying is a true reflection…and it is greeted with blank looks as though there's nothing wrong with that, with the inferred criticism and also then the implied fact this is, this is a women who's probably a bit hysterical, she's obviously got some issues, you know, that kind of hormonal, almost insane…"*

Louise proposes solutions including, *"targeted events that showcase successful women and whether that is in academia, whether that is in, in certain clinical disciplines, whatever it is, that they are focussed events, because it is important for women to see other women doing well and to be able to ask them and say how would you overcome this scenario that I'm encountering? How would you make sure you've got equal pay? How have you made sure? And for them to talk about it openly and in, in a safe space, but then I think there needs to be a more specific education about these kind of micro-aggressions and micro-inequalities that exist because you and I recognise them but lots of people don't, including women and including men who, who think they're trying their best and they don't see them, and I think there needs to be a more compulsory element of education."*

Major barrier(s):	**Major enabler(s):**
• Maternal wall bias • Pay inequalities • Overt sexism & patriarchal structure • Gender discrimination	Not Applicable

Case 6: Zainab

Gender: Female	**Ethnicity:** Black African	**Professional role:** Medic

Zainab is a Black, Muslim African female Academic GP, who is also a working mum with young children. She identifies as *"proudly intersectional."* Having just learnt about intersectionality, she sees how her multiple identities or protected characteristics may impact on differential attainment within clinical academia. Although her intersectional score is low and as such flagged her as a low achiever with no prospects, she refuses to see it as an obstacle and become a self-fulfilling prophecy.

While Zainab was a GP trainee, an opportunity came up to be an academic GP and she decided to apply. She just had a child and wanted to work part-time and found that they were not accepting part-time workers. As a result, she lost the opportunity *"there was an opportunity to reply to be an academic GP and I'd just had a child at the time and I wanted to apply and I sent off an email and it said sorry, we can't accept part-timers…at that point it fell flat on its face just simply because it wasn't a level playing field because I wanted to work sixty percent and they said no…this just has to be full-time."* In her academic role, she works less than full-time with full-time academics. As a result, Zainab reported feeling like she's missing out on important meetings and therefore, she's being left behind, and is not as good as they are. This contrasts with her clinical role, which makes her feel quite fulfilled. *"I actually don't feel that when I'm in my clinical work because like I say I've been doing it for so long and I know my patients really well and they literally wait for me if I'm going on holiday to see me so I've always felt quite fulfilled in that role…but it's about not feeling that imposter syndrome that you can't do three jobs and be good at three jobs because you're just spreading yourself too thin."*

Zainab's emotional resilience and ability to self-motivate are among the enablers that have kept her achieving as an academic GP against all odds. According to her *"the field is very competitive, and people are so competitive with each other, it's like a race. I don't think I've ever been part of that race, I've just done things because I wanted to [laughs] because I thought it's the right thing to do and because it allowed me to align with my own values, so that's really a driving factor…I honestly believe a lot of progression in life is to do with your mindset and having quite a positive mindset."* Another major enabler was being self-funded. Although it was not easy initially, according to her, *"[it was] liberating knowing I'm free to think how I want, to write what I want, I'm not bound by being accountable to an organisation that has an agenda."* Another enabler that she is extremely passionate about is the research she does and that made it a lot easier and makes people a lot more interested in listening to her.

Major Barrier(s):	**Major enabler(s):**
• Inflexible working patterns and careers for CAs • Difficulty juggling academic and clinical roles as well as family responsibilities	• Emotional resilience and self-motivator • Credibility and confidence that comes from being a clinician • Passion for academia • Proudly intersectional • Academic support • Self-funded

Case 7: Chloe

Gender: Female	**Ethnicity:** White	**Professional role:** Dentistry

Chloe, a UK dental graduate, undertook longitudinal foundation training. She then undertook Dental Core Training 2 in paediatric dentistry and special care. A further year in community dentistry followed and she took up a University-funded staff grade paedodontic position in a dental school. She holds an honorary NHS contract and her working week includes personal clinical sessions, teaching and supervising dental undergraduates and one nominal day of research. As a dental student she had no exposure to research and her interest in research developed following qualification. She feels that she has been fortunate that her DFY Educational Supervisor nurtured her interest in research and introduced her to local research leads. She feels that there is insufficient awareness of the CA pathway. She has struggled to understand the CA career in dentistry pathway and feels that this may put prospective candidates off: *"…I think just better dissemination of information about the pathway, particularly for dentistry and possible entry routes and sort of information on sort of where it can go, where it can lead to as well."*

Chloe is aware of the limited number of jobs available in dental clinical academia in the UK and worries that this may become an issue when she has additional commitments: *"It's not too much of an issue at the moment in terms of mobility, you know, I could move if I needed to but it could be, could be an issue in future when, or maybe had other commitments and wasn't so easy to move."* Nevertheless, she is now exploring the possibility of undertaking a PhD and has applied for a Paediatric Dentistry ACF. She feels that the only realistic entry route to Dental CA training is through a national training number for clinical training. She is aware that the CA pathway is a lengthier one than clinical training alone with the potential for it to be extended even more by maternity but is not put off by this.

Another obvious barrier has been the competition between the clinical and academic components of her role: *"when you're doing a dual job, often the clinical can almost become priority, not that it's necessarily less important but patient-related stuff certainly feels like higher priority."* Frequently, patient care has taken priority and Chloe has found it difficult to achieve a balance with academic work suffering. She is already aware that clinical colleagues have a lack of understanding of her role as a fledgling CA and prioritise clinical activity over academic activity: *"…one of the clinical consultants had said oh the students aren't in, [name] can't be doing much, let's give her this to do, this job to do…"*

She remains optimistic about CA training and has benefitted from good supervision and mentorship. She is aware of the value of having positive role models who are enthusiastic about research and teaching and who have supported and inspired her to search out opportunities. She additionally highlighted the support and guidance that she has received from her ACF peers who have been awarded grants for their PhDs. Whilst she hasn't suffered from active discrimination personally, she has observed that female colleagues have needed to prove themselves or defend their ground more than equivalent male trainees.

Major barrier(s):	**Major enabler(s):**
• Clinical work impacting on academic work • Lack of understanding and clarity of the pathway and work of a clinical academic • Length of training • Limited job opportunities and potential need to move geographical location	• Supportive mentoring and supervision • Senior and peer support network • Positive role models

Case 8: Balvinder

Gender: Female	**Ethnicity**: Indian	**Professional role**: Dentist

Balvinder works part-time as a Dental ACF in Restorative Dentistry and has recently returned from a year-long maternity leave. She works eight sessions a week of which 25% is spent undertaking academic work. She is now in her final year of training which has been extended after she became part-time on her return to training. During her maternity leave she has had time to reflect on in the impact of her academic training on her clinical training: *"…it's really become obvious to me now how difficult it is because I'm required to do the same amount as any other STR in terms of competencies, both practical, managerial, like all the competencies required of a STR, in seventy five percent of the time…"* Although she is making satisfactory clinical progress, she feels that she is at a disadvantage in comparison with her StR colleagues: *"when you get to an ARCP, because your numbers in surgical dentistry are adequate, you always get signed off but internally you feel, you haven't done the same amount as some of your colleagues."*

Balvinder feels frustrated and that the clinical component of ACF training should be elongated to compensate for the additional academic components of training. With the added pressures of childcare and her return to clinical training she has found things difficult and has felt pressurised whilst completing a grant application. Additionally, like many ACFs, she has found: *"it's very easy for my clinical work to encroach into my ACF time."* As a result, much of her academic work takes place at home in her own time. The lack of flexibility of her timetable has frequently stopped her from networking or attending relevant conferences. She strongly advocates splitting ACF timetables up into dedicated, protected blocks of separate clinical and academic time to avoid this encroachment possibly with the research component occurring on a different physical site.

She recognizes that because she has chosen to train in a particularly clinically-driven specialty this may influence the outcome of her ACF training in terms of grant submission and immediately starting a PhD. She feels it might be wiser for her to consolidate her training, avoid deskilling during a PhD and build her experience as a consultant before undertaking a research degree. She feels that this additional time would also provide her time to identify important research areas of interest to her.

She has struggled to find female academic role models and mentors and has found it difficult to get advice. She feels that the choice of an experienced research supervisor with a promising research topic based in an active and successful research group is essential given the limited time available to ACFs. She dropped an initial self-designed research project when it became clear that it would not be funded: *"if they want you to be able to do a grant application by year three, you really have to be paired up with someone who is experienced in putting grants through."* Balvinder still finds clinical academia attractive owing to its teaching components and the opportunity to be innovative, but is concerned about the *'lifelong pressures of being an academic…'* and to balance this with her external commitments to motherhood, her husband and being a homeowner. *"That is not something that I want to be stressed about."*

Major Barrier(s)	**Major Enabler(s)**
• Clinical pressure • Perceived pressures of clinical academia • Maternal wall bias • Lack of role models and mentors	• Attractions of clinical academia

Text mining

Exploration of Interview Transcripts using Text mining and Natural Language Processing (NLP)

Background

In order to further analyse the transcripts of the hundred and three interviews (104 interviews were conducted, though one was not recorded) as part of this project, some text mining and natural language processing was carried out. This was in order to see if any features, in terms of the structure of the text, could highlight additional themes that may not have been apparent in the qualitative analysis. This provides a quantitative approach to understanding free text. At a basic level, text mining sometimes allows one to learn something about the content of language, according to word/phrase frequencies and contexts. Moreover, it may be that machines can sometimes detect themes a qualitative analysis may miss.

Methods

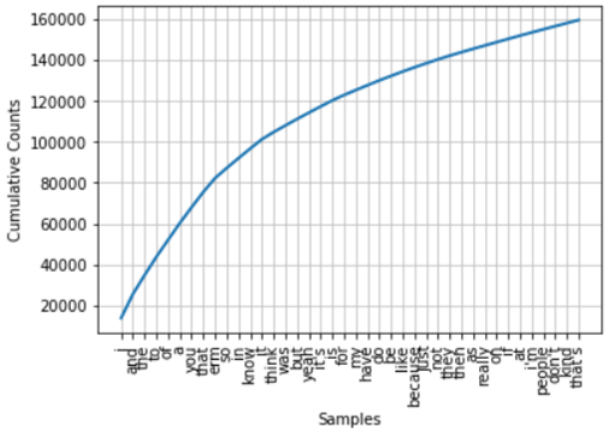
The natural language tool kit (NLTK) package for Python 3.7 was used for the basic text exploration. The Word Cloud was generated using the wordcloud package in Python 3.7. The Latent Dirchlet Allocation (LDA) topic modelling was conducted using the Gensim package in Python 3.7. The full code for the analysis is available on request.

Basic text-analysis

The corpus (body of text) from the interview transcriptions was 2,509,101 characters long. The text was separated into tokens. In this case each token represented a word, with words including apostrophes such as '*don't*' treated as single tokens. There are 472,665 words in the corpus of transcripts. Lexical diversity is a measure of how many different words are used, as a proportion of the total number of words. In this case, the value 0.02. This is a relatively low value - for example, romantic novels typically have a value of around 0.12 for lexical diversity. This suggested that the interview material was relatively focused and restricted, which is unsurprising given the fairly circumscribed topic.

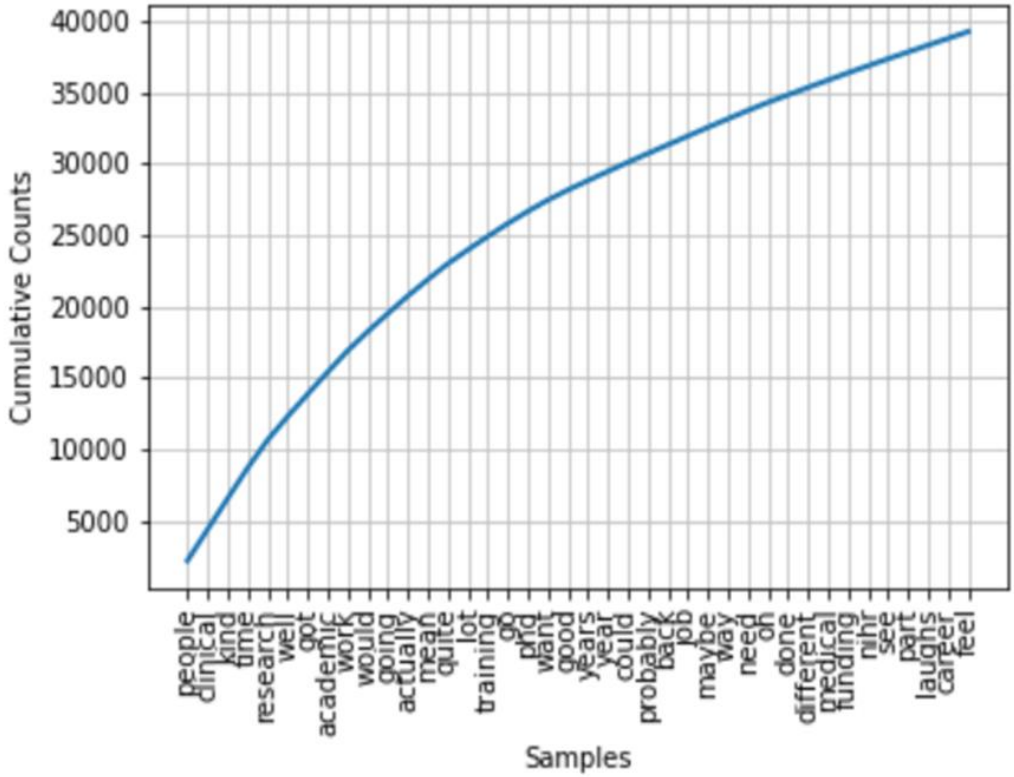
In order to examine the initial word frequency distribution, the 40 most common words were plotted (Figure 8).

Figure 8: A plot of the word frequency distribution of the 40 most common words



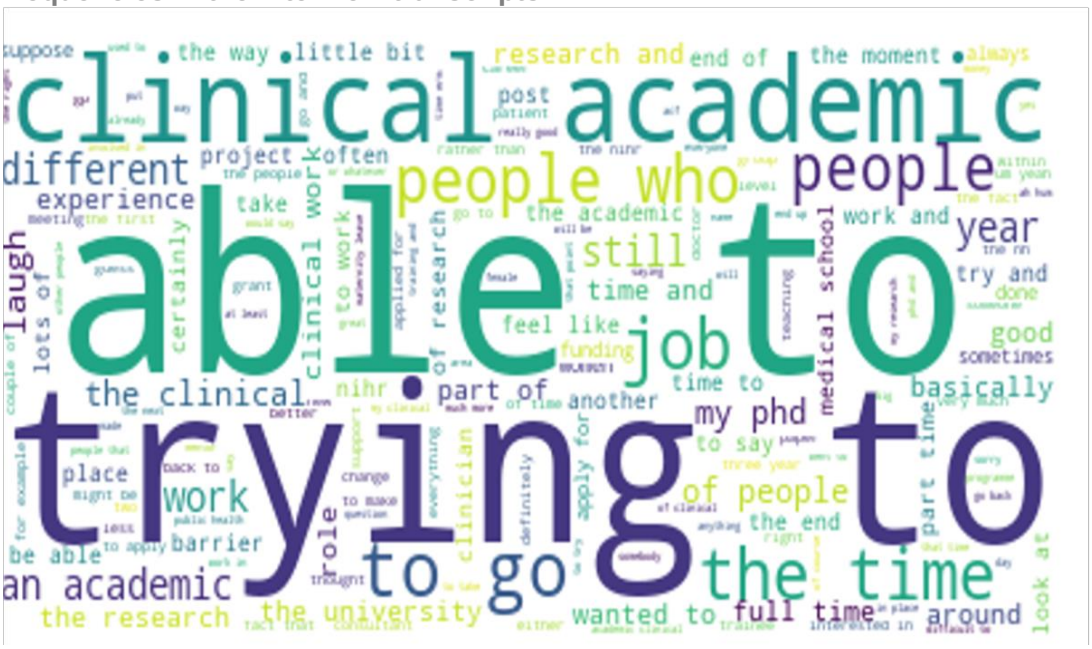
As can be seen, unsurprisingly, many of the words were common, often conjunctives such as *'and'*, '*or*' etc., but were not meaningful in their own right. These are referred to as 'stop words' in text mining. They are often removed at an early stage before further analysis. A standard dictionary of stop words is included in the NLTK package that was used, but an additional, bespoke list of stop words was also added, for example *"erm...", "I've", "bit",* etc. Interestingly the word '*NIHR*' occurred in the transcripts (corpus) 494 times, and after removing the stop words, made the top 40, as can be seen in the revised list of word frequencies (Figure 9).

Figure 9: A plot of the word frequency distribution of the 40 most common words, having removed common 'stop' words



Common words and phrases were also visualised using a word cloud (Figure 10).

Figure 10: 'A word cloud' that was generated, based on word and phrase frequencies in the interview transcripts



Looking at the word cloud and word frequency plots, common words in the transcripts can be easily identified, including ones that might be expected, given the topic of the interviews, such as '*research', 'clinical', 'funding', 'career', 'PhD'* and '*academic'*. However, it can be noted that there were other words such as '*people', 'training'* and '*time'* which suggested the importance of the relational aspects of a CA career, the vital importance of time to engage in academic activities and opportunities for training. Other, more ambiguous words and phrases, such as '*able to',* and '*trying to'*, were fairly prominent in the word cloud. These seemed to underline the aspect of striving, and emphasis on opportunity, that are hallmarks of a CA career, where progress depends on high levels of dedication, as well as some degree of fortune. The fact that the word '*laughs'* also made it into the top 40 commonest word list also suggested that the topic is not without moments of lightness, and even fun, for many.

Word associations: N-grams

From an NIHR perspective, the context that the word '*NIHR*' was mentioned in was investigated. This was done by evaluating which two words were most often associated with the word '*NIHR*', excluding any stop words. That is, what were the 'trigrams' (groups of three words) that included '*NIHR'*? The likelihood ratio for finding words associated with NIHR, as opposed to not associated, was set to 50.

The results are shown below in Table 7.

Table 7: A list of the most common groups of three words ('trigrams') which included the word 'NIHR'

'Part', 'Time', 'NIHR'
'NIHR', 'Medical', 'Education'
'NIHR', 'Clinical', 'Lecturer'
'NIHR', 'Academic', 'Clinical'
'NIHR', 'Wellcome', 'Trust'
'Foundation', 'Programme', 'NIHR'
'NIHR', 'Clinician', 'Scientist'
'NIHR', 'Clinical', 'Lectureship'
'NIHR', 'Clinical', 'Fellow'
'Clinical', 'Fellow', 'NIHR'
'NIHR', 'Doctoral', 'Fellowship'
'NIHR', 'Advanced', 'Fellowship'
'Clinical', 'Fellowship', 'NIHR'
'NIHR', 'Anything', 'Else'
'NIHR', 'Doctoral', 'Research'
'Applied', 'NIHR', 'Doctoral'
'NIHR', 'Practice', 'Fellowship'
'Applied', 'NIHR', 'Grant'
'NIHR', 'Funded', 'Clinical'
'Successful', 'Getting', 'NIHR'
'NIHR', 'Quite', 'Good'
'NIHR', 'Anyone', 'Else'
'Applied', 'NIHR', 'Practice'
'PhD', 'Funded', 'NIHR'
'NIHR', 'Career', 'Development'
'Put', 'Application', 'NIHR'
'Deeply', 'Offensive', 'NIHR'
'Mean', 'Obviously', 'NIHR'
'NIHR', 'Quite', 'Keen'
'NIHR', 'Research', 'Professorship'
'Go', 'NIHR', 'Website'
'Extremely', 'Grateful', 'NIHR'
'NIHR', 'Trainees', 'Conference'
'Research', 'Fellowship', 'NIHR'
'NIHR', 'Funding', 'Mean'
'NIHR', 'Funding', 'Even'
'Gone', 'NIHR', 'Route'
'NIHR', 'Funding', 'Kind'

'NIHR', "Can't", 'Speak'
'Took', 'NIHR', 'Fellowship'
'Available', 'Actually', 'NIHR'
'People', 'Getting', 'NIHR'
'NIHR', 'Research', 'Professor'
'Going', 'End', 'NIHR'
'Actually', 'NIHR', 'Quite'
'Mean', 'Went', 'NIHR'
'Kind', 'NIHR', 'Clinical'

As can be seen from Table 7, most are related to NIHR-funded CA roles. However, there is also an association noted with '*medical education*' and '*Wellcome*' another healthcare research funder.

This exercise was repeated with the word '*female*'. Again, the likelihood ratio for word associations was set to 50. The trigrams located are shown in Table 8.

Table 8: A list of the most common groups of three words ('trigrams') which included the word 'female'

'Female', 'Medical', 'School'
'Female', 'Clinical', 'Academic'
'Clinical', 'Academic', 'Female'
'Female', 'Clinical', 'Academics'
'Clinical', 'Academics', 'Female'
'Female', 'Fifty', 'Percent'
'Female', 'Role', 'Models'
'Female', 'Senior', 'Lecturer'
'Eighty', 'Percent', 'Female'
'Make', 'Sure', 'Female'
'Female', 'Role', 'Model'
'Sixty', 'Percent', 'Female'
'Role', 'Model', 'Female'
'Ethnic', 'Minorities', 'Female'
'Female', 'Caring', 'Responsibilities'
'Everything', 'Else', 'Female'
'Research', 'Group', 'Female'
'Male', 'Female', 'Female'
'Male', 'Female', 'Authors'
'Female', 'Academic', 'Careers'
'Female', 'PhD', 'Students'
'Senior', 'Female', 'Academics'
'Male', 'Female', 'Trainees'
'Whether', 'Male', 'Female'
'Male', 'Female', 'Different'
'Rules', 'Male', 'Female'
'Supervise', 'Male', 'Female'
'People', 'Male', 'Female'
'Male', 'Female', 'Primarily'
'Practice', 'Male', 'Female'
'Male', 'Female', 'Salaried'
'Male', 'Female', 'Though'
'Supervisors', 'Male', 'Female'
'Salary', 'Male', 'Female'
'Many', 'Female', 'Academics'
'Head', 'Male', 'Female'
'Balance', 'Male', 'Female'
'Male', 'Female', 'Either'

'Male', 'Female', "He's"
'General', 'Male', 'Female'
'Sometimes', 'Male', 'Female'
'Male', 'Female', 'Year'
'Male', 'Female', 'Well'
'Female', 'Black', 'Ethnic'
'Academics', 'Female', 'Academics'
'PhD', 'Supervisor', 'Female'
"Can't", "Can't", 'Female'
'Funnily', 'Enough', 'Female'
'Upcoming', 'Female', 'Academics'
'People', 'Female', 'Academics'

Some of these trigrams highlighted conversations about the proportions of females in clinical academia, as well as the importance and the availability of role models and comparison with males. There were also two trigrams that highlighted issues raised about intersectionality ('*Ethnic', 'Minorities', 'Female'/'Female', 'Black', 'Ethnic'*).

Trigrams were also identified for mentions of the word '*woman*', yielding the results listed in Table 9.

Table 9: A list of the most common groups of three words ('trigrams') which included the word 'woman'

'Woman', 'Clinical', 'Academic'
'Role', 'Models', 'Woman'
'Woman', 'Twenty', 'Five'
'Woman', 'Clinician', 'Scientist'
'Woman', 'Oh', 'God'
'Woman', "Can't", 'Remember'
'Woman', 'Someone', "Who's"
'Woman', 'See', 'Mean'
'Woman', 'Small', 'Children'
'Family', 'Commitments', 'Woman'
'Man', 'Woman', 'Terms'
'Single', 'Woman', 'Children'
'Upon', 'Man', 'Woman'
'Puts', 'Man', 'Woman'
'Year', 'Old', 'Woman'
'Man', 'Woman', 'Individuals'
'Man', 'Woman', 'Clearly'
"Can't", 'Single', 'Woman'
'Us', 'Man', 'Woman'
"Who's", 'Woman', "Who's"
'Whether', 'Man', 'Woman'
'Single', 'Woman', 'Without'
'Woman', 'Single', 'Woman'
'Become', 'Single', 'Woman'
'Could', 'Man', 'Woman'
'Man', 'Woman', 'Could'
'Mentor', 'Woman', "Who's"
'Lambasting', 'Woman', "Who's"
'Single', 'Woman', 'Academia'
'Academia', 'Single', 'Woman'
'Single', 'Woman', 'Clinical'
'Time', 'Single', 'Woman'
'Single', 'Woman', 'Well'
'Commitments', 'Woman', "Who's"
"I'll", 'Woman', 'Starts'
'Earth', 'Woman', "Who's"
'Woman', "Who's", 'Working'
'Spot', 'Spot', 'Woman'

'Woman', 'Spot', 'Spot'
'Woman', 'Young', 'Consultant'
'Formative', 'Experience', 'Woman'
'Woman', 'Late', 'Twenties'
'Italian', 'Biochemist', 'Woman'
'Woman', "Who's", 'Trying'
'Come', 'Naturally', 'Woman'
'Well', "I'll", 'Woman'
'Woman', "Who's", 'Already'
'Woman', 'Starts', 'Building'
'Woman', "Who's", 'Told'
'Woman', "Who's", 'Successful'

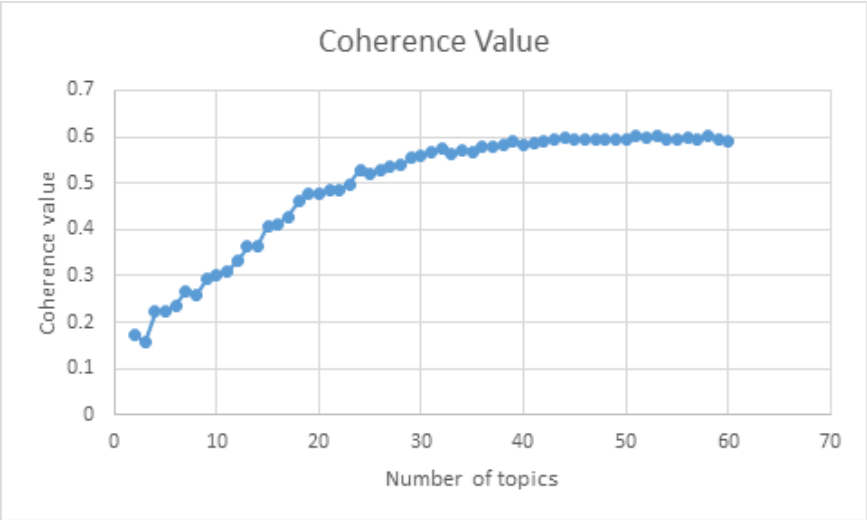
As can be seen, the trigrams highlighted a number of themes, including issues relating to age, family commitments and relationship status (the word '*single'* features in six trigrams).

Natural Language Processing- Latent Dirichlet Allocation (LDA)

Having explored some of the text structure of the interview transcripts using text-mining, an approach that forms an aspect of natural language processing (NLP) was used to explore the text structure of the interview transcripts. One way that machines can be used to make sense out of text data is via 'topic modelling'. In topic modelling a machine attempts to identify the themes that may be present in the text, via the way that words might be associated with each other. By asking a machine to identify themes it may be possible to complement the human qualitative analysis of the transcripts. That is, a machine may be able to identify alternative themes, or overarching themes, simply from the (latent) pattern of words. A common way of topic modelling is using Latent Dirichlet Allocation (LDA). In LDA a machine seeks to understand how words make up themes, and how themes may relate to 'documents'. This approach is useful in the present study, as it is a form of 'unsupervised' learning - that is, it does not require any training on annotated or pre-labelled text. Documents can be relatively long, such as reports, or very short, such as Tweets, or brief product reviews. In the present case, 'documents' were defined in two ways. Firstly, each individual transcript, relating to a participant, and secondly, as each individual sentence, or clause (if separated by a comma). There were no obvious differences in the results between these two approaches so only the findings from the LDA which treated clauses as individual documents were reported. A mathematical explanation of LDA is beyond the scope of this review. However, the basic motivation for the method is to identify the set of words that are most closely associated with each of a fixed set of topics, that simultaneously explain the content of each 'document'. Thus, each document is considered to be described by a number of topics (though they may mainly relate to one each) and each topic is described by a number of words. The mathematical estimation process thus seeks to solve this situation in a way which is most parsimonious and optimally fits the data (text). The number of topics is often decided on a priori, though in this case the possible number of topics was explored and selection of the final model was according to the *coherence values* estimated for the number of topics identified. The coherence value is a marker of how similar the words most commonly associated with each topic are. The similarity between words is calculated via specialised dictionaries, based on taxonomies of words, such as *wordnet*. In this case, the coherence values seem to maximise around a value of 0.60 with around 50 topics (the maximal value was observed for 51 topics). A coherence value of 0.60 is consistent with 'moderate to good' topic coherence. In the present case, the maximum coherence values were observed for eight topics. Therefore, the results for the LDA with eight topics were reported.

Prior to running the LDA analysis, the text data were managed in order to 'lemmatize' words. This means that words were automatically converted into standard forms using standard dictionaries designed for such purposes. The coherence values for each number of topics estimated are plotted and shown in Figure 11.

Figure 11: Plot of coherence values for number of topics identified by the Latent Dirichlet Analysis (LDA).



As can be seen from Figure 11, the coherence values levelled out at about 40 topics and reached a peak at about 50, before they started to decline. The full results for 51 topics (the number with the maximum observed coherence value) are given in the Appendix at the end of this section of the report. The number followed by an asterisk at each word represents the probability of that word appearing (i.e. associated) with that topic.

Most of the topics identified by the LDA analysis were not easily interpretable. However, most could be labelled according to the single word most closely associated with that topic. For example, topic 17 was closely associated with the word "training" although many of the other words also associated with that topic did not seem obviously directly related ('*early*', '*remember*', '*loads*', '*mean*', '*along*', '*advice*', '*intercalate*', '*body*' and '*achieve*' - see Appendix). However, approximately ten topics did seem to be at least tentatively interpretable and these are listed in Table 10 below.

Table 10: Results of a Latent Dirichlet Analysis (LDA) set to 51 topics, with 10 interpretable topics shown.

Topic words (values represent the probability that the word is associated with that topic- those associated values over 0.1 (10%) in **bold)**	Possible interpretation
0.269"medical" + 0.147"student" + 0.145"teaching" + 0.069"specialty" + 0.067"science" + 0.048"impact" + 0.044"trust" + 0.038"path" + 0.033"service" + 0.032"wellcome"	Almost certainly relates to medical student teaching.

0.253"university" + 0.231"career" + 0.112"role" + 0.080"another" + 0.069"whole" + 0.057"base" + 0.039"means" + 0.033"community" + 0.033"various" + 0.033"without"	Probably relates to the role of universities in supporting (or otherwise) the career of clinical academics.
0.620"time" + 0.149"part" + 0.081"long" + 0.029"difference" + 0.027"slightly" + 0.022"effectively" + 0.020"turn" + 0.007"suspect" + 0.007"valuable"	The impact of less than full time working on duration of training and the way one is viewed.
0.145"salary" + 0.127"enjoy" + 0.118"certain" + 0.104"income" + 0.089"stop" + 0.074"know" + 0.073"look" + 0.064"amount" + 0.035"happening" + 0.026"produce"	May refer to the salaries of clinical academics (compared to non-clinical academics?).
0.276"child" + 0.222"suppose" + 0.099"tend" + 0.066"access" + 0.055"struggle" + 0.052"whilst" + 0.034"therefore" + 0.031"older" + 0.028"progression" + 0.021"cancer"	May be a reference to the challenges of having children and caring responsibilities whilst pursuing a clinical academic career.
0.315"say" + 0.195"NIHR" + 0.169"fund" + 0.162"side" + 0.034"shift" + 0.027"capacity" + 0.018"incredibly"	Reference to the importance of NIHR funding and the ability to build research capacity, both individual and national?
0.201"support" + 0.192"might" + 0.142"understand" + 0.140"around" + 0.077"mentor" + 0.062"completely" + 0.039"responsibility" + 0.021"bit" + 0.015"amaze" + 0.011"amongst"	A reference to accessing support from mentors.
0.410"post" + 0.132"next" + 0.119"looking" + 0.076"small" + 0.070"anyway" + 0.041"line" + 0.039"decide" + 0.033"recruit" + 0.015"manager"	May reflect the tenuous nature of early academic careers, where one is 'always looking for the next post'.
0.193"find" + 0.184"working" + 0.121"hard" + 0.113"tell" + 0.109"percent" + 0.077"hours" + 0.055"realise" + 0.047"recognise" + 0.019"afterwards" + 0.019"discrimination"	A reference to the incredible workload often faced by clinical academics who often work brutal hours in order to meet university, research funder and clinical demands.
0.278"right" + 0.221"grant" + 0.192"sometimes" + 0.111"application" + 0.048"weekend" + 0.022"rota" + 0.020"third" + 0.013"rubbish" + 0.012"massively" + 0.003"annual"	Perhaps reflects the critical importance of getting a grant at the right time, in terms of one's career.

Text mining section summary

This exploration of free text using text mining and natural language processing was able to highlight some interesting word associations and themes, which were also echoed in the qualitative analysis. These included references to medical student teaching, the challenges, hard work and precarious nature of a CA career, as well as the importance of

mentoring and role models, especially for female academics. Similar to many cases where factor analysis is used with questionnaire data, many of the topics identified by the LDA analysis were not easily interpretable as such. However, around one fifth of them did indicate particular themes, which again were picked up in the qualitative analysis. As this analysis was not resourced there was a limited amount of time available to spend on the work. It may be that further exploration could have yielded further interesting themes and features within the text. For example, it may have been possible to re-run the LDA using bigrams or trigrams, rather than individual words. Moreover, a sentiment analysis, which picked up the overall attitudes and feelings associated with each interviewee or theme could have been possible. However, this would have required a certain amount of text to have been hand annotated in order to train a machine to automatically label sentiments. Without this human annotation, 'unsupervised' sentiment analysis tends to perform relatively poorly. Moreover, although there was a relatively large body of text, only a hundred or so interviewees were involved and it might be that such computational linguistic approaches would be more suited to larger corpora of texts, ideally composed of many thousands of documents.

Take-home message:

- Text-mining and natural language processing (NLP) may complement traditional qualitative approaches to analysing interview transcripts.
- Although many of the 'topics' identified by the Latent Dirichlet Analysis (LDA) were not easily interpretable a number had themes that made substantive sense and echoed the findings from the qualitative analyses.
- Such interpretable topics implied that the NIHR was seen as the main financial source of support for CA careers, as well as highlighting perception of the challenging and, often precarious, nature of this path.
- Other notable topics appeared to relate to the issues related to part-time work and child rearing, the role universities have in determining CA careers as well as medical student teaching.
- These findings suggest the need to pay special attention to these issues when considering interventions as they emerged from both the traditional qualitative analysis as well as the LDA.

Intervention plan

Following data synthesis from the interviews and audio-diaries, we developed an intervention plan (see intervention table below). Participants were specifically asked for suggestions for interventions that would improve their experiences, supporting literature was also considered. This plan suggests interventions based upon the initial narratives of participants. The interventions have been grouped according to nine higher-level recommendations, each with example interventions beneath. For each intervention outlined, contextual information from the participant voice, an indication of the parties who may take responsibility, the intended audience and professions are provided. Proposed evaluation and performance metrics are provided, including an indication of the perceived complexity of the intervention.

Proposed evaluation and performance metrics are not intended to replace robust studies to assess the efficacy of interventions, rather they are suggestions for monitoring of intervention uptake. There is a need to create research infrastructure in order to facilitate implementation and evaluation of interventions.

The participants in this study were from diverse backgrounds and thus had experiences from a range of funders. We are aware that the outputs from some of the suggested interventions may have been implemented previously by some funders. Thus, we recommend that funders are selective in considering which interventions most suit their needs and their participant demographics. In addition, participants reported not being aware of interventions previously introduced; thus, more robust advertising of interventions is advised.

Before considering the intervention plan, the higher-order recommendations are presented in isolation (Figure 12) and a summary of the interventions is presented in Figure 13. Figure 13 is numerically and colour coded to match the 9 over-arching recommendations.

Figure 12: Nine higher-order recommendations

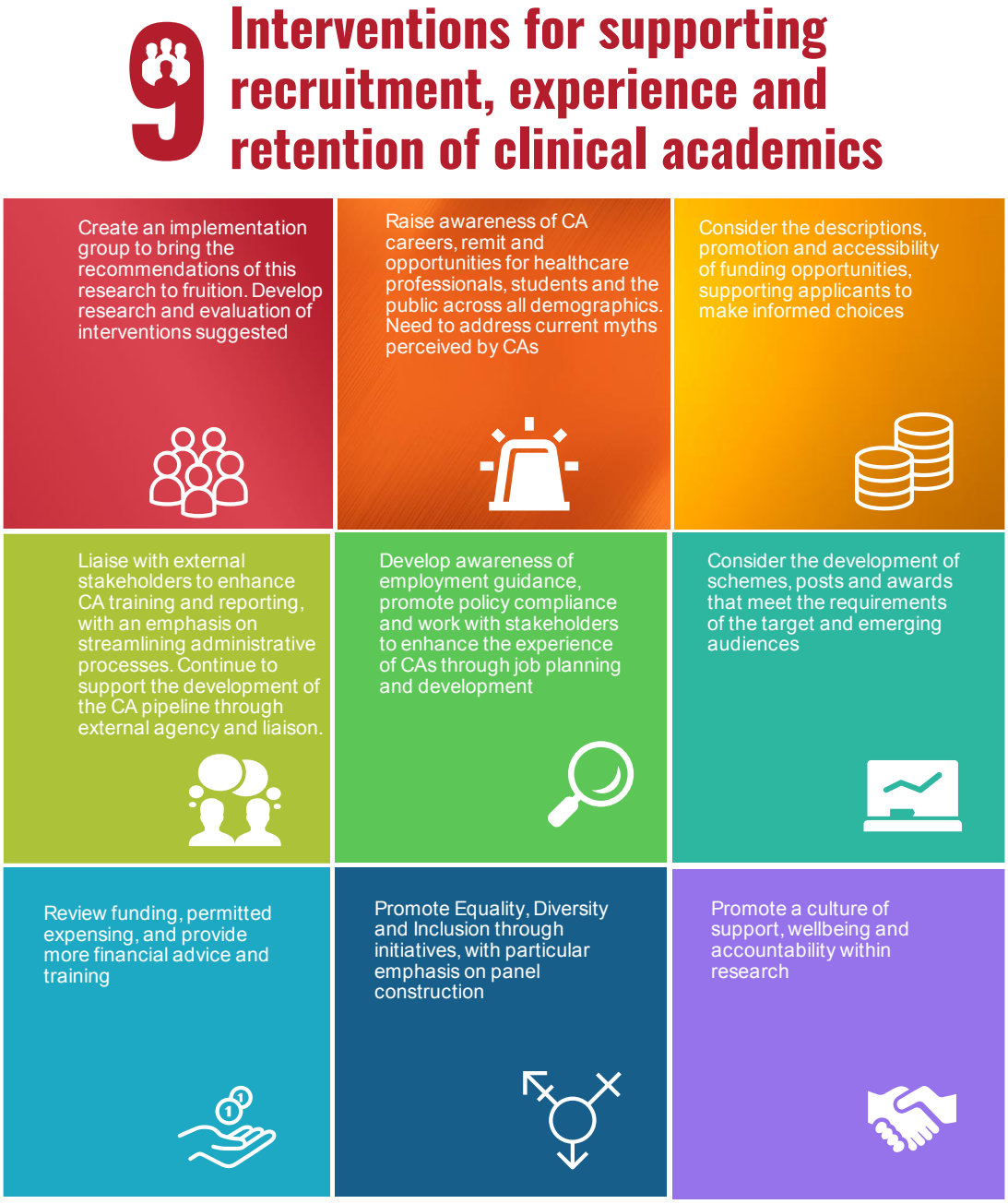
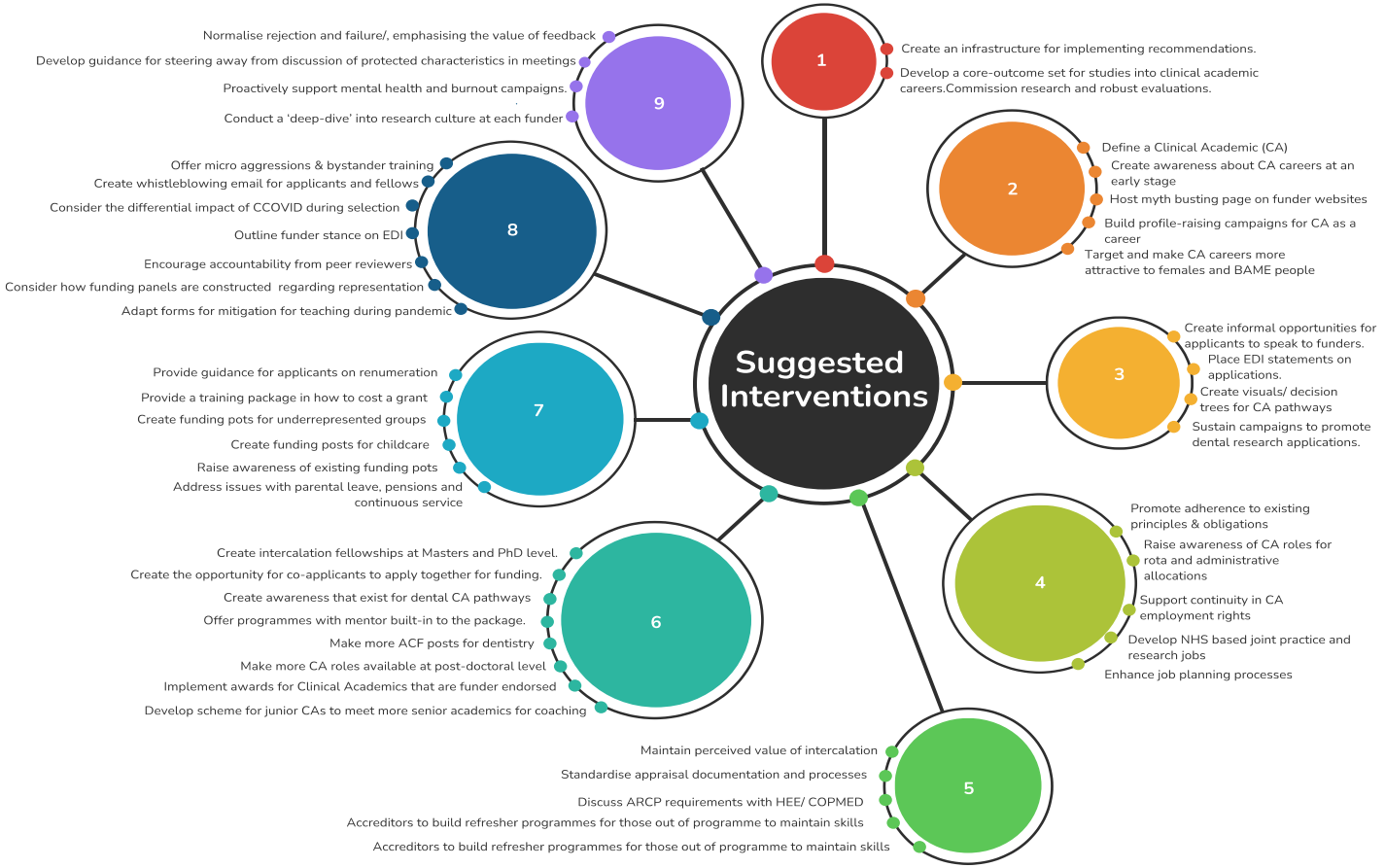


Figure 13: Summary of suggested interventions



1. **Create an implementation group to bring the recommendations of this research to fruition. Develop research and evaluation of interventions suggested.**		
Suggested interventions	Create an infrastructure for implementing recommendations.	Develop a core-outcome set for studies into clinical academic careers. Commission research and robust evaluations.
Context / rationale from data	This research has identified interventions that will require a steering group to take ownership of review and implementation.	Lack of evidence for interventions tried by funders. Participants reported a lack of awareness of interventions designed to help them, or if they were aware, they did not appreciate the rationale.
Responsible party & stakeholders	Funder	
Suggested output	Construction of an implementation group that includes major funders and associated stakeholders. Consideration of strategic aims.	Advertise interventions to show applicants the efforts being made. Transparent reporting of interventions that have and haven't worked - academic dissemination via conferences and papers. Advertise on website and marketing materials. Prioritise RCTs, with clearly defined populations, interventions and outcomes. Ensure consultancy (e.g. with educationalists and methodologists) for optimising evaluation and research, including CA involvement (PPIE-like). Ensure interventions follow the 'top-down' model so that the burden of work doesn't fall to those at the bottom.
Intended audience	Applicants Stakeholders Academic institutions Public Clinical workplaces	
Professional group/ specialty (dentists/medics)	All	
Suggested evaluation/ performance metrics	Group instigated Completion of most pertinent interventions	Publications & reports on evidence of efficacy Overt advertising of interventions including more explicit rationale Research and evaluation tenders advertised
Priority of implementation	High	High
Complexity of implementation	Low	Medium

2. **Raise awareness of CA careers, remit and opportunities for healthcare professionals, students and the public across all demographics. Need to address current myths perceived by CAs.**					
Suggested interventions	Define a Clinical Academic: -qualifications -training pathway -remit -explain dual aspect of role -feature example profiles across range of demographics and backgrounds -triple nature of work (Clinical, Teaching and Research)	Create awareness about clinical academic careers at an early stage (in medical or dental school).	Host myth busting page on funder websites (*See myth busting table provided for content to be included). Ask academic institutions to link to the myth busting pages.	Build profile-raising campaigns for CA as a career (public facing) into existing campaigns and streams of work, such as EDI weeks.	Target and make clinical academia more attractive to people from BAME backgrounds and females Create case studies of CAs covering a range of demographics for use within funder marketing.
Context / rationale from data	There is a lack of understanding with regards to the identity of Clinical Academics. CAs themselves exhibit imposter syndrome or do not identify with the role. Colleagues do not appreciate the dual aspect of the role. Two-way educational process between Trusts and & Academic institution.	CAs felt that pathways and options in CA are not adequately promoted to students at an early stage and so they are mostly clueless about CA and go into academia at a later stage in their career. Intercalation a key theme in early exposure.	Applicants don't seek funding opportunities due to perpetuating myths. Examples: can't apply if pregnant, can't transfer between funders.	Doctors and dentists reported a lack of understanding about what a CA is. Even those who were already CAs were not always aware of their role and identity within the clinical academic world. Peers and colleagues of CAs need to have a better understanding about the role of a CA, hopefully facilitating more support for CAs in practice and making CAs feel appreciated.	CAs from minority backgrounds expressed that they were not initially aware of the ACF, pathway into CA or the roles that exist. Females reported a culture of CA pathways being made more accessible for males and people with no caring responsibilities. Female CAs who work part time or took career breaks report that employment metrics judge them adversely against their full-time academic counterparts. CAs want to see case studies on people who share the same ethnicity as there is a perceived absence of role models. Women want examples of people who have realistic career goals.

				The public should also be aware of the role of a CA in practice and the hard work that they do.	
Responsible party & stakeholders	Funder Academic institutions Clinical workplaces	Funder Academic institutions	Funder	Funder	Funder Academic Institutions Clinical workplaces
Suggested output	Video defining a Clinical Academic. FAQs about Clinical Academics. Beginner's guide to CA. Resources can be shared with HEIs and hosted on funder websites.	CAs go to medical or dental schools to give career talks and create awareness of options available in CA. Signposting the status of faculty in teaching sessions - CAs to provide their background to students. CAs encouraged to give seminars, engage students in their research formally and informally. Provide a CA 'work-experience' where students or foundation clinicians could follow a CA through all aspects of their job over a week (clinic, research, teaching etc). Offer funding to HEIs/ Trusts to set-up CA taster programmes. Scholarships for intercalated programmes (esp. in Dentistry). Fly on the wall videos following CAs (embedded on website and associated social media campaign). How-to-get your foot in the door toolkit.	FAQs and myth busting page on funder webpages. Cross-funder potential. Short videos on social media to debunk common myths.	Clinical academics week culminating in 'International Clinical Academics Day'. NHS poster campaign - public engagement to normalise/ showcase CAs. Specific COVID campaign - these are the people behind the masks in the lab (Clinical genetics etc). Clinical academics showcased at events during various awareness weeks (e.g. Pride week, mental health, specific disease awareness days). Call to arms - Royal Colleges, professional research journals for awareness campaigns, featured profiles and articles.	Short video/ podcasts demonstrating that women, carers and BAME applicants are wanted in CA regardless of protected characteristics. Profiles of CAs in eminent publications such as BDJ and BMJ. Transparency regarding how funders view employment metrics for LTFT CAs. Short videos or profiles on CAs across broad range of protected characteristics. Focus on BAME and women with children. Jointly hosted website. Advertise and normalise less than full-time working. Obvious signposting of metrics for part time vs full time.

				Media campaign showcasing Clinical Academics on popular platforms (e.g. Guilty Feminist podcast, news nights, popular TV documentaries) -specifically include items aimed at younger audiences e.g. Operation Ouch (KS2+).	
Intended audience	Clinical Academics Students Colleagues working with CAs Management (Trusts) Government	Medical or Dental Students Foundation clinicians (doctors and dentists)	Public - all service users Medical or Dental Students Foundation clinicians (doctors and dentists)	Public - all service users Medical or Dental Students Foundation clinicians (doctors and dentists)	BAME and female Medical or Dental Students Prospective BAME and Female Applicants Part-time and career break applicants
Professional group/ specialty (dentists/medics)	All				
Suggested evaluation/ performance metrics	Track access metrics and performance metrics	Track views Programme evaluation (inc. interviews with CAs, students & foundation clinicians)	Track views Feedback surveys Populations polls Market research with general public Collect metrics of those applying	Track views Feedback surveys Populations polls Market research with general public Collect metrics of those applying	Satisfaction surveys Track views Monitor enrolment numbers Monitor attrition levels of individuals with protected characteristics
Priority of implementation	High	High	High	High	High

Complexity of implementation	Low	Low	Medium	Low	Low
3. Consider the descriptions, promotion and accessibility of funding opportunities, supporting applicants to make informed choices					
Suggested interventions	Create clearer visuals and guidance on career paths that can be used by funders, clinical and academic institutions. Create decision trees to guide participants to the correct level of application (trees may be specific to the funder in question).	Place Equality Diversity and Inclusion statements on applications.	Sustain campaigns to promote dental research applications. Liaise with academic institutions to promote more overt research culture in dentistry and encourage applications.	Consider your accessibility and approachability. Create more informal opportunities for prospective applicants to speak to funders – being able to have a two-way conversation with funders would help applicants enormously rather than email. Maximise the virtual outreach.	
Context / rationale from data	Pathways are confusing for applicants therefore clear visual maps of all stages are required to help participants, especially those who doubt their credentials or who are intimidated by calling funders.	These statements are needed to help overcome myths and assumptions that applicants face.	Dental clinical academics felt there is currently a poor research culture that exists within some dental specialities and that current opportunities were not advertised directly to their professional groups.	Prospective applicants are intimidated by funders and want to meet informally.	
Responsible party & stakeholders	Funder Academic institutions	Funder	Funder Academic institutions	Funder Academic institutions	
Suggested output	Joint website with clear pathway visuals. Algorithm that helps navigate appropriate level to apply. Generate a decision tree support tool that uses a tree-like model of decisions to	Explicit statements of support for EDI practice needs to be demonstrated to CAs at the beginning of the application form. These statements should also be evident on the funder website. Further EDI reviews and Example intervention ideas can be found at: https://www.ukri.org/research/global-challenges-research-fund/gender-	Larger banners and Social media adverts to encourage dental applicants. Funders to do seminars and workshops specific to dental research to encourage	Booths at major conferences - taking advantage of virtual ways of working to increase presence and approachability. Seminars at institutions with a Q&A. Senior members to be present on social media - put a face to a name. Social media Q&A opportunities or webinars.	

	recommend an experience appropriate funding pathway (e.g. result is apply for Advanced Fellowship). Trainees can proofread or sense check websites and application forms.	equality-and-international-development-research-and-innovation/	applications and collaboration. Encourage dental programmes to include more research components.	Consider interactivity with advertised phonelines and chatbots.
Intended audience	Applicants	Clinical Academics	Dental Clinical Academics	Prospective applicants
Professional group/ specialty (dentists/medics)	All	All	Dentists	All
Suggested evaluation/ performance metrics	Survey Track views	Survey Track views	Monitor dental research applications and collaborations	Satisfaction survey
Priority of implementation	High	High	High	Medium
Complexity of implementation	Low	Low	Low	Low
4. Develop awareness of employment guidance, promote policy compliance and work with stakeholders to enhance the experience of CAs through job planning and development				
Suggested interventions	Promotion of and adherence to the existing principles and obligations documents (issued by NIHR). Support CAs moving between contracts to retain employee rights so there is continuity.	Ensure academic institutions and employers are supportive of clinical work that CAs must also do. Enhance job planning process and ensure that this has effective and supportive clinical and academic involvement.	Raise awareness and train healthcare staff, management, administrative staff and rota clerks on the role and remit of a clinical academic to enable them to create more diligent rota allocation for CAs.	Develop NHS based joint practice and research jobs attached to the clinical pay scale.
Context / rationale from data	Lack of awareness of principles previously published. Some academic institutions	CAs are often given other academic responsibilities within the university that are not part of their CA role. Many feel it is difficult to say no, despite already struggling to manage workload.	Many CAs reported struggling to do their academic work alongside long clinical hours and	NHS employers sometimes struggle to understand the needs of research active clinicians and CAs in the face of demands on clinical services.

	do not adhere to the guidance. Used as a workaround for people to maintain NHS privileges (e.g. sick leave entitlement etc) -but may not be viewed in the same way as substantively held HEI posts. CAs reported that whenever they moved, their contracts for training restart as new employees - this means they lose maternity, sickness and other employment rights.	Some CAs have received negativity about not being present in the academic environment full time, despite practicing clinical work on those days. CAs are not always able to attend academic events due to their clinical rotas. Many CAs report that their clinical responsibilities impinge on their academic time.	night shifts. Many also highlighted that their protected time was often filled with clinical duties. CAs sometimes faced negativity from other staff when they were absent from the clinical workplace. ACFs reported that supervisors are not always clear that ACFs role clinically is a supernumerary one i.e. they are not there to provide service.	
Responsible party & stakeholders	Funders Academic institutions (who are direct employers) Clinical workplace	Academic Institution Funder Clinical workplaces BMA/BDA	Clinical Workplace Academic Institutions	NHS Trusts
Suggested output	Guidance/ policy that states that clinicians taking clinical academic posts with HEIs as lead employers should have their previous continuous service with NHS employers recognised for contractual purposes (e.g. for maternity, sick leave entitlements etc).	Raise awareness of academic institutions about the dual responsibilities of CAs through information leaflets and posters. Develop an expectation of job role document for both CAs and employers. Work with Funders, Trusts, Deaneries, BMA/BDA to promote the importance of effective job planning for CAs.	Those who are doing the rota need to understand the needs of CAs and this needs to be reflected in their rota. Information sheets Online platforms Regular training/induction	Joint job planning with the Director (or equivalent) for R&D for research active clinicians and CAs. NHS Trusts should liaise with partner HEIs over the creation of doctoral fellowships or clinical academic roles that address business critical issues for the Trust that would have strong business cases.

	Build awareness in order to change perceptions of Honorary positions as not viewed in the same way as substantive HEI employments for clinical academics. Work with unions, HEIs and trusts to help protect CAs employment rights. Support CAs to keep NHS continuous service. Mindful some find it helpful to have two main employers or flexibility on substantive employer.			
Intended audience	Clinical Academics	Clinical Academics Non-clinical academics Clinical Leads Academic Leads TPDs or rota co-ordinators	Clinical Academics Non-clinical academics Administrative staff	Research active and research aspiring clinicians
Professional group/ specialty (dentists/medics)	All			
Suggested evaluation/ performance metrics	Feedback surveys Assessment of access to rights Track Views	Feedback – opinion polls Audits Focus groups	Satisfaction surveys Rate of attrition	The proportion of research active clinicians in a Trust (I.e. those with two or programmed activities for research activity)
Priority of implementation	High	High	Medium	High
Complexity of implementation	High	High	Medium	High

5. Liaise with external stakeholders to enhance CA training and reporting, with an emphasis on streamlining administrative processes. Continue to support the development of the CA pipeline through external agency and liaison.					
Suggested interventions	Work with Foundation Programme & Deaneries to maintain perceived value and weighting for Intercalation & the associated qualifications and/or papers. Stress must be placed on the long-term benefits of intercalation.	Discussion regarding Annual Review of Competency Progression (ARCP) requirements with HEE / COPMED and equivalents.	Standardise appraisal documentation/ streamline processes. NHS and academic institutions should try to harmonise these systems for CAs.	Accreditors to build refresher courses for those out of programme to maintain skills sets, particularly craft specialties.	Create more opportunities and posts for early career researchers to get involved in research on an informal basis through the advertising of voluntary positions.
Context / rationale from data	Intercalation encourages future CA endeavour. Ensuring intercalation remains valued is paramount to CA pipeline.	CAs felt that they should follow an alternative curriculum to standard trainees with respect to audits and Quality Improvement (QIPS) projects, particularly as their outputs are not recognised by the process. There should be better understanding of CA outputs and their value by ARCP panels. HEE need to have more understanding and be sympathetic to the challenges facing CAs during this time. Participants perceive value in face-to-face ARCPs and request clinical and academic representation.	Many CAs have reported duplication of effort and time, particularly noting doing similar appraisal / documentation for clinical and academic work.	CAs feel that when they are out of a training programme or reduce their clinical work significantly, they are deskilling.	Early career researchers at non-research-intensive institutions did not have projects in order to apply for funding. They requested the opportunity to apply for personal development funding with assigned mentors who could help them get a foot on the CA ladder.
Responsible party & stakeholders	CATF / funders	HEE/ COPMED and equivalents Funder	Academic institution Clinical Workplace	HEE Funder	Academic institution Funder
Suggested output	Letter to Foundation Programme and Deaneries from CATF and funders to champion intercalation and its weighting in rankings.	Provide a contact person to speak to about requirements from HEE. Provide signposting of relevant information on HEE website.	Less work for both employers and CAs.	Create pots of funding to develop refresher courses for specific specialties or funding to access existing courses with	Creation of personal development projects for grassroots researchers. Similar ‘starter’ scheme for students to gain experience.

	Work with UKFPO to build awareness of the value of intercalation.	Consider face-to-face, in depth ARCPs with clinical and academic representation.		some KiT days attached.		
Intended audience	Stakeholders in Foundation Doctors & Dentists	Applicants	Clinical Academics	Clinical Academics	Clinical Academics Aspiring Clinical Academics	
Professional group/ specialty (dentists/medics)	All					
Suggested evaluation/ performance metrics	Monitor decision making by Deanery & FP in weightings for intercalation on foundation applications	Survey Track views Satisfaction and comparison of any ARCP adjustments	Satisfaction surveys	Look at performance data for individuals	Satisfaction surveys Track views Uptake of programme Success in moving on to other CA posts	
Priority of implementation	Low	High	High	Medium	Medium	
Complexity of implementation	Low	High	Medium	Medium	High	
6. Consider the development of schemes, posts and awards that meet the requirements of the target and emerging audiences						
Suggested interventions	Implement awards for Clinical Academics that are funder endorsed.	Make more CA roles available at post-doctoral level.	Create awareness that pathways exist for dental CAs and stamp out myths associated. Specifically create more ACF training posts in dentistry and make them more flexible in terms of research.	Offer programmes with mentor built-in to the package.	Create the opportunity for co-applicants to apply together for funding (e.g. part time and job share).	Create intercalation fellowships at Masters and PhD level. Develop a scheme for junior CAs to meet more senior academics (not just clinical)- sharing advice and career coaching sessions.

Context / rationale from data	CAs felt that CAs were not the recipients of prestigious awards in the same way that clinical excellence is awarded.	CAs reported a 'bottleneck' once they have completed a PhD. There is a lack of posts in certain specialties. Many cannot move location to obtain a post, which is often necessary if they are to continue.	Dental CAs commented how they felt almost second best to their medical counterparts in terms of advancement in research and opportunities that they we offered, but both funder and institution. Some noted that despite their academic institution being a hub for great research, this did not include dental research. Many felt that they were not given the same funding and research development in their CA posts as their counterparts. Dental CAs reported that there were not as many funding streams within dentistry. There is a need for capacity building and creation of more ACF posts to be able to share fellowship related resources.	Trainees lack the confidence and/or network to approach potential mentors. Support for programmes offering a mentor for the duration for advice on career progression, networking etc. Mentors with shared or relatable experiences. Choice in mentor - compatibility a priority (interpersonal and expertise).	CAs reported that the standard practise of only allowing one applicant was discriminatory and did not mirror employment norms such as part-time working or job share situations.	CAs report the motivation for pursing started during intercalation. Inspiring students earlier on would help maintain the supply for the CA pipeline. CAs and aspiring need to understand how others have navigated their careers, particularly those who have faced rejection/ setbacks.

Responsible party & stakeholders	Funder Academic Institution	Funder Clinical workplace Academic Institution	Funder Academic Institutions	Funder Academic Institution	Funder Academic institutions	Funder Academic Institutions
Suggested output	Develop a scheme that rewards CAs for research excellence and also serves to promote the field. Akin to Clinical Academic Oscars - measure of esteem. Awards could centre on themes, have an annual rollout or include special profile-raising awards.	Create more CA posts for those post PhD. Look specifically at the location of where these posts need to be across the UK.	Funders to discuss possibility of offering two separate pathways for doctors and dentists following further collection of data. Funders need to work with academic institutions to support them in raising the profile of their dental research. Create more awareness of ACF posts within dentistry.	Creation of a new scheme with mentor built-in or a system where applicants can flag that they would like to be allocated a mentor. Production of a mentor data-base, kept up to date. Trainees given choice of mentors to suit preferences. Trainees encouraged to select mentors out with their home institution. More strategic advertising of existing offerings, particularly across funders. Development of comprehensive mentor training (e.g., online SCORM package). *We advise robust evaluation across such a package as evidence is mixed (see SR results earlier).	Permit more than one applicant to be submitted on a grant (co-authoring applications). Revise scheme regulations to reflect changes.	Offer one-year fellowships for intercalation for health professions students - focus on MRes opportunities. Develop a scheme for junior CAs to meet more senior academics (not just clinical)- sharing advice and career coaching sessions Offer intercalation PhD opportunities for health professions students. Host seminars where junior or prospective CAs can meet with local senior CAs.

Intended audience	Clinical Academics	Clinical Academics Academic institutions	Clinical Academics Academic institutions	Applicants Established CAs looking to mentor	Clinical Academics	Aspiring Clinical Academics
Professional group/ specialty (dentists/medics)	All	All	Dentists	All	All	All
Suggested evaluation/ performance metrics	Feedback survey Evaluation of impact	Monitor number of CA posts Monitor attrition rates of CAs following PhD level	Satisfaction surveys Monitor uptake of dental CA posts	Metrics on applications and uptake of mentors Programme evaluation (inc. interviews with mentors and mentees) Analysis of outcome measures for those with a mentor Feedback from mentors and mentees	Monitor submissions Feedback surveys	Monitor uptake of fellowships for intercalation by Masters and PhD level students Satisfaction surveys Track views
Priority of implementation	Medium	High	High	High	High	Medium
Complexity of implementation	Low	High	High/Medium	Medium	Medium	Low
7. Review funding, permitted expensing, and provide more financial advice and training						
Suggested interventions	Raise awareness of existing funding pots to bridge gaps between finishing a funded level and applying for the next. Specific guidance on the use of awards for development, skills and enhancement is required.	Funding pots for childcare for CAs to attend conferences and funder events or to enable a family member attend to provide childcare. Include better promotion of existing available funding.	Provide a training package on how to cost a grant. Increase funding opportunities and reduce complexity of funding applications.	Create personal funding pots for underrepresented groups (targeting women, caregivers and BAME CAs).	Provide financial advice for applicants and publish guidance on regulations with regards to employment and remuneration. Address current issues with contracts including parental leave, pensions and continuous service with stakeholders.	
Context / rationale from data	CAs concerned that progress halts while	CAs who were young parents felt that it is increasingly becoming difficult to get funding to attend conferences and	Trainees felt assumptions were made that they	These groups of individuals find it more difficult to	CAs reported variable practice across trusts and institutions with regards to remuneration and	

	looking for new funding. Request for bridge funding.	thought that they would be encouraged to attend conferences if they had a pot of money to support their childcare expenses.	would automatically know how to cost a grant. Clinical academics reported that the funding applications were few and when available they process was often not straightforward and sometimes complex.	obtain money due to particular difficulties these groups of CAs face.	employment packages (leave, maternity, sick pay etc). Individuals have faced financial problems due to contracts/ pensions when taking a leave of absence. There is variability across Trusts. Funder letter to advocate for fair treatment of CAs and adherence to employment principles.
Responsible party & stakeholders	Funder	Funder Academic Institutions	Funder Academic Institutions	Funder	Funder Clinical Trusts Academic institutions Department of Health
Suggested output	More explicit explanations of development funding schemes and options for those looking for bridge funding.	Creation of funding pots for childcare. Build claims into travel expenses to make this easier to facilitate. Consider funding additional childcare sessions to enable CA to attend virtual conferences.	Creation of a 'how to' page including costing a grant. Examples of costings for different types of projects. FAQs and pitfalls. Talking head video to make information more accessible. Consider webinars. How-to videos explaining funding applications. FAQ page on funder website.	Produce a funding stream that is only open to a certain group (this needs to adaptive and depends on collection of real time data illustrating inequality). e.g., BAME women, LGBTQIA+ individuals. Promotion and launch of funding themes could be tied to events such as centenaries, anniversaries, awareness weeks etc.	Funders to have a specific page on their website or a financial advice service that CAs could contact to discuss contract issues that may prevent them from working as a CA e.g. sick pay, continuous service, new employee rights. Funders to have visible advisor who can answer questions. HEIs to recognise continuous service including sick leave. Work to standardise UK wide. Scotland - CAs not entitled to NHS pension scheme if employed by HEIs.
Intended audience	Clinical Academics	Clinical Academics	Applicants Clinical Academics	Clinical Academics	Clinical Academics

Professional group/ specialty (dentists/medics)	All				
Suggested evaluation/ performance metrics	Feedback survey Evaluation of impact	Conference attendance metrics by demographic Survey	Assess costings presented in applications for improvements Tracking and feedback on resource (survey, usefulness markers) Feedback and satisfaction survey on ease of completing and understanding of applications Monitor funding application submissions	Monitor submissions Feedback surveys	Metrics of access on links Satisfaction surveys Track views
Priority of implementation	High	High	Medium	Medium	Medium
Complexity of implementation	High	High	Low	Medium	Medium
8. Promote Equality, Diversity and Inclusion through initiatives, with particular emphasis on panel construction					
Suggested interventions	Consider how funding panels are constructed, and peer reviewers selected. Peer reviewers and panels members to be named on documentation to promote fairness and accountability. Consider possibility of open peer review.	Create and promote gender balanced panels. Issue statement to HEIs and Clinical stakeholders to outline funder stance on EDI.	Advise HEIs to consider the differential impact of COVID when selecting applicants for competitive and submission limited schemes. Add specific section to application forms that permits mitigation for teaching	Whistleblowing email address for applicants with accompanying statement to HEIs regarding zero tolerance.	Training on micro-aggressions, prescriptive, descriptive and unconscious biases for all panel members and mandate the training for all successful applicants. Provide a training module on active bystander training for those that witness discriminatory behaviours to promote a culture of 'stand up, speak out'.

			responsibility during pandemic.		
Context / rationale from data	All levels of CA felt that they were at the mercy of peer reviewers & that the process was not transparent. Suggestions of how funders are enforcing values based on demographic and social backgrounds.	CAs felt that panels were predominantly made up of white middle-class male. Some female CAs reported being advised not to pursue CA if they want children and were not permitted to apply for fellowships/funding due to having children.	Established and aspiring CAs reported that the pandemic had resulted in a call to arms to teach and transform delivery of provision to online – this has resulted in a reduction in research productivity.	Applicants described actionable discriminatory comments or being refused permission to apply for CA funding based on protected characteristics. Applicants feel powerless in raising these issues.	CAs report a culture of discrimination, bias, micro-aggressions and overt racism and sexism. People not directly impacted often felt helpless and wanted techniques to call out discrimination when they witnessed it.
Responsible party & stakeholders	Funder	Funder Academic Institutions	Funder Academic Institutions	Funder	Funder Academic Institutions
Suggested output	Creating a culture of accountability by recommending the naming of peer reviewers. Feed into sector-wide discussions on best practice. Build awareness of defensible and transparent decision making as a fundamental principle in the sector. Reasons for decisions and who they are made by should be transparent.	Ensure panels are representative and diverse. Publish panel metrics annually to be held accountable. Statement with an emphasis on reproductive decision making. Outline expectations and plans to monitor. Advertise zero tolerance approach to discriminatory attitudes and behaviours to potential applicants.	New section on application forms that allow applicants to provide context for their work during the pandemic, specifically with regards to teaching commitments and family responsibilities. HEIs to be reminded of the need to be fair when selecting candidates to put forward for competitive awards that need institutional backing – similar section for	Email address or anonymous form on website that applicants can use to whistle blow on unethical behaviours at their institution. Needs to be clear the purpose & statement of action in a letter to HEIs.	Develop training on microaggression, discriminatory behaviours and biases and how to identify and avoid them. Create disciplinary panel for perpetrators of microaggressions and discriminatory behaviours. Whistle-blower system for reporting witness or first-hand cases of discriminatory behaviour or microaggressions.

	Evaluation and research on the reliability (e.g. inter-rater agreement) between peer reviewers and panel members should be conducted and published and reasons for disagreement, or particular weight being put on certain reviews, explored.		COVID impact could be added to appraisal documentation.		
Intended audience	Clinical Academics	Clinical Academics Academic institution Clinical employers	Aspiring CAs Applicants	Applicants Academic Institutions	Clinical Academics Funders HEI Government
Professional group/ specialty (dentists/medics)	All				
Suggested evaluation/ performance metrics	Satisfaction survey at the end of a selection process Add panel construction to routinely collected data in order to gather reliability information Satisfaction surveys Track views	Review the construction of panels regularly to ensure representation and diversity Review metrics Feedback surveys	Review performance of scheme applicants – comparative review pre-COVID Feedback survey	Monitor frequency and audit content of emails	Monitor access Feedback surveys Review and monitor data for patterns (hopefully decline in incidents)
Priority of implementation	High	High	High	Medium	High
Complexity of implementation	Low	Low	Medium	Medium	Low
9. Promote a culture of support, wellbeing and accountability within research					

Suggested interventions	Proactively support mental health and burnout campaigns.	Normalise rejection and failure as part of normal career experiences to help create a positive narrative around the feasibility of clinical academia as a career. Emphasis should be placed on the importance of this feedback process and that it is essential to develop strong research ideas.	Issue guidance for career meetings to assist CAs in keeping meetings on track and to steer away from inappropriate topics or personal topics.	Conduct a 'deep-dive' into research culture at each funder. Encourage, or even fund, academic institutions to conduct similar deep-dives.
Context / rationale from data	Burnout and anxiety were high amongst CAs and they felt stigmatised by this. Mental health and burnout were particularly prevalent during and post-pandemic. CAs feel they cannot go off sick because their research careers and progress will suffer.	CAs feel clinical academia is very competitive and often full of rejection. This leads to many returning to full time clinical posts or not applying in the first place.	Female CAs reported meetings about potential applications being unsupportive and often discussion being based upon their reproductive decision making rather than research. They felt disempowered to challenge this. CAs were questioned on resilience if they expressed concerns over workload.	Participants described negative cultures around research including bullying, discrimination, perceived hierarchies in research topics etc.
Responsible party & stakeholders	Funder	Funder Academic Institutions	Funder	Funder Academic institutions
Suggested output	Create campaigns, videos and endorse charity activities related to mental health, anxiety and burnout to destigmatize it, promote help seeking behaviours. Specific reference to research careers should be made.	Recruit clinical academics to share their narratives using various media specifically discussing their failures and previous rejections to create a culture where rejection is viewed as normal and part of the development process. Offer more support throughout each stage.	Sample proformas and discussion points to guide careers meetings. Issue steer on not discussing protected characteristics or reproductive decision making.	'Deep-dives' are meetings with a focus on a topic such as culture, gender, curricula etc. Evidence, evaluations, policy documentation is scrutinized and objectives set/ assessed. The purpose is to interrogate evidence and improve performance. A deep-dive on culture might look at how is positive culture promoted (collaboration, inclusivity etc), what do policies say, what objectives need setting, how are current performance metrics looking.

	Form a partnership with a mental health charity to normalize mental illness. Dedicated mental health and support section on websites with links to resources or case studies. Consider 'therapeutic mentoring'.		Encourage audit trails of meetings. Form for best practice, encouraging co-creation of meeting notes that are signed.	Can be done at any institution - funders can mandate HEIs to conduct culture deep-dives and provide templates.
Intended audience	Clinical Academics	Clinical Academics	Clinical Academics	Clinical Academics
Professional group/ specialty (dentists/medics)	All			
Suggested evaluation/ performance metrics	Feedback and satisfaction surveys Metrics of access on links to mental health information	Track access metrics Feedback surveys	Surveys	Completed process Review outcomes following the 'deep-dive' Develop SMART objectives to assess performance against subsequently
Priority of implementation	High	Medium	Medium	Medium
Complexity of implementation	Low	Low	Low	Low

Discussion

In order to address our original research questions, we have summarised the findings from all elements of the projects below and selected the key contributions from each section. We then go on to discuss the theoretical and broader context to which our findings relate, culminating with study implications. For a collated synthesis summary of the project please see the following chapter.

Summary of systematic review findings

This systematic review found a substantial volume of research relating to CA careers. However, the reporting of details about populations of interest and interventions evaluated (where relevant) in the included studies was often incomplete. Studies were frequently small, uncontrolled cohorts of participants from single centres, often reporting surveys of groups of clinicians or CAs. The majority of the data were collected in the USA.

Most quantitative evidence was available for multi-faceted academic training programmes which tended to focus on academic productivity such as publications and grant funding success. There was evidence to suggest that such programmes may increase recruitment to academia among clinicians and increase short-term publication productivity, but findings were less clear for retention or for other outcomes such as participation in research and research funding.

Studies of career/faculty development programmes showed mixed results, with some studies suggesting a benefit and others showing no benefit for recruitment and retention to academia and for secondary outcomes such as career satisfaction and skills and knowledge development.

There was very limited quantitative evidence about creating a research-tailored curriculum or using support network programmes as interventions to improve CA careers. Intervention programmes that focused specifically on mentorship demonstrated significant benefits related to number of publications, grant awards achieved and funding success, and promotion of academic staff, whilst outcomes related to journal impact factor were non-significant but still in favour of intervention groups. Outcomes related to recruitment or research participation were not evaluated by these specific programmes.

Few quantitative studies reported the effects of interventions for women or minority groups specifically. Results for recruitment diversity training suggested a positive impact on recruitment in one study (Sheridan et al., 2010). One evaluation showed that implementation of a career/faculty development programme was linked to improved recruitment of women (Valantine et al., 2014), but there was no evidence suggesting benefits for other outcomes. There was no evidence of an effect on recruitment of minority groups and one study showed no impact of a career/faculty development programme on retention in academia for these groups (Daley et al., 2006).

Within the findings of the qualitative synthesis, various career/faculty development and academic training programmes successfully improved research/scholarship knowledge and skills of participants, or their understanding of academic careers. A recurrent theme across studies was the development of greater confidence in conducting research-related activities, as well as in relation to other aspects of their career, by participants who received these interventions. For example, greater self-confidence to pursue new opportunities and apply for promotion. Increased confidence was gained in multiple ways such as through networking and other forms of interaction with peers, colleagues and mentors. Some

career/faculty development programmes and mentoring relationships resulted in feelings of empowerment, improved positivity and higher motivation levels.

Consistently, intervention participants benefited from interaction with peers and colleagues, in terms of support, encouragement and assistance, and the opportunity to develop professional collaborations. Peer interaction helped reduce feelings of isolation and fostered a sense of community and belonging. Participants in some studies benefited from 'peer mentoring', but how this differed from other forms of peer interaction was often unclear. Opportunities to interact with other women was important to female participants. One study indicated that sponsorship was of benefit to women in terms of career advancement. Some individuals gained encouragement from hearing how senior CAs had successfully overcome career challenges and achieved success.

Not every study participant experienced beneficial mentoring relationships with senior colleagues, but overall experiences were positive and valued. Mentors provided a broad range of types of assistance to mentees. Having a team or portfolio of mentors was seen as important for successful outcomes as it allowed mentees to draw on a range of opinions and gain advice from individuals who had different areas of expertise. Individuals' mentoring needs are likely to develop and change over time as their career progresses.

Several studies suggested that having at least one mentor of the same gender was important to women. Evidence from a single study was mixed on whether it was important for mentor and mentee to both be from an ethnic group underrepresented in medicine. Some mentees believed they gained more objective and impartial advice from having mentors who work at a different institution to the mentee. There were differing opinions expressed across several studies on the issue of training for mentors.

Some studies identified the personal attributes and actions of individuals as factors that could influence the success of interventions.

Findings indicated that issues related to time and competing demands were key factors in shaping individuals' experiences and intervention impact. There was consistent evidence of the importance and benefit of having protected time, particularly in terms of mitigating the negative impact of competing clinical demands on research-related activity. However, there was also some evidence to suggest that maintaining protected time for research could be difficult in practice. One intervention targeted at junior faculty physician–scientists who had substantial caregiving responsibilities, appeared to have multiple positive effects including facilitating greater research productivity, an improved work-life balance and retention in academia at critical time points.

Across studies, having committed, supportive, and experienced programme staff was seen as a key facilitator of programme success. Respondents identified several other factors at a programme, organisational or national level which acted as a facilitator or barrier to success. One study identified several factors that potentially undermined the principles and impact of the Athena SWAN programme in the UK.

Summary of qualitative interview findings

The conceptualisation of a CA was seen as someone who held a clinical role alongside teaching and/or research activities. At first, participants struggled to clearly articulate their understandings but then gave examples of the types of activities in which a CA would be involved. The involvement in research spans from those who were leading teams as principal investigators to those who were undertaking small localised studies and data analysis.

Participants offered a great deal of insight into their drive and motivation towards becoming or continuing as a CA. At its core, many participants focused on the ability to be able to make a difference to patient care, on a broader scale than individual care, and to enhance patient outcomes. Personal motivation, enthusiasm and curiosity for research topics helped individuals to see the bigger picture and encouraged them to want to enhance their knowledge and understanding. Other individual-level reasons included the flexibility afforded by the CA role and the ability to be more autonomous in day-to-day work activities. The opportunistic nature of being in the right place at the right time was also influential, alongside that of 'luck', in beginning their CA careers. Role models were also discussed, particularly in relation to those with protected characteristics and the positive impact of seeing those from minority groups in successful leadership roles.

Several enablers were identified across organisational, team and individual levels that supported CA careers. The supportive culture of both clinical and academic workplaces was pivotal in providing various types of support such as workload, financial, pastoral and peer. Organisational support for individual circumstance issues, including maternity and paternity, mental health and job rotation, was especially effective in providing reassurance. The importance of supervisors, role models and mentorship was highlighted, helping to increase confidence and open up opportunities. Advice and guidance experienced through processes such as applications for funding, and career moves, helped to build relationships and forge stronger networks in academic fields. An appreciative understanding of the CA demands helped to provide protected time and allow CAs to undertake their required roles. Once participants obtained their first CA post, it was felt that the role formed a strong backbone in their careers and helped to drive future success. In addition, funder support and flexibility of funding arrangements helped to alleviate pressures. Flexibility of the CA role and increased autonomy were also highly influential when CAs were deciding whether to maintain their CA role. Despite the much-needed support, it is important to recognise the role of individual resilience; it takes a great deal of hard work and persistence to pursue a career in Clinical Academia.

CAs underlined many barriers that negatively impacted on their experiences within clinical academia. These factors included an unsupportive and competitive culture; a paucity of mentors and realistic role models to provide career guidance; microaggressions; lack of support for certain research specialties considered to be unpopular or low priority; financial loss; paucity of jobs within their geographical region; difficulty in juggling both clinical and academic careers; and issues with the process and pipeline. Among dental CAs, a significant barrier that was discussed was the lack of dental research and availability of CA posts. Major barriers experienced by female CAs included difficulties around reproductive decision making, maternity and childcare and reverse discrimination. These barriers created anxiety for female academics and contributed to their struggle to continue their CA careers over time. Within both academic and clinical environments there were significant misunderstandings from peers and colleagues about their roles and the subsequent lack of affordance given to CAs to fulfil their roles. Many CAs also reported the role senior figures or trailblazers played in discouraging them from realising their full potential by creating blocks and ensuring that they endured similar struggles they had experienced.

Reasons for the attrition of CAs from the workforce was highlighted across motivators, enablers and barriers. Across all three, we discovered that the importance of guidance and support was pivotal and could either make or break the CA role. The availability of funding and CA roles was highlighted within attrition, as participants often desired to stay on the pathway but were unable to access their desired job within an appropriate timeframe. Here, the geography and availability of posts within certain regions was discussed as certain specialties and hospitals were seen to provide more support and opportunities. Similarly, the lack of clarity surrounding CA pathways made it very challenging for participants to know how to take the next step. Many participants spoke vehemently about the difficulties of being

both ‘clinicians’ and ‘academics’ and in effect having to ride both horses. The demands on both these roles are high and juggling prioritisation across from one to the other at various stages provided many barriers. The clinical roles often needed to take precedence due to service demands and patient care; however, the academic demands of outputs were not lessened in the meantime and provided a further source of anxiety.

The constructions of participants’ personal and professional identities as CAs were explored. The narratives provided valuable insight and explanation as to how these different identities could have an impact on CA progression. Imposter syndrome was frequently exhibited in the form of participants not feeling like a ‘real academic/clinician’ in the sense that they were split and didn’t fully adhere to either identity. Participants cited multiple reasons such as not producing the same level of outputs, feeling like they belonged or being able to provide support to others in such a role. Within the analysis we identified that females struggled with imposter syndrome in the CA role as they particularly grappled with the fear of not being a proper academic. Intersectionality factors such as gender, race and ethnicity were identified which impacted on the ways in which individuals attributed factors to their success and/or failures. Whilst one individual may have experienced positive affirmations in relation to their characteristics, others may have been challenged in different environments, subject to local institutional and organisational biases. Furthermore, academic work is often associated with quantifiable indicators and without reaching such expectations it may provide a false economy in the perception of what a CA actually is. The competing nature of not being one or the other was highlighted, along with the lack of understanding from colleagues about the CA role.

CAs suggested several individual level interventions they believed could possibly reduce attrition within clinical academia. These interventions included providing them with more support, mentorship and guidance that will allow smooth navigation through the Clinical Academic pathway. CAs placed a high value on having realistic role models and mentors to guide them carefully through key points in their CA career and with identifying and applying for funding for their research. Additionally, CAs identified the need for flexible and longer contracts as well as bridge funding for times when they had to take career breaks. As these critical points during career breaks were when they were most likely to fall off the pathway, they suggested that support was paramount. CAs also believed that longer and more flexible contracts could help with building a more solid career portfolio and continuity on a project not merely based on completing research projects and getting a few publications. Finally, CAs suggested that there was a need for the clinical organisations they worked in to understand their roles and allow for protected research time.

Summary of audio-diary findings

In utilising the method of audio-diaries, we were able to obtain a unique and important cross-sectional insight into CA experiences, in particular it provided us with the national CA landscape during the COVID-19 outbreak. Numerous perceived barriers to continuing academic activity within family, academic and clinical contexts were identified. What became clear was that pre-existing barriers to academic activity had become magnified during the COVID-19 outbreak. Although such barriers are not insurmountable, they have been experienced as stressful for the participants, and could potentially adversely impact on their future career. Many issues were discussed, including; restrictions on face-to-face contact, international travel, uncertainties over clinical and academic training and funding extensions, home working, and, in many cases, redeployment to frontline clinical duties. These were all cited as negative influences on the usual activities of the informants. Both dental and medical academic trainees, who were redeployed to full-time clinical work, described how they felt disadvantaged in comparison to trainees who had been able to maintain their research activities. Perhaps our most prominent finding was the evidence that women in clinical academia were being disproportionately impacted by the pandemic. Female

participants described barriers that directly related to their gender, as well as to their maternal status. This intersectionality of participants and associated discrimination experienced was a repeating pattern.

Summary of text mining analysis

The exploration of free text using text mining and natural language processing highlighted some interesting word associations and themes, supported by the qualitative analysis. These included references to medical student teaching, the challenges, hard work and precarious nature of a CA career, as well as importance of mentoring and role models, especially for female academics. Similar to many cases where factor analysis is used with questionnaire data, many of the topics identified by the LDA analysis were not easily interpretable as such. However, around one fifth of them did indicate themes, which again were picked up in the qualitative analysis.

Discussion of results within the wider literature

The systematic review used machine learning methodology to enable very high-volume title and abstract screening. Our methodological findings represent a clear contribution to the field of systematic reviews, which are transferrable to other areas of research where large numbers of records are identified at the title and abstract screening stage. This process, and the measures of its success, have been evaluated and will be submitted for publication, as an additional methodological output of this project.

One of the key issues with this literature is the lack of high quality, well-reported research. Our quality assessment demonstrated that both quantitative and qualitative studies lacked methodological rigour or were hindered by incomplete reporting. In most cohort studies there was minimal participant matching between intervention and control groups, and participant comparisons were often unadjusted. Group selection was equally problematic as many studies included pre-selected or highly motivated populations that may unintentionally bias positive results in favour of the intervention programmes. Comprehensive analysis plans and complete outcome data were not provided in most qualitative studies, and there was little reflexivity demonstrated. Future research needs to provide more clarity and detail in relation to the methods of intervention evaluations so that clearer applications can be made.

Across all studies, the reporting of interventions was ambiguous, especially for interventions that involved multiple components. Studies evaluating the same intervention programmes were variably reported by different authors and even by some research teams who had conducted more than one study with the same intervention in the same population. It is clear that ambiguity in methodological reporting within such interventions needs to be addressed in future evaluations. This lack of explicit detail makes it difficult to identify which interventions are most effective, or which components of interventions are most useful. Furthermore, the statistical analyses performed were often poorly reported or imprecise, resulting in uncertain conclusions, often in favour of the interventions described. This may have resulted in a bias towards positive effects of interventions in this review, particularly considering the risk of publication bias within studies reporting small non-controlled cohorts. The paucity of the descriptions impacts on the replicability of these interventions, even if efficacy had been demonstrated.

Similar to the lack of clarity in describing interventions, the population of studies was often ill-defined and the description of characteristics of the CAs taking part was challenging to interpret. This was especially difficult when comparing different clinical and academic terms across different countries/settings. Some studies did not formally express the academic roles of selected participants, which contributed to challenges in study selection. This high degree of variability in population definitions adds further to the paucity of high-quality research in

this area. Consequently, there is uncertainty in identifying which types of development programmes should be best delivered for which group of CAs. Further work is needed to establish clear population definitions so that future research can be more tailored to specific populations.

It is important to note that the literature in this area is dominated by research from the USA. In total, 26 of the studies included in the quantitative synthesis and 11 of the studies included in the qualitative synthesis were conducted there. Findings from only three UK studies were included in the qualitative synthesis and there were no UK studies meeting the quantitative synthesis inclusion criteria. This represents a notable research gap and weakness in the evidence base. Crucially, it is unclear to what extent findings from studies conducted in the health and higher education sectors of the USA can be generalised to the UK context. Multiple contextual factors, including inter-country differences in organisational structures and practices, potentially limit the generalisability of findings.

In addition to these geographical restrictions, the evidence base is also limited in its evaluation of interventions to support CA dentists. There were no studies included within the synthesis of this review that described interventions for this population. This is a clear area for further attention in terms of funding and research. The data from the primary qualitative study also support this suggestion.

Within the qualitative synthesis, some studies suggested that the personal attributes of individuals could be a key influence on programme success. However, there was a lack of focus across studies on the factors that potentially foster or diminish attributes such as commitment, enthusiasm and motivation, and the extent to which these characteristics are influenced by the experiences of individuals whilst participating in programmes. The complex interplay of gender, ethnicity, parenthood and other protected characteristics on these experiences and attributes has not been explored within the included literature.

A range of factors at an organisational or national level had a negative impact on the success of interventions described in studies included within this review. For example, some respondents reported that a lack of clinical coverage and competing clinical demands eroded protected research time. In other studies, including research from the UK, service pressures and competing demands on supervisors and mentors were identified as barriers to success. Furthermore, a realist evaluation of the Athena SWAN initiative found evidence of meetings being held at times that potentially made attendance difficult for individuals with caregiving responsibilities (Caffrey et al., 2016). Such evidence indicates that the potential success of any future initiatives seeking to improve the recruitment, retention, and progression of CAs will be limited unless action is taken to ensure that organisational policies, practices, and culture, as well as relevant national policies, facilitate and support intervention aims.

Findings from the qualitative synthesis showed that mentoring of junior CAs by senior colleagues was often beneficial and valued. Notably, the data suggested that the nature and composition of the mentoring team may play a key role in determining the success of the relationship. This includes factors such as the number and gender of mentors and whether they are based at a different institution to the mentee. There was little evidence identified from included studies relating to the ethnicity of mentors. Care should be taken, however, not to interpret these findings to indicate that funders should require specific mentorship teams, or overly formalised mentorship. Participants in some studies suggested that this would not be beneficial, and thus, there is a risk of unintended consequences of these interventions if not evaluated carefully. Some mentees would have liked more guidance and training in relation to mentoring. Such training could be used to highlight the need for mentees to be proactive in developing and maintaining contact with mentors, which was an issue raised by respondents in some studies including the evaluation of the UK Academy of Medical Sciences mentoring scheme (Iversen et al. 2014).

Notably, the quantitative data were less supportive of mentoring interventions, with some findings in favour, but others finding no evidence of benefit. Most evidence suggested mentorship improved funding received and supported programmes incorporating both peer and senior mentorship. The fact that the studies included within this synthesis did not demonstrate quantitative data that was strongly supportive of mentorship interventions may reflect the design of individual programmes, or the studies evaluating them, but this lack of evidence of benefit should be carefully considered when planning future interventions, particularly the need for detailed evaluations.

It was sometimes difficult to assess findings related to the interactions and relationships of intervention participants owing to a lack of clarity in papers around terminology and specifically, whether various terms used by authors were describing differing forms of interaction or ones that were essentially the same in nature. This was particularly the case for terms used to describe forms of peer interaction and in relation to junior/senior mentoring and coaching. A clear distinction was made in the study by Lin et al. (2019) between mentoring and sponsorship, with the latter appearing to play an important role in advancing the careers of some women.

Jones et al. (2019) acknowledged that gender intersects with other social identities such as ethnicity, and they revealed an intention to conduct additional analyses of evaluation data in the future to examine programme effects through an intersectionality lens. In addition, participants in the study by Lin et al. (2019) highlighted the need for a women-focused national organisation to improve inclusion of women from more diverse ethnic backgrounds. However, overall, there was a notable absence of a focus on intersectionality within the qualitative literature examined. Very few quantitative studies focused on interventions tailored towards women and/or URM faculty, and no single quantitative study evaluated an intervention from an intersectional standpoint. Adopting an intersectionality perspective when developing and evaluating future strategies and interventions, offers the potential to address more effectively issues related to inequality within clinical academia. Most benefit would be gained through focusing not only on gender, ethnicity and parenthood, but other key social identities as well, such as sexuality and disability.

Motivation and myths – the impact of culture and mentorship

The data in this study demonstrate that the CA career pathway, although a difficult path to navigate, is a rewarding one. The major motivation to pursue clinical academia stemmed from early exposure to research, typically through intercalation[2] during professional degree programmes. CAs described positive role-modelling and mentoring that inspired them to pursue research following graduation from their professional degrees. This transition from the novice during their intercalated research experiences to expert once established as a CA demonstrates the phenomenon of Legitimate Peripheral Participation (LPP). LPP describes how newcomers or novices become experienced members within a community of practice, until they eventually assume the role of expert in a community of practice as described by Lave and Wegner (Lave and Wegner, 1991). Lave and Wegner describe learning as a social process that the success of which is dependent upon the interplay of social dynamics and the power. When a novice navigates the moves from the periphery of their community to its centre they become more ingrained within the culture. This will continue until they eventually

[2] Intercalation is an additional year of study on top of a primary degree programme that provides an opportunity to explore a new area in greater depth, gain new knowledge and develop new skills. Some intercalate at Bachelor's while others pursue a Masters in another subject. A medical student may, for example, choose to intercalate and undertake a MSc in Genetics or the History of Art.

assume the role of an expert - which in the case of a CA, might be the Principal Investigator on a project.

As training occurs in situ, one could conclude that learning is in fact both contextual and embedded within the social and physical environment of the community in question (Finn et al., 2010). Lave and Wegner propose that situated learning "is not an education form, much less a pedagogical strategy or a teaching technique" (Lave and Wegner, 1991). Their argument centres upon the notion that learning is a function of the community in which it occurs – a result of the activity, culture and content. It appears that the situated learning process is unintentional, rather than deliberate. This matters in the context of clinical academia as, in order to attract and retain clinicians, the unintentional lessons need to be both considered and positive. Much of the data in our study paid testimony to a negative culture within clinical academia, including discrimination based upon protected characteristics. This was exhibited through oral story telling cultures, role-modelling and the tacit messaging of the hidden curriculum[3], as previously depicted in Figure 6. That being said, not all discrimination was so covert or surreptitious, participants described blatant and overt discriminatory behaviours from microaggressions to illegal and actionable incidents. However, given that much of the discrimination pertained to covert bias, it is difficult to challenge and thus the negative culture perpetuates. Many go as far as to claim that such patterns of discrimination no longer exist. Thus, marginalised groups are further deterred from progressing within clinical academia. Furthermore, there is often a gendered distribution of knowledge of gender bias and the associated literature - those impacted know the data, those unaffected don't know the studies exist. A supportive culture in both the academic and clinical workplace is essential to ensure CAs continue to progress in their career. However, as our findings would highlight, this support is lacking in many areas.

Mentorship

The value of mentorship is considerable. Henry-Noel and colleagues (2019) postulated that mentoring skills are perceived as highly prized attributes for clinical academics. Mentors influence and help shape the careers of the next generation of healthcare providers (Henry-Noel et al., 2019). The authors hypothesised that mentors can "enhance implicit knowledge about the hidden curriculum of professionalism, ethics, values, and the art of medicine not learned from texts." In the context of the CAs within the qualitative study, mentors have proven their worth for participants in many ways, offering advice and opportunities for development. What remains is the need to buffer the negative tacit messaging aspiring CAs are receiving in order to promote the profession. Quantitative evidence on the success of mentoring is limited, existing research has included limited objective outcomes due to the typical use of single-centre study populations, the lack of reported controls and avoidance of quantitative techniques (Geraci and Thigpen, 2017); this has been demonstrated within the systematic review in this study. That being said, the participant discourse in this current national study vocalised fervent advocacy for the value of mentorship, again citing it as a motivator for their decisions to pursue clinical academia. There are many advocates for the role of mentors in dental education (Schrubbe, 2004), especially in the COVID-era (Nelson et al., 2020). Successful mentors have been reported to take trainees under their wings offering a plethora of positive contributions including guidance, encouragement, and advice which then is practiced by the mentee – in doing so the mentor creates a legacy (Schrubbe, 2004). As with all interventions, mentoring has its pitfalls – most notably these have been in relation to personal factors, social factors, or institutional and structural barriers (Sambunjak et al., 2006, Sambunjak et al., 2010).

[3] The hidden curriculum refers to the tacit, implied, unwritten, unofficial, and often unintended behaviours, lessons, values, and perspectives that people learn during their training.

Gender discrimination

A major source of discrimination was that of the maternal wall[4]. Despite the economic and social position of women having improved significantly in recent decades, for example there are more women in leadership roles in executive professions, some gendered expectations and roles have proved remarkably intractable (Crosby et al., 2004). A growing literature documents that mothers encounter specific forms of bias that stems from stereotypical linking of motherhood with a lack of competence and commitment (Williams, 2005, Williams, 2015, Williams and Dempsey, 2018, Williams and Segal, 2003). Research has found that in comparison with women with identical curriculum-vitae but without children, mothers were approximately 80% less likely to be hired, 100% less likely to be promoted, offered significantly lower salaries for the same position and were held to higher performance and punctuality standards (Crosby et al., 2004). The impact of such factors should not be underestimated, especially when many progression decisions in clinical practice are subjective and thus prone to bias. It is worth noting that these biases against mothers not only stem from assumptions about what mothers do, but also from assumptions about how a mother should behave. Pertinent examples include statements encountered by working mothers such as that they should be at home with their children or that they wouldn't want a promotion or extra responsibility as they had just had a baby. This is something that resonates with the participants in this research, as well as within the wider literature. In this study, female CAs reported their reproductive decision-making being questioned within formal supervision, informal conversations and even during selection panels – thus further reinforcing messaging that clinical academia is not for women, and that it is certainly not for mothers.

Caffrey et al. (2016) report that societal-level norms often undermine the impact of programmes aimed at improving gender inequality in academic medicine (Caffrey et al., 2016). The assumption that women should provide a disproportionate level of care-giving in the home is a prime example. In line with suggestions in the broader literature, (Breen and Cooke, 2005, Evans, 2004, Brooks, 1998, Ellis, 2018) our findings suggest that the gendered division of labour will persist until greater gender equality for the majority of women in society is achieved, domestic work is viewed as masculine, and an evolution in men's gender ideology is witnessed. Attempts to introduce policies that champion family-friendly working may in fact result in reinforcing the perception of domestic duties and childcare as women's work. Rather, it has been suggested that there should be a shift to encourage men to share parental leave and to challenge traditional working patterns. Women in this study described how they were met with assumptions that when not 'at their desks' they were attending to the needs of their children. This is something that Williams described as attribution bias (Williams, 2005, Williams, 2015, Williams and Dempsey, 2018). Raising awareness of such biases will go some way to help alleviate them; however, institutions need to take a firm stance and have meaningful consequences for those who exhibit such behaviours. These biases also fall into patterns known as benevolent stereotyping where women are policed into traditional roles and therefore protected, for example they are not given the opportunity to attend a conference as employers feel that it is kind to protect the woman's family time and not ask her to travel. Women are often held back by such benevolent stereotyping, as with the example given, they miss the opportunity to

[4] The maternal wall is a form of gender bias faced by women and in particular working mothers, one experienced by the participants in this study. Prejudices that stem from the maternal wall include presumptions about a woman's work ethic or priorities and, less opportunity for promotion or development. The maternal wall can be encountered by females when they become pregnant, when they request maternity leave or even upon becoming engaged to be married. Instances have been reported where females have encountered the maternal wall simply for being a female of child-bearing age, often despite clearly signposting to their employer that they do not wish to have children.

network or present research at conferences. The take-home message from the broader literature is that leaders should be educating supervisors and mentors to engage in dialogue with their CA trainee regarding their needs and avoid making assumptions. This is, of course, true for men, as well as women, institutions need to support fathers and avoid inflicting assumptions of gender roles on their families too.

These experiences are akin to the findings of Crosby et al. (2004) who reported that within the workplace many women, and in particular mothers, are systematically disadvantaged by unexamined assumptions. Despite progress in gender equality, the persistent notion that a good mother is always readily available for her children serves as an important vehicle for traditionalist gender roles (Kobrynowicz and Biernat, 1997). Williams reports that mothers are frequently caught between tension of the perceived image of a perfect or ideal employee and that of an 'ideal mother' (Williams, 2005). Women are more frequently relegated to teaching and adjunct positions when compared to men who received their PhDs at the same time. The men are more likely to be granted positions with tenure (Mason and Goulden, 2002). Studies in surgical specialties have highlighted that the same is true, men are more likely to get leadership positions, progress through the ranks quicker and receive higher salaries than women (Zhuge et al., 2011). A recent study within academic psychiatry also found that whilst the representation of women has improved, men still dominate at professorial level (Dhingra et al., 2020). What was extremely interesting about this study was that the gender inequality was worse outside of London. This supports our findings about the role of geography and increased negative impact on gender inequality due to the diminishing availability of posts across the UK (Dhingra et al., 2020). Furthermore, recent studies support the data in the interviews that suggested men do not perceive inequality in the same way as women (García-González et al., 2019). As per the implementation plan in this report, García-González and colleagues advocate for the introduction of measures that raised awareness of gender bias and discrimination within the research environment – stipulating that such training should be available for men and women.

Bhopal (2020) notes that importance of intersectionality when considering discourses of inequality. Such inequity is inexplicable if only considering a single factor. The lens of intersectionality allows an analysis of the interplay between competing factors that result in different outcomes of power and hierarchy (Bhopal, 2020). In the audio-diary study, theme three (personal characteristics) in particular, also identified that a number of women in our sample described feeling and being compelled to assume, to a greater degree than before the pandemic, gender stereotypical roles in the home. Specifically, when faced with competing responsibilities, women appeared to feel under more pressure than their male partners to allocate more time to childcare and household tasks. Indeed, there was a recurrent motif of narratives relating to the '1950s housewife' stereotype within the family context (Chung, 2020). In line with suggestions in the broader literature (Breen and Cooke, 2005, Evans, 2004, Brooks, 1998, Ellis, 2018) and as mentioned previously, our findings suggest that the gendered division of labour will persist until greater gender equality for the majority of women in society is achieved, domestic work is viewed as masculine, and an evolution in men's gender ideology is witnessed. It remains a misconception that equality has been achieved within clinical practice.

The potential gender biases in both medicine and academia have previously been well documented (Gonyea et al., 2014, Crosby et al., 2004, Williams, 2004, Brown et al., 2020b, Halley et al., 2018). The present findings suggest that the pandemic and resultant lockdown has, in many cases, exacerbated the discrimination already faced by many women in clinical medical and dental academia. Also, in this regard, our findings are consistent with media accounts that the lockdown has, more generally, placed a disproportionate burden on women, who frequently report taking on the bulk of the childcare, domestic duties and home-based education of school-aged children (Ferguson, 2020, Alon et al., 2020). It has been postulated that many women are currently doing 'second and third shifts' with

regard to housework and welfare after their first shift of childcare or paid work (Chung, 2020). Prior to the COVID-19 pandemic, there was evidence that parental working determined that, on average, women spent two to three times as much time on care and housework compared to men (Wishart et al., 2019). Our findings suggest that these effects have become more pronounced as a result of the pandemic and are impacting on female CAs. Our data may go some way towards explaining reported declines in publications by female academics (Viglione, 2020).

The data in the present primary study and systematic review, and in the wider literature evidences the existence of many sources of inequity of experience for CAs. There are, however, many 'facts' that can be disputed – namely the myths that perpetuate within clinical academia. Numerous myths have been detailed previously (see Figure 5), but their reach is vast and their impact is immeasurable. It is certain that these myths and the associated hidden curriculum of clinical academia, has resulted in the attrition of CAs from the pathway. In addition, as with gender bias, such myths inhibit many aptly qualified clinicians from contemplating an academic career. The surreptitious way in which the hidden curriculum operates, and the unique experience every individual has of it, makes it challenging to correct for. There is not one intervention that can prevent sources of the hidden curriculum, such as oral story-telling and anecdote, from inflicting negative perspectives of academic life upon clinicians.

Privilege

This study identified reverse discrimination[5] to be a major barrier perceived by men. There was a proportion of men who, as McIntosh described, showed 'unwillingness to grant that they are over-privileged, even though they may grant that women are disadvantaged' (McIntosh, 1988). Conversely, many were aware of their privilege and exploited it as a means by which to advocate for women – for example, by taking an active bystander role and challenging colleagues who ignored women during research meetings or conference discussions. It is plausible that, as McIntosh postulates 'whites are carefully taught not to recognize white privilege, as males are taught not to recognise male privilege' (McIntosh, 2007). Regardless, the data supports our thesis that there is not parity of experience or esteem for women in clinical academia. Further, literature supports the notion that privilege confers power (McIntosh, 2007) – this resonates with the data of this study. Initiatives such as Athena SWAN were regarded by some men as being a particular source of reverse discrimination. In addition, 'gender equality programmes in universities and colleges may operate as a form of 'moderate feminism', producing contradictions through simultaneously providing a site of resistance and complicity for feminists' (Tzanakou and Pearce, 2019). There are well publicised calls to arms for clinicians to 'name their privilege' in order to deconstruct the structures and cultures that propagate both racism and gender discrimination within the healthcare professions (Romano, 2018).

Ethnicity

Ethnicity was an important factor within the study, particularly considering the intersectional identities of participants. This was not just due to the underrepresentation of ethnic minorities in western clinical academia, but especially relevant given the disproportionate number of BAME doctors and other health workers left seriously ill, or even dying after contracting COVID-19 in the course of their work (Rimmer, 2020). Anxiety was notably higher within the BAME participants' diary entries, especially in light of the increased evidence relating COVID-19 and ethnicity (Rimmer, 2020, Trivedy et al., 2020, Lacobucci, 2020, Mutambudzi et al., 2020). Within our data, ethnicity was not deemed to be a cause of active

[5] Reverse discrimination is discrimination against members of a dominant or majority group, in favour of members of a minority or historically disadvantaged group.

discrimination in the same way that gender was. Within existing literature, racism is considered an ingrained feature of both the societal and clinical landscapes. Thus, it is perceived as both ordinary and natural to people within that culture (Rollock and Gillborn, 2011, Bhopal, 2001, Gillborn, 2015). Similarly, critical race theory argues that racial inequality is upheld through invoking structures and assumptions that may appear 'normal and unremarkable' (Rollock and Gillborn, 2011); this is also likely to be true of the institutional racism within healthcare contexts (King, 1996).

Sexuality

A significant issue for participants who identified as LGBTQIA+[6] was the discrimination faced within clinical and academic environments. Many described a culture supporting and advocating heteronormativity[7], notably at odds with the inclusive, diverse and equal ethos projected by the NHS and Higher Education Institutions. Their experiences further marginalised them as members of an already marginalised community. More disturbing were the homophobic remarks and behaviours that demanded LGTBTQIA+ CAs to change their behaviour or mannerism and to stop pursing their preferred clinical specialism due to incorrect associations and harmful stereotyping. Gay cis-gender males reported harrowing attitudes that prevented them from pursing specialities such as paediatrics.

The requests demanded of LGTBQIA+ participants made them feel compelled to moderate their behaviours – this aligns with Impression Management Theory. Impression management described any attempts to influence the perceptions of other people. This can be with regards to a person, or an object or event. This occurs through regulating and controlling information in social interaction via conscious or subconscious processes. As Goffman stated, "To display or not to display; to tell or not to tell…to lie or not to lie."(Goffman, 1976) This phenomenon within gay male doctors has been evident for decades (MacDonald, 2001, Rose, 1994), yet worryingly CAs still feel compelled to act a part rather than be themselves.

The British Medical Association (BMA) and The Association of LGBT Doctors & Dentists (GLADD) co-authored a report concluding that, "too many of our LGB colleagues are still experiencing the NHS as a less than supportive place to work and be themselves." (BMA and GLADD, 2016) In their survey of 803 LGBTQIA+ doctors and medical students, in excess of 70 per cent of their respondants stated that they had experience of at least one sort of harassment or abuse within the recent two year period, and that this was related to their sexual orientation (BMA and GLADD, 2016). The report delineated the range of experiences including being inhibited to talk openly about their personal lives to direct homophobic slurs. Our data further supports this report, but also adds data demonstrating perverse attitudes and associations between those of LGBTQIA+ orientation and predatory behaviours towards minors. Our data offer further evidence to support the BMA/GLADD report which reported that a number of trainees had 'changed specialty because of a negative experience for LGB doctors in their previous specialty.'

Discrimination and microaggressions – the cumulative impact

There is a propensity for gender, sexual and racial discrimination to be dismissed as a micro-aggression. Microaggressions are defined as, "subtle verbal or nonverbal everyday behaviours that arise from unconscious bias, covert prejudice, or hostility" (Periyakoil et al., 2020). The label of micro-aggression trivialises the incident. Regardless of the perceived

[6] LGBTQIA+ is an accepted abbreviation for Lesbian, Gay, Bisexual, Pansexual, Transgender, Genderqueer, Queer, Intersexed, Agender, Asexual, and Ally community.
[7] Heteronormative denotes to a world view that promotes heterosexuality as the normal or preferred sexual orientation.

severity of the discriminatory behaviour, there is an impact on the recipient. Periykoil and colleagues described the invisibility of privilege is often to those who hold such privileges, whereas bias and discrimination are obvious and explicit to those who are the recipient (Periyakoil et al., 2020). Awareness of common microaggressions, perhaps in the form of training or signposting campaigns, has been suggested a mechanism by to mitigate disparities (Periyakoil et al., 2020).

A popular metaphor sees microaggressions being depicted as mosquito bites. The victim witnesses their attackers turning from friendly humans to giant mosquitos. Video depictions of this metaphor demonstrate how swarms of mosquitos and repeated victimisation could affect individuals - demonstrating how a commonly held misconception that a victim is over-reacting to seemingly trivial incidents, when it is just the last of a swarm of 'bites'. This metaphor explains the relentless nature of microaggressions to those who suffer, it becomes easier to recognise how implicit biases that lead to microaggressions could lead to mosquitos engaging in unrecognised acts of discrimination.

The implications for this study centre on the cumulative impact of the micro-aggressions received by marginalised groups. Repeated comments, that may appear innocuous, serve to constantly reinforce stereotyping and negative cultures. This disenfranchises individuals to the point that they leave clinical academia. Microaggressions have a significant detrimental impact on the mental health of the recipients - thus training to build awareness and to empower bystanders is critical. It is the duty of funders and employers alike to change the culture of clinical academia. This culture is documented to include workplace bullying (Thompson et al., 2020). This oral culture further fuels the tacit messaging experienced by CAs that this is not the career for them. Moving from a victim-blaming culture and victim-targeted interventions, such as resilience training, to develop concrete actions and discourses that target allies and bystanders (known as micro-intervention (Sue et al., 2019)), will go some way to bring about positive change.

Interventions & the impact of Athena SWAN

Participants conceived a plethora of interventions to improve attraction to, access to, and experience within clinical academia. Interventions ranged from the low hanging fruit to larger-scale, multi-stakeholder and aspirational interventions. When considering the development of interventions to support marginalised groups, the findings of Laver et al., need consideration - interventions within clinical academia that require those they are designed to support, to bear the brunt of the workload, so called ‘bottom-up’ approaches are less likely to succeed (Laver et al., 2018). Their review advocates the use of ‘top-down’ approaches, led by change in practice at a management level.

The findings from the systematic review coupled with the qualitative findings demonstrate the critical importance of facilitative research environments and how the infrastructure available to individuals may make or break CA careers. Within the literature, the intersecting mechanisms of protected time, professional identities and relationships have been found to be key to understanding the ways in which certain interventions aimed to enhance research activities may lead to successful outcomes or not (Ajjawi et al., 2018). Within our study, the professional identities of the participants allowed insights into how they brokered the barriers and enablers. For instance, we revealed findings around imposter syndrome, identifying as neither a clinician nor academic, and difficulties juggling clinical and academic responsibilities (riding two horses). All of these identities influence the ways in which people may access appropriate support and foster relationships in their domains. So that funders are able to appropriately support and maintain the CA workforce, they need to acknowledge and tackle these factors in order to implement successful interventions designed to enable the transition of professionals and their associated professional identities towards CA careers.

There is a cautionary tale with interventions, as the data in this study has shown, many interventions designed and developed with good intentions have unintended consequences. The unintended consequences described, particularly related to initiatives to help women access clinical academia and were analogous with the Cobra Effect.

The Cobra Effect transpires when an attempt to solve a problem results in the problem being made worse, as a type of unintended consequence. The negative consequences with regard to Athena SWAN broadly related to two domains: (1) burden of work and, (2) the career limitations resulting from the initiative. Participants were positive about initiatives such as Athena SWAN, however, the burden of work repeatedly fell to women. Athena SWAN applications require coordination, case studies, the assimilation and analysis of significant data. Institutions requested women, and in more recent years, people from under-represented ethnicities to lead the accreditation processes, often in the face of cynicism, or even disdain, from male colleagues. With respect to limitations, women reported being unable to move institutions, typically due to family ties and sacrificing their careers for their husbands, in order to assume new roles as they would forfeit being at an institution with an Athena SWAN level high enough to qualify to submit applications for funding.

While programmes developed to provide equity have the potential to be a real force for positive change, paradoxically they can both unintentionally reproduce discriminatory practice and reinforce gender inequity through their enactment. Furthermore, Caffrey and colleagues suggested that programme success is impacted by a range of factors including local factors, such as staff access and institutional practice, to broader influences at a national and societal level (Caffrey et al., 2016). This hypothesis corroborates the data in the present study. While Athena SWAN has reported benefits in terms of culture, the burden of undertaking this work predominantly falls upon women and other marginalised groups (Tzanakou and Pearce, 2019). Such initiatives are frequently designed poorly and thus fail to address complex constructs such as intersectionality and any associated discrimination or biases.

Since the interim findings of this study were reported to funders (in February 2020) and disseminated internationally over the summer of 2020, Athena SWAN requirements have been redacted. Policy makers stated that this was because ‘Athena SWAN has done its work and that gender diversity is now valued and supported throughout academic medicine, so the substantial administrative burden is no longer necessary (NIHR, 2020).’ It has since been argued that this is not the case due to an absence of female theme leads, and the evidence that ‘more powerful and influential centre directors remain overwhelmingly male’ (Stewart-Brown, 2020). It has been acknowledged that where Athena SWAN has been useful is with regards to giving institutions the impetus to reduce structural gender imbalances and consider unconscious bias. However, it does not resolve issues related to the somewhat ruthless culture of clinical academia. Stewart-Brown purports that unless this is superceded collaboration, inequality with respect to gender will persist (Stewart-Brown, 2020).

Whatever the future landscape of clinical academia holds, those implementing change need to be mindful of the dentistry specific issues and perspectives. Without adequate representation from the dental community, specifically including primary care, there is an imminent danger of the creation of a medical fiefdom. There are misconceptions regarding parity of esteem that need to be addressed in order to not further fuel the negative research culture and hierarchy, as perceived by trainees. In addition to profession, gender continues to be reported as impacting upon the amount of occupational prestige received by CAs, despite being reported as early as 1979 (England, 1979).

Implications for policy and funders

It is recommended that research funders commit to establishing large scale national infrastructure to facilitate research into the careers of UK CAs and interventions to support them. This infrastructure should span both the hospital and university environments, in which CAs exist. Research programmes embedded within this infrastructure should consider focusing on primary data collection of high-quality quantitative data designed to capture longitudinal outcomes for cohorts of CAs, which should include both doctors and dentists. The formation of large cohorts of participants will provide populations for high-quality evaluations of interventions in such a way as to be able to robustly answer the key research questions in this field. Importantly, the researchers can be clear that there is no benefit to doing further small cohort studies from single centres in this field. Well-considered, high-quality, research into these questions for this population of researchers is essential.

Interventions evaluated within this infrastructure are most likely to be successful when embedded within comprehensive multi-faceted programmes of training. Interventions focused on developing interactions and relationships between CAs should be robustly evaluated. In addition, consideration should be given to evaluating the support structures around CAs, including administration, personnel and programme leadership. Notably, evaluations of structural and environmental changes should be prioritised over interventions focused on individual CAs.

The data collected within such programmes should be regularly reviewed, analysed and transparently shared with the community through open access publications, including accessible summaries, with close attention to the clarity of reporting of methods, populations and interventions. Consideration should be given to working with CAs throughout the research process, in a manner similar to that of Patient and Public Involvement and Engagement within healthcare research. Results should be presented in a disaggregated form, as a minimum reporting gender and ethnicity differences, so as to better understand the impacts of interventions on these groups, with analyses that clearly consider the intersectionality of factors experienced by CAs.

The findings raise an alarm that a prolonged period of lockdown could reverse general trends towards a more equitable distribution of household labour (Wishart et al., 2019). More concerningly, it may substantially put back efforts to achieve a more gender representative body of CAs, characterised by gross underrepresentation of women (Brown et al., 2020a). For example, a survey of dental CAs in 2018, found that overall female representation in the academic grades in dentistry is increasing and in fact overtaking male representation. Thus, this is beginning to mirror gender representation in dentistry as a whole (Dental Schools Council, 2018). Given our data, it is possible that the COVID-19 pandemic could reverse such trends towards more balanced gender representation in clinical academia. In this regard gender representation is more than a matter of social equality; the male dominance of science in general has served women's health poorly (Burford et al., 2014).

There are a number of steps that could be taken to mitigate the impact of the COVID-19 pandemic on clinical academia as a whole and the risk of reduced long-term clinical research capacity, especially the loss of female academics. Funders and employers could intentionally target support for those with caring responsibilities during lockdown. As the pressing clinical need recedes, prioritising the return of female CAs to their research activities may also offset the bias more generally experienced by female scientists both before and during the pandemic. Whilst virtual networks of collaborators have organically sprung up in places during the lockdown, more of these could be strategically formed to counter the isolation felt by many academics. This support should also extend to academics who are primarily clinical educators, and have historically felt marginalised and undervalued

(Kumar et al., 2011). Indeed, some of the participants in the present study voiced perceptions of a lack of support and appreciation from both their academic and clinical employers, and clinical colleagues. Both existing and trainee CAs reported a perception that neither non-academic clinical and management colleagues, nor non-CAs fully appreciated the competencies and the time demands of their academic roles. This perception has been reinforced by their experiences during the COVID-19 outbreak. Going forward, enhanced collaboration and empathy between university and clinical staff and employers must be targeted to remedy this.

As the UK navigates its immediate and ongoing response to COVID-19, it is important to consider the potential implications for those whose careers are most vulnerable and require additional nurturing. There needs to be increased flexibility in career pathways and expectations, along with a review of funding and support offered. Participants requested flexibility with existing funding to make changes to study protocols and costings to enable them to pursue opportunistic COVID-related research. Leaders in academic institutions and funding bodies must be cognisant of the varying degrees to which CAs will have been able to mitigate for COVID-19 in their assessments of applications for funding and positions and must revise their expectations for dissemination and impact. Causal explanations of the issues faced during COVID-19 will be multi-faceted and sensitive to personal context. Teaching commitments must be valued and accounted for, as well as physical and mental health. It has been shown that CAs create national wealth as well as health (Innovation and Team, 2003). As the UK heads into an inevitable global financial recession, if not depression, likely to also to be characterised by an increase in mental and physical health needs.

More generally, the infrastructure for medical and dental clinical academia is relatively well established, yet our data suggest that better support is required to develop future CA roles and enhance the provision of evidence-based patient care in the post-COVID-19 era. Participants report substantiated concerns over access to funding and positions once the status quo is resumed. ‘Imposter syndrome’, well documented in academia (Bothello and Roulet, 2019, Laux, 2018) and medicine (LaDonna et al., 2018), is also becoming more of a troubling phenomenon during the pandemic as participants’ anxiety and self-doubt increasingly manifests. The feeling of being a fraud could be inhibitory to the future development of CAs as they negotiate life post-pandemic.

As our evidence would suggest, there is a great need for all stakeholders to ensure those with protected characteristics have the necessary support in place and that these CAs are encouraged to both apply for and maintain a CA career. This is not only needed for the sake of the individual, but for the sake of organisations. Diversity is essential in both the academic and clinical environment, diversity within teams being found to increase productivity (Curtis-Lopez et al., 2020).

Concluding remarks

Limitations and strengths of the research

Strengths and limitations of the systematic review

The systematic review was carried out by an experienced team. Literature searches were designed and carried out in collaboration with an experienced information specialist. We used a machine learning algorithm to prioritise and assist the study selection process, allowing us to screen over 34,000 identified records. Adopting a pragmatic and iterative approach to data extraction and synthesis, we focused on intervention studies with a control group to ensure that our results are relevant and informative to anyone seeking to implement and evaluate interventions for CAs in the UK.

Despite our use of innovative methods to handle the large volume of literature, within the time and resources available, it was not possible to investigate all relevant primary studies in depth. We have not reported detailed information on barriers and facilitators of recruitment and retention in clinical academia. The preliminary data we have collected provide a rich resource for future research on this topic.

We thoroughly assessed the quality of the included primary studies, using appropriate tools, methods, and quality assurance processes. Limitations of the quality of the conduct and reporting of these studies hindered our ability to draw conclusions on the effectiveness of interventions and applicability of the evidence to the UK setting.

Strengths and limitations of the qualitative arm

The qualitative arm presents a large-scale, robust, national dataset on this under-studied topic area. Authors have engaged in reflexive practice throughout the analysis and synthesis. The research team included a balanced mixture of CAs, practitioners, researchers, educators and academics across various levels of CA pathways from medicine and dentistry. Additionally, members of the team had research and/or personal experience of inequality in healthcare education. Whilst the authors recognise that there is often a self-selection bias associated with studies of this nature, participants were felt to be balanced in their presentation of barriers and enablers due to the experienced research team conducting interviews and collecting audio-diary data (Collier and Mahoney, 1996). As we had an extremely experienced qualitative research team, we were able to use a range of techniques within our question prompts to help participants reflect on the full breadth of their experience, rather than focus excessively on certain issues.

The selflessness and dedication of the study participants to contribute to the clinical response to the COVID-19 pandemic is evident in the data. Participants were also permitted to submit written diary entries, but this was not deemed to be a limitation and had the added benefit of preventing diary entries from becoming formulaic (Crozier and Cassell, 2016).

For the qualitative arm, the participants ranged across a breadth of specialties, but some demographic groups dominated the sample. It was difficult to recruit participants with certain protected characteristics, but the overall sample was likely to be at least approximately representative of the proportions within clinical academia. Through the screening questionnaire we were able to understand the characteristics of the sample, and aligned to our initial sampling framework, sought representation from various demographic groups and

characteristics. Furthermore, we were unable to recruit an equal number of dentists as medics, the reason being that there were far fewer dental CAs to recruit in the first place.

The ease of completion of the audio diaries was felt to be advantageous since this encouraged engagement and resulted in lower levels of participant attrition. The real-time nature of the data, as captured by audio diaries has facilitated the capturing of experiences related to periods of change and flux. It has also permitted the research team to document the impact of COVID-19 as it unfolded, thus increasing immediacy and accuracy of data capture (Monrouxe, 2009, Crozier and Cassell, 2016). The experience of COVID-19 during the study has unquestionably had an impact on the data we collected for the audio diaries; however, the bulk of the interview data had been collected at the onset of the pandemic. The impact of COVID-19, however, is not seen as detrimental to our study findings. Rather, the pandemic amplified the disadvantage reported by certain underrepresented groups, providing richer insights. For the audio diaries we experienced a range of participation in terms of the number of diary entries per participant, with some participants only producing one-two entries. As we did not undertake a temporal analysis of each individual participant, we chose not to restrict analysis to those who had completed a certain number of entries.

Directions for future research

Collectively the study suggests numerous avenues for further research to enhance the CA experience, tackle underrepresentation across the pathway and better support those on CA pathways, especially in transition periods. More research is needed on certain under-researched groups (dentists and other non-medical disciplines) including teaching orientated academics. Within the study there was a tendency to focus on academics who were primarily involved within research-academic activity. The contribution of teaching activities was largely silent and how this interacted with the CA role. As identified in ‘what is a clinical academic’, the activities usually span multiple domains and herein lies more difficulties in being able to support individuals. To better understand the barriers, enablers and motivators, further work is needed to explore experiences from those across sub-specialities within medicine and dentistry. Each discipline often has its own contextual factors within which an individual must tackle in their career trajectories.

There is a need to robustly evaluate existing interventions that have been developed to support access to clinical academia. The CA pathway has been exposed as unclear by many individuals, and the experiences shared highlighted the diverse ways individuals had taken to become successful CAs. For example, while some had received NIHR funding along the pathway, others had been self-funded. For these reasons, we suggest that an intervention study should robustly evaluate how the various interventions (e.g. funding streams, protected time, mentoring) interact and how these impact on individuals in different ways. Realist evaluation could support examination of contextual factors surrounding individuals (e.g. location, speciality, protected characteristics, training, work status, etc.) and exploration of various mechanisms leading to intended and unintended consequences. In the systematic review we identified one paper (Caffrey et al. 2016) which had used such an approach, however this was limited to one specific intervention.

Future research should also continue to garner quantitative evidence to extrapolate the ‘footprint’ of COVID-19 (e.g. based on bibliometrics by group). The activities of CA and research groups can be tracked to capture quantitative data such as the number of papers submitted for publication, number of papers published, number of grant applications, number of successful grant applications, etc. Whilst these will not provide the full picture of research activity, it will go some way to detailing activity hotspots and areas of inactivity which may

require further support. Across various regions, NIHR incubator support hubs are being established and will require robust data to inform decisions. From the data collected in our study, whilst it is important to enhance the knowledge of such indicators, there is also a need to collect evidence on other characteristics which may impact and mediate for periods of inactivity. Rationale for inactivity is of particular importance given in light of the findings around supportive cultures and the lack of support for those who take a period of leave to return to the workforce.

Future research should include the evaluation of plausible policy changes and specific interventions, as well as track any post-Athena SWAN cessation changes. At many institutions there are ongoing interventions which do not currently include detailed analysis of the intended and unintended consequences. The impacts of NIHR funding decisions towards institutional status of Athena SWAN is an area of contention which may in avertedly exacerbate gender inequalities. To review and monitor such approaches is critical to ensure diversity across the CA workforce pipeline.

More research on the potential and actual benefits of better representation in clinical academia is needed (e.g. proportion of research likely to impact positively on BAME and women's health, as well as teaching influences on clinical care [e.g see recent shocking findings (Mahase, 2020)]).

With respect to the global pandemic, further research should seek to monitor and track the experiences, and career progression of CAs, and particularly those in training, in the wake of the pandemic. Only through such longitudinal research can any differential impact of COVID-19 on the careers of underrepresented groups be quantified. If policy interventions are attempted, then these should also be robustly evaluated. Indeed, well-meaning initiatives, with initial face validity, may emerge as having undesirable and unintended consequences.

Additional research opportunities, both within the dataset identified by this systematic review, and more broadly are outlined within Box 1.

Box 1: Additional research opportunities

Within the dataset identified by this systematic review:

- Further exploration and synthesis of identified studies investigating barriers and facilitators to clinical academic careers.
- Assessment and, where appropriate, synthesis of the systematic reviews identified within the review's study selection process.
- Future exploration of the data within this review, to focus on differences according to other protected characteristics (e.g. parenthood, sexuality, disability).

Broader research opportunities:

- Identification of clear terminology for describing clinical academics, and clear core outcome sets for studies of clinical academic careers, to guide future research and facilitate clearer reporting for this population.
- Exploration of the experience of parenthood in clinical academia according to gender. (Note: some studies within the systematic review dataset report the parental status of participants which could be further explored).
- Factors affecting clinical academic career choice in medical/dental students, and which interventions may be effective at an earlier career stage.

Conclusion

The multiple challenges associated with a career in clinical academia are evident from the voices of the study's participants. The findings of this study offer further insight into the debate surrounding access to, training for and maintenance of CA careers (Rothwell, 2006). We add weight to the evidence surrounding gender disparity and the need to further support and encourage diversity in the workforce. The data analysis elucidates the direct and systemic discrimination that creates barriers to women's career trajectories in the field of clinical academia. Furthermore, the data raises awareness of the need to be alert to the possibility of reverse discrimination, many being averse to raising the issue. The well documented attrition of workforce (Fitzpatrick, 2012, Brown et al., 2020a), especially in mid-career grades[8], could continue if strategies to support CAs are not implemented. An ongoing commitment to supporting and developing CAs is required, acknowledging the implicit biases facing parents in reaching their potential, and those with other competing demands on their time. Of paramount importance is the need for greater recognition of the value and contribution made by CAs to both the clinical and academic workforces to which they contribute. The study points towards a general lack of recognition of the role of CAs in teaching and assessment. A focus on dental research and recruitment of dental CAs is also required. The findings also emphasise the need for guidance for aspiring CAs, as one remarked, "I just need guidance on next steps. It is just so challenging to think about who might help me."

Participants highlighted the perceived precarious nature of a career in clinical academia in comparison with a non-academic clinical career which may be associated with financial incentives[9]. This uncertainty may compound other disadvantages faced by underrepresented groups. The success rates for postdoctoral fellowships are currently only around 10%. This suggests that the 'CA pipeline' is likely to be most 'leaky' in the mid-career zone. It also hints at the presence of talented candidates, especially in the absence of robust mentoring and support, who may not even apply for such funding, given the pessimistic prior odds of success. Women, in general, may be more risk-averse, in academia, compared to men (Mayer and Rathmann, 2018). Thus, this uncertainty will differentially affect female clinicians. It follows that, without urgent action, COVID-19 has the potential to increase the gender divide seen within clinical academia. It is hoped that the narratives in this study initiate a dialog between CAs, funders and institutions to successfully navigate the CA pathways moving forward.

There are multi-factorial causes of the leaky pipeline within clinical academia; although there is no single solution or quick fix, stakeholders should seek to drive forward a culture of support for CAs and develop an infrastructure to evaluate interventions for those marginalised within the CA workforce. It is imperative to ensure equity in access and parity in experience for CAs, present and future.

[8] Professor count increasing as many don't have to retire at a certain age now

[9] Private practice in both Medicine/Surgery and Dentistry

Synthesis

To synthesise the various phases of the project we now revisit our initial research questions.

The aims of this project were to: **1)** Understand the experiences of CA careers from a fully representative sample of those within CA pathways from trainee to senior CA including those who may have left or never embarked on a formal, structured CA pathway; **2)** Identify barriers to progression throughout a CA career across medicine and dentistry, notably female careers; **3)** Identify the key factors which impact career decisions and perceptions of how attractive CA careers are considered to be, by both those who have chosen to pursue these careers and those who have not; and **4)** Identify existing interventions to enhance CA pathways and propose new ones that may be relevant in UK settings.

1. **What are current and recent trainees' experiences of CA careers; how do they conceptualise a CA career?**

- Interview participants conceptualised a CA career as one of high workload to balance clinical and academic activities for multiple employers.
- A CA was often involved with many research projects and in some cases had a more substantial role in teaching.
- Amongst participants the CA career pathway experience was defined by multiple paths with no clear direction or funding stream.
- For these reasons a CA career was individualistic, opportunistic and heavily based upon local environmental factors such as job opportunities, specialty, networks and funding availability.

2. **What are key factors impacting career decisions and perceptions of how attractive CA careers are considered to be?**

- Undertaking research that makes a difference to patient care was a key driver as CA participants often described their curiosity and desire to tackle systemic issues in healthcare.
- Within the interviews we identified the importance of how work environmental cultures could support or damage CA career opportunities.

3. **What factors influence the decision to become and maintain a CA career and how do these factors change over time?**

- Demographic characteristics (e.g. gender, ethnicity, age) and personal situations (e.g. family, location) were influential in the paths taken, or not, and the opportunities available.
- The continuous drive and passion for research helped to stem any barriers and obstacles.
- Identified across the review and qualitative data, mentors were highly influential in guiding, supporting and enabling participants to maintain a CA career.
- Early experiences and exposure to academia (e.g. intercalation) was seen to drive future motivation.
- Similarly, those who undertook Master and PhD study, described the ways in which the experiences changed their perceptions more favourably towards CA careers.

4. **What are the main reasons for leaving a CA career?**

- There was clear level of frustration over the lack of funding and unclear pathways to continue in CA careers.
- A more localised factor was around the lack of suitable job opportunities that balanced both the clinical and academic side. Those who pursued CA careers had to make tough decisions about the impact on their clinical training.

- There were many critical factors within unsupportive workplace environments such as lack of understanding from colleagues, lack of protected time, lack of mentorship and service pressures. There were corroborated across the literature review and qualitative data.
- Family reasons relating to childcare and geography of home.

5. **How do clinical training demands impact research activity at different CA career transition points, and does the type of research make a difference?**
- At all levels, clinical demands were seen to outweigh the priority of academic roles.
- Certain specialities were regarded as being more/less difficult in which to obtain funding. For instance, general practice and medical education were seen as lower priorities for funding bodies making it more difficult to forge a career in this area.

6. **What are facilitators and barriers to progression through a CA career across medicine and dentistry?**
- Access to appropriate mentors and role models who can provide career guidance.
- Supportive academic environments in which challenges could be shared and tackled.

7. **What factors impact upon access to Clinical Academia?**
- There was an alarming characterisation of inequalities related to intersectional factors such as gender, ethnicity, age and disability.
- Privileges were acknowledged by certain demographic groups (e.g. white, middle class, male) and the opportunities afforded to those within healthcare institutional environments and academia.

8. **How do prescriptive and descriptive biases impact upon careers in clinical academia?**
- The audio diaries helped to extrapolate the contemplation of decisions between posts and the underpinning factors driving reasons.
- Reproductive decision making and the maternal wall bias featured heavily and played an important part in career decisions.

9. **What existing or new interventions aimed at helping clinicians to pursue, and or transition across CA career pathways may have potential in UK settings?**
- In the literature there is a substantial lack of rigorous evidence regarding successful interventions within and across CA career pathways.
- However, from those we did find, there was a strong emphasis on a multi-faceted approach.
- Robust evaluations of components, which may include mentorship alongside other features, are required. Triangulated by the interview findings.

10. **What existing or new interventions could help to reduce attrition in CA careers?**
- To address attrition, there is a key need to understand and support those who take breaks from CA careers for various reasons.
- Supporting those to return to clinical academia needs to focus on the value of the person and what they can bring to a future leadership career in CA roles. For example, through full paid maternity leave and continuation of service which facilitates staggered transitions back into the workplace.

11. **How can organisations support trainees and CAs in their career decisions and academic pathways?**
- Relevant and timely guidance is needed across CA careers to tackle short term, siloed and fixed term research project working.

- Bridge funding with reduced expectations for outputs are suggested to help provide short term support in the build-up for longer, bigger grant applications.

12. How do medicine and dentistry compare in terms of the aforementioned facilitating and hindering factors, interventions and attrition?

- Across medicine and dentistry, from the qualitative work we observed minimal differences in relation to the barriers, enablers and opportunities afforded to those within CA careers
- Within the literature there was a complete scarcity of research related to dental CA careers.

Appendices

Appendix 1: Database search strategies

MEDLINE(R) ALL

via Ovid http://ovidsp.ovid.com/
1946 to October 25, 2019
Searched on: 28th October 2019
Records retrieved search B: 13473
Records retrieved search A: 4241
1 ((doctor or doctors or physician$ or medic or medics) adj4 academi$).ti,ab. (1872)
2 ((doctor or doctors or physician$ or medic or medics) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (1979)
3 ((doctor or doctors or physician$ or medic or medics) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (232)
4 ((doctor or doctors or physician$ or medic or medics) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (1435)
5 (medical adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (65)
6 (medical adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (154)
7 (medical adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (5)
8 (medical adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (59)
9 ((GP or GPs or general practioner$) adj4 academi$).ti,ab. (75)
10 ((GP or GPs or general practioner$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (96)
11 ((GP or GPs or general practioner$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (4)
12 ((GP or GPs or general practioner$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (59)
13 ((dentist or dentists) adj4 academi$).ti,ab. (63)
14 ((dentist or dentists) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (73)
15 ((dentist or dentists) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (20)
16 ((dentist or dentists) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (72)
17 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (24)
18 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (22)
19 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (1)
20 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (23)
21 or/1-20 (6146)
22 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 academi$).ti,ab. (139)

23 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (242)
24 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (18)
25 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (166)
26 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 academi$).ti,ab. (445)
27 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (188)
28 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (116)
29 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (468)
30 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 academi$).ti,ab. (4)
31 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (20)
32 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (0)
33 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (31)
34 or/22-33 (1774)
35 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (academi$ or research$ or scholar$)).ti,ab. (1313)
36 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (399)
37 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (79)
38 or/35-37 (1705)
39 exp Physicians/ (133681)
40 exp Dentists/ (18486)
41 Faculty, Medical/ (12770)
42 Faculty, Dental/ (2398)
43 Academic Medical Centers/ (17857)
44 39 or 40 or 41 or 42 or 43 (180811)
45 Research Personnel/ (15675)
46 Universities/ (38946)
47 research/ or biomedical research/ or dental research/ (267864)
48 45 or 46 or 47 (313057)
49 44 and 48 (7101)
50 21 or 34 or 38 or 49 (15969)
51 (academic adj (medicine or dentistry or primary care)).ti,ab. (2568)
52 (academic adj2 (an?esthesi$ or an?estheti$ or oncolog$ or emergency medicine or radiolog$ or intensive care or intensivist$ or obstetric$ or gyn?ecolog$ or ophthalmolog$ or paediatric$ or pediatric$ or patholog$ or psychiatr$ or public health or surgery or surgeon$)).ti,ab. (4937)
53 51 or 52 (7395)
54 ((clinical or clinician$ or medical or dental or dentistry) adj academi$).ti,ab. (780)

55 ((clinical or clinician$ or medical or dental or dentistry) adj (lecturer$ or lectureship$)).ti,ab. (61)
56 ((clinical or clinician$ or medical or dental or dentistry) adj professor$).ti,ab. (177)
57 ((clinical or clinician$ or medical or dental or dentistry) adj fellow$).ti,ab. (325)
58 ((clinical or clinician$ or medical or dental or dentistry) adj research fellow$).ti,ab. (37)
59 in-practice fellow$.ti,ab. (8)
60 clinical research train$.ti,ab. (103)
61 physician$ scientist$.ti,ab. (854)
62 surgeon$ scientist$.ti,ab. (165)
63 ((clinical or clinician$) adj scientist$).ti,ab. (1193)
64 ((clinical or clinician$) adj scholar$).ti,ab. (175)
65 ((clinical or clinician$) adj researcher$).ti,ab. (2597)
66 ((clinical or clinician$) adj investigator$).ti,ab. (1649)
67 ((clinical or clinician$) adj educator$).ti,ab. (1011)
68 or/54-67 (8891)
69 50 or 53 or 68 (30102)
70 (integrated adj3 academic adj3 (train$ or career$ or path or paths or pathway$ or program$)).ti,ab. (33)
71 (IAT adj2 (career$ or path$ or program$)).ti,ab. (10)
72 Clinical Research Training Fellowship$.ti,ab. (10)
73 Academic Foundation Program$.ti,ab. (17)
74 (academi$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (383)
75 (research$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (330)
76 or/70-75 (751)
77 Career Choice/ (22485)
78 career mobility/ (11228)
79 Staff Development/ (9142)
80 (career$ or pathway$ or pipeline$).ti,ab. (1105747)
81 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (choice$ or choos$ or select$ or decid$ or decision$)).ti,ab. (7714)
82 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (mobility or ladder$ or route$ or trajector$ or structure$)).ti,ab. (2939)
83 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (progress$ or promot$ or develop$ or advanc$)).ti,ab. (26577)
84 or/77-83 (1166195)
85 69 and 84 (4314)
86 Personnel Selection/ (12625)
87 (recruit$ or hire$ or hiring).ti,ab. (355306)
88 86 or 87 (363489)
89 69 and 88 (1460)
90 Personnel Turnover/ (5027)
91 (retain$ or retention).ti,ab. (350726)
92 (resign$ or terminat$ or disenroll$ or withdraw$ or attrition).ti,ab. (247203)
93 90 or 91 or 92 (595449)
94 69 and 93 (887)
95 85 or 89 or 94 (5724)
96 76 or 95 (6051)
97 exp animals/ not humans/ (4637358)
98 96 not 97 (6040)
99 limit 98 to english language (5741)
100 limit 99 to yr="2004 -Current" (4471)
101 (editorial or letter).pt. (1554107)

102 100 not 101 (4241) **[Records downloaded for search A – clinical academics AND career]**
103 69 or 76 (30413)
104 103 not 97 (30248)
105 limit 104 to english language (27498)
106 limit 105 to yr="2004 -Current" (18930)
107 106 not 101 (17714)
108 107 not 102 (13473) **[Records downloaded for search B – clinical academics with search A results removed]**

Embase

via Ovid http://ovidsp.ovid.com/
1974 to 2019 October 25
Searched on: 28th October 2019
Records retrieved search B: 19969
Records retrieved search A: 5260
1 ((doctor or doctors or physician$ or medic or medics) adj4 academi$).ti,ab. (2652)
2 ((doctor or doctors or physician$ or medic or medics) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (2641)
3 ((doctor or doctors or physician$ or medic or medics) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (264)
4 ((doctor or doctors or physician$ or medic or medics) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (1896)
5 (medical adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (91)
6 (medical adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (201)
7 (medical adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (5)
8 (medical adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (90)
9 ((GP or GPs or general practioner$) adj4 academi$).ti,ab. (106)
10 ((GP or GPs or general practioner$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (125)
11 ((GP or GPs or general practioner$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (9)
12 ((GP or GPs or general practioner$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (101)
13 ((dentist or dentists) adj4 academi$).ti,ab. (65)
14 ((dentist or dentists) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (76)
15 ((dentist or dentists) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (19)
16 ((dentist or dentists) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (81)
17 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (25)
18 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (23)
19 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (3)

20 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (20)
21 or/1-20 (8257)
22 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 academi$).ti,ab. (203)
23 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (378)
24 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (33)
25 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (245)
26 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 academi$).ti,ab. (614)
27 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (312)
28 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (149)
29 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (664)
30 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 academi$).ti,ab. (13)
31 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (53)
32 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (1)
33 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (73)
34 or/22-33 (2642)
35 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (academi$ or research$ or scholar$)).ti,ab. (1715)
36 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (454)
37 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (95)
38 or/35-37 (2167)
39 exp *physician/ (159620)
40 exp dentist/ (23403)
41 medical school/ (56034)
42 university hospital/ (118150)
43 or/39-42 (349069)
44 scientist/ (61622)
45 academic dean/ (77)
46 university/ (110788)
47 research/ or medical research/ or clinical research/ or dental research/ (379530)
48 phd student/ (509)
49 postdoctoral education/ (733)
50 academic achievement/ (34074)
51 academic success/ (747)
52 or/44-51 (564099)

53 43 and 52 (26051)
54 21 or 34 or 38 or 53 (37818)
55 (academic adj (medicine or dentistry or primary care)).ti,ab. (3135)
56 (academic adj2 (an?esthesi$ or an?estheti$ or oncolog$ or emergency medicine or radiolog$ or intensive care or intensivist$ or obstetric$ or gyn?ecolog$ or ophthalmolog$ or paediatric$ or pediatric$ or patholog$ or psychiatr$ or public health or surgery or surgeon$)).ti,ab. (8736)
57 55 or 56 (11727)
58 ((clinical or clinician$ or medical or dental or dentistry) adj academi$).ti,ab. (966)
59 ((clinical or clinician$ or medical or dental or dentistry) adj (lecturer$ or lectureship$)).ti,ab. (89)
60 ((clinical or clinician$ or medical or dental or dentistry) adj professor$).ti,ab. (206)
61 ((clinical or clinician$ or medical or dental or dentistry) adj fellow$).ti,ab. (502)
62 ((clinical or clinician$ or medical or dental or dentistry) adj research fellow$).ti,ab. (73)
63 in-practice fellow$.ti,ab. (12)
64 clinical research train$.ti,ab. (129)
65 physician$ scientist$.ti,ab. (975)
66 surgeon$ scientist$.ti,ab. (181)
67 ((clinical or clinician$) adj scientist$).ti,ab. (2184)
68 ((clinical or clinician$) adj scholar$).ti,ab. (221)
69 ((clinical or clinician$) adj researcher$).ti,ab. (3378)
70 ((clinical or clinician$) adj investigator$).ti,ab. (2210)
71 ((clinical or clinician$) adj educator$).ti,ab. (1338)
72 or/58-71 (12125)
73 54 or 57 or 72 (58708)
74 (integrated adj3 academic adj3 (train$ or career$ or path or paths or pathway$ or program$)).ti,ab. (53)
75 (IAT adj2 (career$ or path$ or program$)).ti,ab. (17)
76 Clinical Research Training Fellowship$.ti,ab. (12)
77 Academic Foundation Program$.ti,ab. (17)
78 (academi$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (446)
79 (research$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (453)
80 or/74-79 (957)
81 career/ (20988)
82 career mobility/ (10103)
83 career planning/ (2878)
84 personnel management/ (56691)
85 (career$ or pathway$ or pipeline$).ti,ab. (1410134)
86 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (choice$ or choos$ or select$ or decid$ or decision$)).ti,ab. (9834)
87 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (mobility or ladder$ or route$ or trajector$ or structure$)).ti,ab. (3764)
88 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (progress$ or promot$ or develop$ or advanc$)).ti,ab. (33960)
89 (recruit$ or hire$ or hiring).ti,ab. (526934)
90 (retain$ or retention).ti,ab. (427156)
91 (resign$ or terminat$ or disenroll$ or withdraw$ or attrition).ti,ab. (321272)
92 or/81-91 (2673636)
93 73 and 92 (10428)
94 80 or 93 (10862)
95 (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5893065)
96 94 not 95 (10791)

97 limit 96 to english language (10445)
98 limit 97 to yr="2004 -Current" (8967)
99 (editorial or letter).pt. (1729471)
100 98 not 99 (8545)
101 (conference abstract or conference review).pt. (3638584)
102 100 and 101 (3285)
103 100 not 101 (5260) **[Records downloaded for search A – clinical academics AND career]**
104 73 or 80 (59119)
105 104 not 95 (58503)
106 limit 105 to english language (54414)
107 limit 106 to yr="2004 -Current" (44362)
108 107 not 99 (41654)
109 101 and 108 (16425)
110 108 not 101 (25229)
111 110 not 103 (19969) **[Records downloaded for search B – clinical academics with search A results removed]**

PsycINFO

via Ovid http://ovidsp.ovid.com/
1806 to October Week 3, 2019
Searched on: 29th October 2019
Records retrieved search B: 4546
Records retrieved search A: 1807
1 ((doctor or doctors or physician$ or medic or medics) adj4 academi$).ti,ab. (404)
2 ((doctor or doctors or physician$ or medic or medics) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (548)
3 ((doctor or doctors or physician$ or medic or medics) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (96)
4 ((doctor or doctors or physician$ or medic or medics) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (277)
5 (medical adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (22)
6 (medical adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (69)
7 (medical adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (0)
8 (medical adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (12)
9 ((GP or GPs or general practioner$) adj4 academi$).ti,ab. (14)
10 ((GP or GPs or general practioner$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (21)
11 ((GP or GPs or general practioner$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (2)
12 ((GP or GPs or general practioner$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (18)
13 ((dentist or dentists) adj4 academi$).ti,ab. (5)
14 ((dentist or dentists) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (9)
15 ((dentist or dentists) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (0)

16 ((dentist or dentists) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (5)
17 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 academi$).ti,ab. (1)
18 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (2)
19 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (0)
20 ((dental or dentistry) adj (profession$ or practitioner$ or specialist$) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (1)
21 or/1-20 (1458)
22 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 academi$).ti,ab. (165)
23 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (414)
24 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (24)
25 ((consultant$ or registrar$ or associate specialist$ or staff grade$ or house officer$ or houseman or housemen or housestaff) adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (122)
26 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 academi$).ti,ab. (195)
27 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (100)
28 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (380)
29 ((medical or specialt$ or specialist$ or clinical or surgical) adj4 train$ adj4 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (182)
30 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 academi$).ti,ab. (20)
31 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (20)
32 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (2)
33 ((FY1 or FY2 or SHO or JHO or FY train$ or CMT or CST) adj10 (universit$ or higher education or research institut$ or research centre$ or research center$)).ti,ab. (12)
34 or/22-33 (1570)
35 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (academi$ or research$ or scholar$)).ti,ab. (332)
36 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (professor$ or dean$ or program$ director$ or lecturer$ or research fellow$ or researcher$)).ti,ab. (64)
37 (facult$ adj5 (medical or medicine or dental or dentistry or clinical) adj5 (doctora$ or predoctora$ or pre-doctora$ or postdoctora$ or post-doctora$ or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)).ti,ab. (28)
38 or/35-37 (403)
39 exp physicians/ (42436)
40 dentists/ (448)
41 39 or 40 (42803)
42 scientists/ (5077)
43 college teachers/ (8013)

44 colleges/ (13419)
45 higher education/ (15606)
46 academic settings/ (463)
47 academic specialization/ (2863)
48 academic aptitude/ (2325)
49 exp academic achievement/ (75159)
50 postgraduate students/ (1149)
51 exp postgraduate training/ (9075)
52 or/42-51 (125718)
53 41 and 52 (2154)
54 21 or 34 or 38 or 53 (5436)
55 (academic adj (medicine or dentistry or primary care)).ti,ab. (666)
56 (academic adj2 (an?esthesi$ or an?estheti$ or oncolog$ or emergency medicine or radiolog$ or intensive care or intensivist$ or obstetric$ or gyn?ecolog$ or ophthalmolog$ or paediatric$ or pediatric$ or patholog$ or psychiatr$ or public health or surgery or surgeon$)).ti,ab. (976)
57 55 or 56 (1602)
58 ((clinical or clinician$ or medical or dental or dentistry) adj academi$).ti,ab. (260)
59 ((clinical or clinician$ or medical or dental or dentistry) adj (lecturer$ or lectureship$)).ti,ab. (10)
60 ((clinical or clinician$ or medical or dental or dentistry) adj professor$).ti,ab. (84)
61 ((clinical or clinician$ or medical or dental or dentistry) adj fellow$).ti,ab. (50)
62 ((clinical or clinician$ or medical or dental or dentistry) adj research fellow$).ti,ab. (12)
63 in-practice fellow$.ti,ab. (0)
64 clinical research train$.ti,ab. (30)
65 physician$ scientist$.ti,ab. (142)
66 surgeon$ scientist$.ti,ab. (3)
67 ((clinical or clinician$) adj scientist$).ti,ab. (422)
68 ((clinical or clinician$) adj scholar$).ti,ab. (120)
69 ((clinical or clinician$) adj researcher$).ti,ab. (1749)
70 ((clinical or clinician$) adj investigator$).ti,ab. (325)
71 ((clinical or clinician$) adj educator$).ti,ab. (571)
72 or/58-71 (3710)
73 54 or 57 or 72 (10296)
74 (integrated adj3 academic adj3 (train$ or career$ or path or paths or pathway$ or program$)).ti,ab. (16)
75 (IAT adj2 (career$ or path$ or program$)).ti,ab. (7)
76 Clinical Research Training Fellowship$.ti,ab. (0)
77 Academic Foundation Program$.ti,ab. (1)
78 (academi$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (139)
79 (research$ adj3 (clinical or clinician$ or medical or medicine or dental or dentistry) adj3 (career$ or path or paths or pathway$)).ti,ab. (110)
80 or/74-79 (255)
81 exp occupations/ (54549)
82 occupational preference/ (1335)
83 occupational aspirations/ (4141)
84 exp career development/ (13145)
85 exp professional development/ (60620)
86 occupational interests/ (2897)
87 (career$ or pathway$ or pipeline$).ti,ab. (142500)
88 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (choice$ or choos$ or select$ or decid$ or decision$)).ti,ab. (12447)
89 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (mobility or ladder$ or route$ or trajector$ or structure$)).ti,ab. (3784)

90 ((occupation$ or profession$ or job$ or staff or employee$ or personnel) adj3 (progress$ or promot$ or develop$ or advanc$)).ti,ab. (36572)
91 or/81-90 (278927)
92 73 and 91 (2081)
93 personnel recruitment/ (2303)
94 personnel selection/ (6876)
95 (recruit$ or hire$ or hiring).ti,ab. (96603)
96 or/93-95 (101600)
97 73 and 96 (425)
98 employee retention/ (993)
99 employee turnover/ (4934)
100 exp personnel termination/ (866)
101 (retain$ or retention).ti,ab. (63898)
102 (resign$ or terminat$ or disenroll$ or withdraw$ or attrition).ti,ab. (66393)
103 or/98-102 (131951)
104 73 and 103 (319)
105 92 or 97 or 104 (2512)
106 80 or 105 (2628)
107 (rat or rats or mouse or mice or hamster or hamsters or animal or animals or dog or dogs or bovine or sheep).ti,ab,sh. (321074)
108 106 not 107 (2609)
109 limit 108 to english language (2548)
110 limit 109 to yr="2004 -Current" (1995)
111 (editorial or letter).dt. (65007)
112 110 not 111 (1878)
113 (encyclopaedia entry or obituary or poetry or "review software other").dt. (6873)
114 112 not 113 (1807) **[Records downloaded for search A – clinical academics AND career]**
115 73 or 80 (10409)
116 115 not 107 (10291)
117 limit 116 to english language (9917)
118 limit 117 to yr="2004 -Current" (6959)
119 118 not 111 (6520)
120 119 not 113 (6353)
121 120 not 114 (4546) **[Records downloaded for search B– clinical academics with search A results removed]**

Cochrane Central Register of Controlled Trials (CENTRAL)

via Wiley http://onlinelibrary.wiley.com/
Issue 10 of 12, October 2019
Searched on: 29th October 2019
Records retrieved search B: 1656
Records retrieved search A: 459
#1 ((doctor or doctors or physician* or medic or medics) near/4 academi*):ti,ab,kw 138
#2 ((doctor or doctors or physician* or medic or medics) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 139
#3 ((doctor or doctors or physician* or medic or medics) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 16
#4 ((doctor or doctors or physician* or medic or medics) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 151
#5 (medical next (profession* or practitioner* or specialist*) near/4 academi*):ti,ab,kw 1

#6 (medical next (profession* or practitioner* or specialist*) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 9
#7 (medical next (profession* or practitioner* or specialist*) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 0
#8 (medical next (profession* or practitioner* or specialist*) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 10
#9 ((GP or GPs or general next practioner*) near/4 academi*):ti,ab,kw 15
#10 ((GP or GPs or general next practioner*) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 8
#11 ((GP or GPs or general next practioner*) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 2
#12 ((GP or GPs or general next practioner*) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 10
#13 ((dentist or dentists) near/4 academi*):ti,ab,kw 4
#14 ((dentist or dentists) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 8
#15 ((dentist or dentists) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 0
#16 ((dentist or dentists) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 7
#17 ((dental or dentistry) next (profession* or practitioner* or specialist*) near/4 academi*):ti,ab,kw 0
#18 ((dental or dentistry) next (profession* or practitioner* or specialist*) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 0
#19 ((dental or dentistry) next (profession* or practitioner* or specialist*) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 0
#20 ((dental or dentistry) next (profession* or practitioner* or specialist*) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 0
#21 (OR #1-#20) 509
#22 ((consultant* or registrar* or associate next specialist* or staff next grade* or house next officer* or houseman or housemen or housestaff) near/4 academi*):ti,ab,kw 5
#23 ((consultant* or registrar* or associate next specialist* or staff next grade* or house next officer* or houseman or housemen or housestaff) near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 24
#24 ((consultant* or registrar* or associate next specialist* or staff next grade* or house next officer* or houseman or housemen or housestaff) near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 9
#25 ((consultant* or registrar* or associate next specialist* or staff next grade* or house next officer* or houseman or housemen or housestaff) near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 25
#26 ((medical or specialt* or specialist* or clinical or surgical) near/4 train* near/4 academi*):ti,ab,kw 25
#27 ((medical or specialt* or specialist* or clinical or surgical) near/4 train* near/4 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 22

#28 ((medical or specialt* or specialist* or clinical or surgical) near/4 train* near/4 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 8
#29 ((medical or specialt* or specialist* or clinical or surgical) near/4 train* near/4 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 65
#30 ((FY1 or FY2 or SHO or JHO or FY next train* or CMT or CST) near/10 academi*):ti,ab,kw 1
#31 ((FY1 or FY2 or SHO or JHO or FY next train* or CMT or CST) near/10 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 5
#32 ((FY1 or FY2 or SHO or JHO or FY next train* or CMT or CST) near/10 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 0
#33 ((FY1 or FY2 or SHO or JHO or FY next train* or CMT or CST) near/10 (universit* or higher next education or research next institut* or research next centre* or research next center*)):ti,ab,kw 9
#34 (OR #22-#33) 195
#35 (facult* near/5 (medical or medicine or dental or dentistry or clinical) near/5 (academi* or research* or scholar*)):ti,ab,kw 78
#36 (facult* near/5 (medical or medicine or dental or dentistry or clinical) near/5 (professor* or dean* or program* next director* or lecturer* or research next fellow* or researcher*)):ti,ab,kw 10
#37 (facult* near/5 (medical or medicine or dental or dentistry or clinical) near/5 (doctora* or predoctora* or pre next doctora* or postdoctora* or post next doctora* or postdoc or post next doc or postdocs or post next docs or PhD or PhDs)):ti,ab,kw 0
#38 (OR #35-#37) 85
#39 MeSH descriptor: [Physicians] explode all trees 1930
#40 MeSH descriptor: [Dentists] explode all trees 83
#41 MeSH descriptor: [Faculty, Medical] this term only 102
#42 MeSH descriptor: [Faculty, Dental] this term only 7
#43 MeSH descriptor: [Academic Medical Centers] this term only 329
#44 (OR #39-#43) 2424
#45 MeSH descriptor: [Research Personnel] this term only 86
#46 MeSH descriptor: [Universities] this term only 863
#47 MeSH descriptor: [Research] this term only 223
#48 MeSH descriptor: [Biomedical Research] this term only 166
#49 MeSH descriptor: [Dental Research] this term only 14
#50 (OR #45-#49) 1334
#51 #44 and #50 25
#52 #21 or #34 or #38 or #51 802
#53 (academic next (medicine or dentistry or primary next care)):ti,ab,kw 71
#54 (academic near/2 (anesthesi* or anaesthesi* or anestheti* or anaestheti* or oncolog* or emergency medicine or radiolog* or intensive care or intensivist* or obstetric* or gynecolog* or gynaecolog* or ophthalmolog* or paediatric* or pediatric* or patholog* or psychiatr* or public next health or surgery or surgeon*)):ti,ab,kw 1059
#55 #53 or #54 1059
#56 ((clinical or clinician* or medical or dental or dentistry) next academi*):ti,ab,kw 30
#57 ((clinical or clinician* or medical or dental or dentistry) next (lecturer* or lectureship*)):ti,ab,kw 5
#58 ((clinical or clinician* or medical or dental or dentistry) next professor*):ti,ab,kw 4
#59 ((clinical or clinician* or medical or dental or dentistry) next fellow*):ti,ab,kw 25
#60 ((clinical or clinician* or medical or dental or dentistry) next research next fellow*):ti,ab,kw 6
#61 in next practice next fellow*:ti,ab,kw 1

#62 clinical next research next train*:ti,ab,kw 7
#63 physician* next scientist*:ti,ab,kw 14
#64 surgeon* next scientist*:ti,ab,kw 2
#65 ((clinical or clinician*) next scientist*):ti,ab,kw 50
#66 ((clinical or clinician*) next scholar*):ti,ab,kw 6
#67 ((clinical or clinician*) next researcher*):ti,ab,kw 189
#68 ((clinical or clinician*) next investigator*):ti,ab,kw 310
#69 ((clinical or clinician*) next educator*):ti,ab,kw 33
#70 (OR #56-#69) 668
#71 #52 or #55 or #70 2469
#72 (integrated near/3 academic near/3 (train* or career* or path* or program*)):ti,ab,kw 3
#73 (IAT near/2 (career* or path* or program*)):ti,ab,kw 1
#74 Clinical next Research next Training next Fellowship*:ti,ab,kw 2
#75 Academic next Foundation next Program*:ti,ab,kw 0
#76 (academi* near/3 (clinical or clinician* or medical or medicine or dental or dentistry) near/3 (career* or path or paths or pathway*)):ti,ab,kw 7
#77 (research* near/3 (clinical or clinician* or medical or medicine or dental or dentistry) near/3 (career* or path or paths or pathway*)):ti,ab,kw 15
#78 (OR #72-#77) 28
#79 MeSH descriptor: [Career Choice] this term only 65
#80 MeSH descriptor: [Career Mobility] this term only 12
#81 MeSH descriptor: [Staff Development] this term only 87
#82 (career* or pathway* or pipeline*):ti,ab,kw 18510
#83 ((occupation* or profession* or job* or staff or employee* or personnel) near/3 (choice* or choos* or select* or decid* or decision*)):ti,ab,kw 619
#84 ((occupation* or profession* or job* or staff or employee* or personnel) near/3 (mobility or ladder* or route* or trajector* or structure*)):ti,ab,kw 199
#85 ((occupation* or profession* or job* or staff or employee* or personnel) near/3 (progress* or promot* or develop* or advanc*)):ti,ab,kw 1238
#86 (OR #79-#85) 20452
#87 #71 and #86 90
#88 MeSH descriptor: [Personnel Selection] this term only 52
#89 (recruit* or hire* or hiring):ti,ab,kw 75420
#90 #88 or #89 75442
#91 #71 and #90 321
#92 MeSH descriptor: [Personnel Turnover] this term only 29
#93 (retain* or retention):ti,ab,kw 23885
#94 (resign* or terminat* or disenroll* or withdraw* or attrition):ti,ab,kw 52663
#95 #92 or #93 or #94 74842
#96 #71 and #95 160
#97 #87 or #91 or #96 481
#98 #78 or #97 500
#99 #78 or #97 with Publication Year from 2004 to 2019, in Trials 459 **[Records downloaded for search A – clinical academics AND career]**
#100 #71 or #78 2486
#101 #71 or #78 with Publication Year from 2004 to 2019, in Trials 2115
#102 #101 not #99 with Publication Year from 2004 to 2019, in Trials 1656 **[Records downloaded for search B - clinical academics with search A results removed]**

Education Resources Information Center (ERIC) database

via Ebsco https://www.ebscohost.com/
1965 to 2019
Searched on: 29th October 2019

Records retrieved search B: 1501
Records retrieved search A: 491
S1 TI ((doctor or doctors or physician* or medic or medics) N4 academi*) OR AB ((doctor or doctors or physician* or medic or medics) N4 academi*) 65
S2 TI ((doctor or doctors or physician* or medic or medics) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((doctor or doctors or physician* or medic or medics) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 90
S3 TI ((doctor or doctors or physician* or medic or medics) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((doctor or doctors or physician* or medic or medics) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 144
S4 TI ((doctor or doctors or physician* or medic or medics) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((doctor or doctors or physician* or medic or medics) N4 (universit* or higher education or research institut* or research centre* or research center*)) 131
S5 TI ((medical N1 (profession* or practitioner* or specialist*) N4 academi*)) OR AB ((medical N1 (profession* or practitioner* or specialist*) N4 academi*)) 3
S6 TI ((medical N1 (profession* or practitioner* or specialist*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((medical N1 (profession* or practitioner* or specialist*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 16
S7 TI ((medical N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((medical N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 62
S8 TI ((medical N1 (profession* or practitioner* or specialist*) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((medical N1 (profession* or practitioner* or specialist*) N4 (universit* or higher education or research institut* or research centre* or research center*)) 9
S9 TI ((GP or GPs or general practioner*) N4 academi*) OR AB ((GP or GPs or general practioner*) N4 academi*) 1
S10 TI ((GP or GPs or general practioner*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((GP or GPs or general practioner*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 3
S11 TI ((GP or GPs or general practioner*) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((GP or GPs or general practioner*) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 32
S12 TI ((GP or GPs or general practioner*) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((GP or GPs or general practioner*) N4 (universit* or higher education or research institut* or research centre* or research center*)) 6
S13 TI ((dentist or dentists) N4 academi*)) OR AB ((dentist or dentists) N4 academi*)) 2
S14 TI ((dentist or dentists) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((dentist or dentists) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 1
S15 TI ((dentist or dentists) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB (

(dentist or dentists) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 5
S16 TI ((dentist or dentists) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((dentist or dentists) N4 (universit* or higher education or research institut* or research centre* or research center*)) 2
S17 TI ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 academi*) OR AB ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 academi*) 1
S18 TI ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 1
S19 TI ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 ((doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 ((doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 1
S20 TI ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((dental or dentistry) N1 (profession* or practitioner* or specialist*) N4 (universit* or higher education or research institut* or research centre* or research center*)) 1
S21 TI ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 academi*)) OR AB ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 academi*)) 123
S22 TI ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 248
S23 TI ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 19
S24 TI ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((consultant* or registrar* or associate specialist* or staff grade* or house officer* or houseman or housemen or housestaff) N4 (universit* or higher education or research institut* or research centre* or research center*)) 418
S25 TI ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 academi*) OR AB ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 academi*) 45
S26 TI ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 36
S27 TI ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((medical or specialt* or specialist* or

clinical or surgical) N4 train* N4 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 49
S28 TI ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((medical or specialt* or specialist* or clinical or surgical) N4 train* N4 (universit* or higher education or research institut* or research centre* or research center*)) 121
S29 TI ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 academi*) OR AB ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 academi*) 16
S30 TI ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 2
S31 TI ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 29
S32 TI ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (universit* or higher education or research institut* or research centre* or research center*)) OR AB ((FY1 or FY2 or SHO or JHO or FY train* or CMT or CST) N10 (universit* or higher education or research institut* or research centre* or research center*)) 26
S33 TI ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (academi* or research* or scholar*)) OR AB ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (academi* or research* or scholar*)) 159
S34 TI ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) OR AB ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (professor* or dean* or program* director* or lecturer* or research fellow* or researcher*)) 43
S35 TI ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) OR AB ((facult* N5 (medical or medicine or dental or dentistry or clinical) N5 (doctora* or predoctora* or pre-doctora* or postdoctora* or post-doctora* or postdoc or post-doc or postdocs or post-docs or PhD or PhDs)) 15
S36 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 1,717
S37 DE "Physicians" 4,218
S38 DE "Dentistry" 912
S39 DE "Medical School Faculty" 903
S40 S37 OR S38 OR S3 9 5,852
S41 DE "Researchers" 6,704
S42 DE "Scientists" OR DE "Women Scientists" 4,524
S43 DE "Universities" OR DE "Research Universities" 20,867
S44 DE "Higher Education" OR DE "Postdoctoral Education" 440,864
S45 DE "Research" OR DE "Medical Research" 18,073
S46 DE "Academic Rank (Professional)" 1,470
S47 DE "Academic Ability" OR DE "Academic Achievement" OR DE "Academic Aptitude" OR DE "Academic Aspiration" OR DE "Scholarship" 95,633
S48 S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 530,633

S49 S40 AND S48 3,214
S50 TI (academic N1 (medicine or dentistry or primary care)) OR AB (academic N1 (medicine or dentistry or primary care)) 130
S51 TI (academic N2 (an#esthesi* or an#estheti* or oncolog* or emergency medicine or radiolog* or intensive care or intensivist* or obstetric* or gyn#ecolog* or ophthalmolog* or paediatric* or pediatric* or patholog* or psychiatr* or public health or surgery or surgeon*)) OR AB (academic N2 (an#esthesi* or an#estheti* or oncolog* or emergency medicine or radiolog* or intensive care or intensivist* or obstetric* or gyn#ecolog* or ophthalmolog* or paediatric* or pediatric* or patholog* or psychiatr* or public health or surgery or surgeon*)) 109
S52 TI ((clinical or clinician* or medical or dental or dentistry) N1 academi*) OR AB ((clinical or clinician* or medical or dental or dentistry) N1 academi*) 478
S53 TI ((clinical or clinician* or medical or dental or dentistry) N1 (lecturer* or lectureship*)) OR AB ((clinical or clinician* or medical or dental or dentistry) N1 (lecturer* or lectureship*)) 6
S54 TI ((clinical or clinician* or medical or dental or dentistry) N1 professor*) OR AB ((clinical or clinician* or medical or dental or dentistry) N1 professor*) 110
S55 TI ((clinical or clinician* or medical or dental or dentistry) N1 fellow*) OR AB ((clinical or clinician* or medical or dental or dentistry) N1 fellow*) 30
S56 TI ((clinical or clinician* or medical or dental or dentistry) N1 research fellow*) OR AB ((clinical or clinician* or medical or dental or dentistry) N1 research fellow*) 9
S57 TI in-practice W1 fellow* OR AB in-practice W1 fellow* 3
S58 TI clinical N1 research N1 train* OR AB clinical N1 research N1 train* 24
S59 TI physician* N1 scientist* OR AB physician* N1 scientist* 37
S60 TI surgeon* N1 scientist* OR AB surgeon* N1 scientist* 1
S61 TI ((clinical or clinician*) N1 scientist*) OR AB ((clinical or clinician*) N1 scientist*) 57
S62 TI ((clinical or clinician*) N1 scholar*) OR AB ((clinical or clinician*) N1 scholar*) 25
S63 TI ((clinical or clinician*) W1 researcher*) OR AB ((clinical or clinician*) W1 researcher*) 232
S64 TI ((clinical or clinician*) N1 investigator*) OR AB ((clinical or clinician*) N1 investigator*) 26
S65 TI ((clinical or clinician*) N1 educator*) OR AB ((clinical or clinician*) N1 educator*) 224
S66 S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 1,407
S67 S36 OR S49 OR S66 5,911
S68 TI (integrated N3 academic N3 (train* or career* or path* or program*)) OR AB (integrated N3 academic N3 (train* or career* or path* or program*)) 93
S69 TI (IAT N2 (career* or path* or program*)) OR AB (IAT N2 (career* or path* or program*)) 30
S70 TI Clinical Research Training Fellowship* OR AB Clinical Research Training Fellowship* 3
S71 TI Academic W1 Foundation W1 Program* OR AB Academic W1 Foundation W1 Program* 4
S72 TI (academi* N3 (clinical or clinician* or medical or medicine or dental or dentistry) N3 (career* or path or paths or pathway*)) OR AB (academi* N3 (clinical or clinician* or medical or medicine or dental or dentistry) N3 (career* or path or paths or pathway*)) 38
S73 TI (research* N3 (clinical or clinician* or medical or medicine or dental or dentistry) N3 (career* or path or paths or pathway*)) OR AB (research* N3 (clinical or clinician* or medical or medicine or dental or dentistry) N3 (career* or path or paths or pathway*)) 30
S74 S68 OR S69 OR S70 OR S71 OR S72 OR S73 164
S75 DE "Careers" OR DE "Science Careers" 4,076

S76 DE "Career Choice"
11,946
S77 DE "Occupational Mobility" 2,354
S78 DE "Staff Development"
11,208
S79 DE "Professional Development"
23,216
S80 DE "Career Development"
13,246
S81 DE "Occupational Aspiration" 4,628
S82 DE "Career Planning" 6,169
S83 TI (career* or pathway* or pipeline*) OR AB (career* or pathway* or pipeline*)
76,383
S84 TI ((occupation* or profession* or job* or staff or employee* or personnel) N3 (choice* or choos* or select* or decid* or decision*)) OR AB ((occupation* or profession* or job* or staff or employee* or personnel) N3 (choice* or choos* or select* or decid* or decision*)) 9,624
S85 TI ((occupation* or profession* or job* or staff or employee* or personnel) N3 (mobility or ladder* or route* or trajector* or structure*)) OR AB ((occupation* or profession* or job* or staff or employee* or personnel) N3 (mobility or ladder* or route* or trajector* or structure*)) 3,713
S86 TI ((occupation* or profession* or job* or staff or employee* or personnel) N3 (progress* or promot* or develop* or advanc*)) OR AB ((occupation* or profession* or job* or staff or employee* or personnel) N3 (progress* or promot* or develop* or advanc*))
62,653
S87 S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86
162,678
S88 DE "Recruitment" 4,123
S89 DE "Personnel Selection" 3,624
S90 TI (recruit* or hire* or hiring) OR AB (recruit* or hire* or hiring)
33,391
S91 S88 OR S89 OR S90
36,171
S92 DE "Labor Turnover" 2,686
S93 TI (retain* or retention) OR AB (retain* or retention)
30,251
S94 TI (resign* or terminat* or disenroll* or withdraw* or attrition) OR AB (resign* or terminat* or disenroll* or withdraw* or attrition)
13,245
S95 S92 OR S93 OR S94
42,869
S96 S87 OR S91 OR S95
220,696
S97 S67 AND S96 1,256
S98 S74 OR S97 1,376
S99 S74 OR S97 Limiters - Date Published: 20040101-20191131; Language: English
508
S100 (ZT "opinion papers")
158,731
S101 S99 NOT S100 491

[Records downloaded for search A – clinical academics AND career]

S102 S67 OR S74 6,028

S103	S67 OR S74 Limiters - Date Published: 20040101-20191131; Language: English	2,055
S104	S103 not S100	1,992
S105	S104 not S101	1,501

[Records downloaded for search B – clinical academics with search A results removed]

Appendix 2: Table of study characteristics for studies exploring barriers and facilitators to clinical academic careers

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Adams (2014)	UK	NR-NR	Qualitative	Primary care academics. Academic level NR	15 (NR)	NR
Adler (2010)	USA	2008-2008	Cohort study	Trainees and fellows in gastroenterology, mixed academic levels	181 (NR)	NR
Agana (2017)	USA	NR-NR	Qualitative	Primary care physicians. Academic level NR	26 (NR)	NR
Agarwal (2010)	USA	2008-NR	Cohort study	Trainee resident radiologists, pre-doctoral	133 (NR)	NR
Ahmad (2013)*	USA	2010-2011	Cohort study	Residency program chairs and directors in anesthesia	96 (NR)	NR
Ahn (2010)	USA	2005-2006	Cohort study	Orthopaedic surgery residents and chairs of the residency programmes, pre-doctoral and chairs	183 residents (18% females), and 86 chairs (NR)	16% from 'minority' ethnic group
Ajjawi (2017)	UK	2014-2015	Mixed methods	Dentists. Academic level and grade not reported	85 in stage 1 questionnaire (46:39) and 649 stage 2 questionnaire (242:407)	Mostly White ethnicity
Amonoo (2019)	USA	2015-2015	Cohort study	Senior residents (post-graduate year 3 or above) and residency training programme directors. Clinical specialities not reported	204 (96 female)	123 White, 47 Asian/Asian American, 5 Black/African American, 13 more than one race, 16 NR. 13/204 did say yes to being Latino or Hispanic
Andriole (2016)	USA	2013-2014	Cohort study	Trainees from mixed specialities, post-doctoral	1846 (1304:542)	1190 White, 480 Asian/Pacific Islander, 164 URM, 12 other/unknown
Andriole (2017)	USA	1997-2014	Cohort study	Trainees from mixed specialities, pre-doctoral and post-doctoral	27521 (57%:43%)	3341 URM

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Athanasiou (2016)	UK	2016-2016	Cohort study	Post-training full professors, specialities NR	104 (70:34)	NR
Ayyala (2019)	USA	2016-2016	Qualitative	Post-training mixed specialty, mixed academic levels	23 (17:6)	4 URM
Aziz (2007)	USA	2004-2004	Cohort study	Post-training, Oral and Maxillofacial surgeons (all dentists but 50% also medics), 1 PhD	48 (NR)	NR
Ballios (2014)	Canada	2011-2011	Cohort study	Trainee and post-training medical and surgical doctors. Mixed academic levels	77 (NR) in clinician investigator programme	NR
Banerjee (2018)	Western Europe	2016-2016	Cohort study	Trainee and post-training medical/ radiation oncologists. Academic level NR	462 analysed (100:330)	NR
Baptiste (2017)	USA	2015-2016	Cohort study	Trainee and post-training surgical clinicians. Mixed academic level	243 (158:76)	NR
Becker (2017)	USA	2015-2015	Cohort study	Mixed speciality trainees and faculty. Academic level NR	47 (21:26) trainees and 26 faculty (19:7)	NR
Beeler (2019)	USA	2016-NR	Cohort study	Post-training radiation oncologist chairs, mixed academic levels	72 (61:10)	53 White, 14 Asian, 3 Black, 2 NR
Bell (2006)	USA	NR-NR	Cohort study	Post-training Obstetrician-Gynaecologists. Academic level NR	75 (50:25) private practice and 53 (40:13) academic physicians	NR
Berlingo (2019)	Western Europe	2016-2018	Mixed methods	Trainee Obstetrician-Gynaecologists. Mixed academic level	204 (34:170) surveys, 8 (0:8) interviews	NR
Biernat (2020)	USA	2015-NR	Cohort study	Post-training. Mixed specialities, academic level NR	1176 (458:609)	737 White non-Hispanic, 171 Asian/Pacific Islander, 159 other URM faculty
Blazey-Martin (2017)	USA	2012-2012	Cohort study	Post-training full professors. Mixed clinical specialities	1214 (610:604)	80% White
Blencowe (2017)	UK	NR-NR	Cohort study	Academic surgical trainees. Mixed academic levels	143 (81% male)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Blood (2012)	USA	2009-2009	Cohort study	Post-training faculty in medicine or dental medicine. Mixed academic levels	1179 (0:1179)	79% White, 3% Black, 2% Hispanic, 15% Asian
Borges (2012)	USA	2010-2010	Qualitative	Post-training academic medicine physicians. Mixed academic levels	53 (0:53)	39 Caucasian, 11 other
Borges (2013)	Mixed	2012-NR	Qualitative	Family/internal medicine physicians. Grade and academic level NR	NR (all female)	Ethnicity included Pakistani, Caucasian, Latino and Mexican
Brod (2017)	USA	2009-2014	Cohort study	Post-training. Specialities included internal medicine and surgery. Mixed academic levels.	533 (63%:37%)	66% White, 5% Black, 29% other (Hispanic, Asian or undisclosed)
Brown (2011)	Canada	2009-2010	Qualitative	Post-training academic surgeons, post-doctoral	17 (8:9)	NR
Bucklin (2014)	USA	2005-2010	Cohort study	Post-training. Mixed academic levels. Specialities NR	77 (44:32) survey respondents	11 Asian, 4 Hispanic, 1 Native American, 60 Caucasian
Buddeberg-Fischer (2008)	Western Europe	2001-2007	Cohort study	Trainee medical school graduates. Academic level NR	406 (196:210)	NR
Buddeberg-Fischer (2009)	Western Europe	2007-2007	Mixed methods	Trainees who were not yet specialised. Pre-doctoral and post-doctoral	31 (25:6) interviews and 404 (198:206) survey	NR
Bunton (2006)	USA	2005-2005	Cohort study	Post-training faculty in basic science and internal medicine. Mixed academic levels	778 completed, 728 analysed	From analysed: 78.4% White, 14.2% Asian, 3.6% Hispanic, 1.5% other, 1.3% Black/African American, 0.5% Native Hawaiian/Pacific Islander, <1% American Indian/Alaska Native
Burkhardt (2011)	USA	2010-2010	Cohort study	Post-training emergency medicine residency directors. Academic level NR	103 (NR)	NR
Burkhardt (2016)	USA	1996-2008	Cohort study	Emergency medicine residents. Academic level NR	377 (251 males)	23 URM

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Calder (2015)	Canada	NR-NR	Cohort study, systematic review	Post-training emergency medicine. Academic level NR	31 (NR)	NR
Calitri (2014)	UK	2013-2013	Cohort study	Post-training primary care academics. Mixed academic levels	217 (65:117 out of 182)	NR
Carr (2009)	USA	2007-2007	Cohort study	Post-training. Mixed clinical specialities and mixed academic levels	96 (43:53)	79% Caucasian/White, 17% African-American/Black, 4% Hispanic/Latino
Carr (2015)	USA	NR-NR	Qualitative	Post-training. Mixed academic levels, specialities NR	44 (22 GWIMS were female, 10 GDI male & 10 GDI female, 2 NR)	GWIMS: 18 Caucasian, 2 Asian, 2 African-American GDI: 4 Caucasian, 2 Asian, 10 African-American, 4 Hispanic
Chaiyachati (2019)	USA	2016-2016	Cohort study	Post-training medical generalists (specialities including internal medicine, paediatrics, family medicine). Academic level NR	162 (58:104)	16 URM
Cheng (2006)	USA	2004-2004	Cohort study	Post-training emergency medicine. Academic level NR	133 (123:10)	NR
Chetta (2018)	USA	2013-2014	Cohort study	Trainee plastic surgeons, mixed academic levels	125 (77 male)	NR
Chinn (2010)*	USA	2008-2008	Cohort study	Paediatric dental residents, academic level NR	67 pre-event; 63 post-event (NR)	NR
Christou (2016)	USA	2014-2015	Cohort study	Neonatology and paediatric critical care medicine. Mixed grade and academic levels included	71 (NR)	NR
Chur-Hansen (2011)	Australia /New Zealand	2008-2008	Cohort study	Trainee and post-training psychiatrists. Mixed academic levels	179 (101:78)	NR
Clough (2017)*	UK	2006-2015	Cohort study	ACF Trainees, mix of specialities, pre-doctoral	1239 quant, 433 survey responses (54%:46%)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Cochran (2013a)	USA	NR-NR	Cohort study	Surgical residents and faculty, post-doctoral	85 residents (41:44) and 69 faculty (43:26)	119 White/Caucasian, 2 African-American, 22 Asian, 8 Hispanic, 1 Pacific Islander
Cochran (2013b)	USA	NR-NR	Cohort study	Surgical residents and faculty, post-doctoral	85 residents (41:44) and 69 faculty (43:26)	119 White/Caucasian, 2 African-American, 22 Asian, 8 Hispanic, 1 Pacific Islander
Cochran (2019a)	USA	2014-2015	Qualitative	Post-training academic surgeons. Mixed academic levels	15 (0:15)	10 Caucasian, 3 African-America, 2 Asian-American
Cochran (2019b)	USA	2014-2015	Qualitative	Post-training academic surgeons. Mixed academic levels	15 (0:15)	10 Caucasian, 3 African-America, 2 Asian-American
Conrad (2010)	USA	NR-NR	Qualitative	Post-training. Mixed clinical specialities and mixed academic levels	96 (55% women)	79% Caucasian/White, 17% African-American, 4% Hispanic/Latino
Cora-Bramble (2010)	USA	2007-2007	Mixed methods	Post-training. Mixed academic levels. Clinical specialities NR	74 (46 female) in survey and 15 were interviews	51 African-American, 15 Latino, 4 multiple-race, 3 Asian
Crawford (2011)	USA	2009-2009	Cohort study	Family medicine residency programme directors, academic level NR	248 (NR)	NR
Cropsey (2008)	USA	2004-2005	Cohort study	Post-training medicine faculty. Mixed academic levels	166 (67.3% male)	77.8% Caucasian
Daldrup-Link (2019)	USA	2018-2018	Cohort study	Post-training radiology faculty. Mixed academic levels	72 (44:28)	44 White, 28 non-white
Daley (2011)*	USA	2010-2010	Cohort study	Post-training, mix of specialities, post-doctoral	12 (6:6)	All URM
Danczyk (2012)	USA	2010-2011	Cohort study	Vascular surgery trainees. Academic level NR	128 (94:34)	68 White, 32 Asian/Indian, 13 Hispanic/Latino, 5 African-American, 2 Native American/Pacific Islander, 2 multiple-race, 6 other-Middle Eastern
Dannels (2009a)*	USA and Canada	2006-2006	Cohort study	Medical school deans	83 (72:11)	NR
Dannels (2009b)*	USA and Canada	2006-2006	Cohort study	Dental school deans	33 (29:4)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Dao (2015)	USA	2012-2012	Cohort study	Post-training. Clinical specialities NR. Mixed academic levels	126 (80:45)	NR
De Jong (2006)	Western Europe	2004-2004	Qualitative	Post-training GPs. Academic level NR	18 (0:18)	NR
DeCastro (2014)	USA	2010-2011	Cohort study	Post-training. Mixed clinical specialities. Academic level NR	1275 completed questionnaires but analytic sample was 1227 (668:559)	854 White, 277 Asian, 87 URM
DeLong (2014)	USA	NR-NR	Cohort study	Post-training plastic surgeons. Academic level NR	624 (519:98)	NR
Desjardins (2010)	USA	2007-2008	Cohort study	Post-training academic rheumatologists. Academic level NR	247 (132:107)	74.9% Caucasian, 15.5% Asian-American, 5.9% Hispanic or Latino American, 1.3% multiethnicity, 0.4% Black or African-American, 2.1% other/unknown
Desjardins (2011)	Canada and USA	2008-2008	Cohort study	Post-training endocrinologists. Academic level NR	817 (403:374)	69% Caucasian, 19% Asian, 6% Hispanic, 3% Black, 3% other
Dev (2008)	USA	NR-NR	Cohort study	Mixed clinical specialities and mixed academic levels. Grade of clinicians NR	384 (294 male)	241 Caucasian, 68 Asian, 19 Hispanic, 13 African-American, 16 other
Dixon (2019)	USA	2016-2017	Qualitative	Paediatric faculty. Mixed academic levels	25 (7:18)	19 African-American, 6 Latino/Hispanic
Doyle (2016)	USA	2014-2014	Cohort study	Post-training psychiatry chairs. Academic level NR	43 (33:10)	35 Caucasian, 4 Asian, 2 African-American, 1 Hispanic, 1 other
Driel (2017)	Australia /New Zealand	2016-2016	Qualitative	Post-training GPs. Mixed academic levels	18 (10:8)	NR
D'Souza (2017)	USA	1999-2012	Mixed methods	Dental-scientists. Grade NR and mixed academic levels	Varying number of participants for different datasets	NR

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Ducrocq (2013)	Western Europe	2013-2013	Cohort study	Trainee interventional cardiologists. Academic level NR	106 (84:22)	NR
Egan (2010)	Canada	NR-NR	Qualitative	Trainee and post-training academics. Mixed specialities and mixed academic levels	16 (5:11)	NR
Ellinas (2018)	USA	2013-2013	Cohort study	Post-training faculty. Mixed academic levels Specialities NR	614 (311:227)	Authors state the majority of participants were White/Caucasian
Ellinas (2019)	USA	2013-2013	Cohort study	Post-training faculty. Mixed academic levels. Specialities NR	614 (311:227)	Majority is White/Caucasian
Englesbe (2011)	USA	2010-2010	Cohort study	Trainee transplant surgery fellows, mixed academic levels	83 (NR)	NR
Fabian (2016)	USA	2013-2014	Cohort study	Mixed grade oncology. Academic level NR	47 (57%:43%) directors and 1306 fellows (53%:47%)	NR
Fallah (2019)	Canada	2015-2015	Qualitative	Mixed grade anaesthesiologists and surgeons. Academic level NR	86 (NR)	NR
Fan (2014)	USA	NR-NR	Cohort study	Trainee orthopaedic surgery residents. Mixed academic levels	60 (56:4)	NR
Farley (2008)	USA	2007-2007	Cohort study	Post-training emergency medicine faculty. Academic level NR	240 (77%:23%)	NR
Fassiotto (2016)	USA	NR-NR	Cohort study	Post-training mixed speciality faculty. Mixed academic levels	174 (66:108)	50% White, 39.7% Asian, 10.3% URM
Fernandez (2016)	Canada	2011-2014	Cohort study	Post-training Obstetrician and Gynaecologists. Mixed academic levels	130 (NR)	NR
Flores (2019)	USA	2018-2018	Modified Delphi	Paediatrics. Grade and academic levels NR	6 (NR)	NR
Frank-Bertoncelj (2014)	Mix of Western and Non-Western Europea	2011-2012	Cohort study	Trainee and post-training rheumatologists. Mixed academic levels	248 (78:170)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
	n countries					
Fridner (2015)	Western Europe	2005-2005	Cohort study	Post-training hospital physicians, mixed academic levels	503 (305:198)	NR
Gadbury-Amyot (2016)	USA	2015-2015	Cohort study	Post-training dental faculty. Academic level NR	537 (0:537)	58.5% White, 8.8% Asian, 6.3% Hispanic, 4.3% Black or African-American, 2.4% mixed race, 0.2% American Indian/Alaska Native, 0.2% Native Hawaiian/Pacific Islander, 19.4% NR
Gandhi (2014)	USA	2014-2014	Case study with survey	Post-training, mixed specialities, post-doctoral	279 (0:279)	77% White
Gazewood (2007)	USA	2004-NR	Cohort study	Post-training in family medicine. Mixed academic levels	94 (52:42)	NR
Girod (2017)	USA	2010-2015	Cohort study	Post-training. Specialities and academic level NR	85 (58:27)	68 White, 8 Asian, 3 Black, 1 Native Hawaiian/Pacific Islander, 1 Hispanic, 2 mixed race, 2 other
Gitlin (2005)	USA	NR-NR	Cohort study	Post-training haematology and medical oncology division directors. Academic level NR	24 programmes (participants unclear)	NR
Goldacre (2011)	UK	2007-NR	Cohort study	Trainee junior doctors on ACF programme. Mixed academic levels	102 (56%:42%)	65% White, 24% Asian, 5% other, 6% not specified
Goldenberg (2007)	USA	2005-2005	Cohort study	Trainees in dermatopathology, mixed academic levels	35 (21:14)	NR
Goudreau (2018)	USA	2017-2017	Cohort study	Post-training general surgeons. Academic level NR	54 (39:15)	45 White, 5 Asian, 4 African-American
Green (2018)	UK	NR-NR	Qualitative	Trainee and post-training. Specialities and academic level NR	Unclear (NR)	NR
Grova (2017)	USA	2013-2013	Cohort study	Trainee general surgery residents. Academic level NR	19 (NR)	NR
Guest (2011)	USA	2009-2009	Cohort study	Post-training cancer surgeons. Academic level NR	72 (NR)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Gunn (2014)	USA	2011-2012	Qualitative	Post-training. Specialities NR and mixed academic levels	22 (0:22)	82% Caucasian, 9% African-American, 9% Asian
Guptill (2018)	USA	NR-NR	Qualitative	Post-training academic emergency medicine department chairs and previous committee presidents. Academic level NR	22 (0:22)	NR
Guttman (2010)	Canada	NR-NR	Qualitative	Trainee paediatricians, mixed academic levels	14 (4:10)	NR
Hagedorn (2019)	USA	2018-2018	Cohort study	Trainees in pain medicine. Academic level NR	45 programmes (NR)	NR
Harris (2008)	USA	NR-2005	Cohort study	Mixed grade otolaryngologists, mixed academic levels	36 (28:8)	NR
Harrison (2009)	USA	2005-2005	Qualitative	Post-training in academic internal medicine, mixed academic levels	7 (0:7) applicants and 6 (6:0) division chiefs	NR
Harrison (2011)	USA	2007-2007	Cohort study	Post-training hospitalist leaders, mixed academic levels	57 (NR)	NR
Hassouneh (2014)	USA	2012-2012	Qualitative	Medical school faculty, grade and specialities NR. Mixed academic levels	29 (14:15)	19 African-American, 5 Latino, 4 Asian-American, 1 Native American. 25 US -born, 4 immigrant
Helitzer (2017)	USA	2012-2012	Qualitative	Post-training. Mixed academic levels, specialities NR	45 (0:45) interviews and 74 (23:51) in focus groups	NR
Hill (2013)	USA	2011-2011	Cohort study	Post-training orthopaedic surgeons, mixed academic levels	164 (0:164)	NR
Hoesli (2013)	Western Europe	2011-2011	Cohort study	Mixed grade academic physicians. Academic level NR	369 (156:211)	NR
Holliday (2015)	USA	NR-NR	Cohort study	Post-training, mixed specialities, mixed academic levels	1267 (685:582)	886 White, 284 Asian, 87 other
Horn (2011)	USA	NR-NR	Cohort study	Post-training hematology and medical oncology fellows and programme directors, mixed academic levels	236 (138:98)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Howell (2015)	USA	2011-2012	Cohort study	Post-training department chairs and faculty in medical pathology	Two surveys: survey 1 - 461 (278:183), survey 2 - 104 (33:9)	Survey 1 - 93.3% White and Asian, survey 2 - 82% White, 5% Asian, 1% African-American, 1% other, 12% NR
Howell (2016)	USA	NR-NR	Qualitative	Post-training chairs of department in pathology, academic level NR	6 (NR)	NR
Isaac (2014)	USA	NR-NR	Qualitative	Internal medicine residents and faculty. Mixed academic levels	52 (28:24)	For 42 respondents: 37 of European descent, 5 of Asian descent
Isaac (2015)	USA	NR-NR	Qualitative	Post-training, full professors. Clinical specialities NR	3 (0:3)	NR
Jagsi (2017)	USA	2010-2014	Cohort study	Post-training. Mixed specialities and mixed academic levels	1066 (573:493)	752 Non-Hispanic White, 233 Asian, 81 other
Jeffe (2019)	USA	2000-2012	Cohort study	Post-training medical school graduates. Mixed academic levels, specialities NR	27219 (14695:12524)	18098 White, 5535 Asian/Pacific Islander, 3213 URM/ethnic minority, 373 other/unknown
Johnson (2017)	USA	2015-2015	Cohort study	Post-training paediatricians, mixed academic levels	58 (29:29)	59% non-Hispanic White, 15% non-Hispanic Black, 6% Hispanic, 2% Asian, 1% other
Jones (2011)	USA	2009-2009	Cohort study	Post-training, mixed specialities. Academic level NR	172 (NR)	NR
Jones (2016)	USA	2010-2011	Mixed methods	Post-training, mixed specialities. Academic level NR	1267 (685:582) quantitative participants and 128 (52:76) qualitative participants	Of the 128 participants, 100 White/Caucasian, 18 Asian/Asian American, 7 Black/African American, 3 Hispanic/Latino, 5 NR (note this adds to more as some participants selected more than one race/ethnicity)
Jones (2018)	USA	2016-2016	Qualitative	Post-training full professors in radiation oncology	24 (unclear)	14 White, 7 Asian/Asian-American, 3 Black/African-American

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Jones (2019)*	USA	2018-2018	Qualitative	Early-career or junior physician-scientists, mixed specialities. Academic level NR	28 (5:23)	11 Non-Hispanic white, 7 Asian, 7 Other, 3 NR
Julien (2014)	USA	NR-NR	Cohort study	Trainees in general surgery. Academic level NR	1217 respondents, of whom 996 (643:351, 2 missing) included in analysis	640 White, 57 Hispanic, 41 Black, 164 Asian, 92 other, 2 missing
Kaderli (2011)	Western Europe	2008-2008	Cohort study	Trainees and post-training surgeons. Academic level NR	189 (0:189)	NR
Kaderli (2015)	Western Europe	2011-2011	Cohort study	Trainees and post-training surgeons. Academic level NR	512 (448:64)	NR
Kaplan (2018)	USA	2011-2012	Mixed methods	Post-training. Mixed academic levels, clinical specialities NR	44 (11:33)	24 White, 12 Black, 4 Hispanic, 4 Asian
Karras (2006)	USA	2004-2005	Cohort study	Post-training emergency medicine research directors. Academic level NR	106 (NR)	NR
Karsy (2019)	USA	2017-2017	Cohort study	Trainee neurosurgical residents, mixed academic levels	278 (NR)	NR
Kass (2006)	USA	2005-2005	Qualitative	Post-training surgeons. Academic level NR	10 (0:10)	NR
Kearney (2007)	Canada	2003-2004	Mixed methods	Post-training, post-doctoral. Clinical specialities NR	473 (398:75) surveys and 12 (NR) in 2 focus groups	NR
Keck (2009)	USA	2007-2008	Mixed methods	Post-training paediatric dentistry, mixed academic level	37 (NR) completed and 21 (NR) partially completed questionnaires. 8 interviews	NR
Kelly (2007)	USA	2005-2005	Cohort study	Post-training academic radiologists, mixed academic levels	38 (25:13)	NR
Keswani (2017)	USA	2015-2015	Cohort study	Mixed grade surgeon-scientists. Academic level NR	1033 (NR)	NR

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Kibbe (2009)	USA	2007-2007	Cohort study	Mixed gade surgical specialties, mixed academic level	555 (441:101)	81.5% White, 9.8% Asian, 4.5% Black/African-American, 2.7% Hispanic/Latino, 0.7% American Indian/Alaska Native, 0.5% Hawaiian/Pacific Islander, 1.5% other
Kin (2018)	USA	NR-NR	Cohort study	Trainees from mixed clinical specialities. Academic level NR	435 (40%:60%)	NR
King (2005)	Canada	NR-NR	Cohort study	Trainees and post-training in paediatrics and internal medicine. Academic level NR	120 (NR)	NR
Kodadek (2016)	USA	2015-2015	Qualitative	Post-training academic surgeons and surgery department chairs. Academic level NR	27 (22:5)	21 Caucasian/White, 4 Asian, 1 Black/African-American, 1 other
Kolokythas (2016)	USA	NR-NR	Cohort study	Post-training oral and maxillofacial surgeons, mixed academic levels	31 (0:31)	NR
Komlenac (2019)	Western Europe	2012-NR	Cohort study	Trainee and post-training academic physicians at university hospitals. Academic level and speciality NR	1333 in total; 111 (60%:40%) Austrian, 204 (40%:60%) Dutch and 1018 (46%:54%) Swedish	NR
Koo (2012)	Canada	2010-2010	Qualitative	Family medicine residents and family physicians. Academic level NR	12 (6:6)	NR
Kowalczyk (2019)	USA	2017-2017	Cohort study	Post-training facial plastic surgeons. Academic level NR	135 (90:14)	NR
Krupat (2017)	USA	2012-2014	Cohort study	Post-training physicians from mixed specialities. Academic level NR	358 (200:148)	285 Non-minority, 58 URM
Kumar (2011)	Australia /New Zealand	NR-NR	Qualitative	Post-training. Clinical specialities and academic level NR	30 (74%:26%)	NR
Kusano (2014)	USA	2011-2012	Cohort study	Radiation oncology chairs. Academic level NR	61 (54:7)	47 White/Caucasian, 9 Asian, 4 Black/African-American, 1 other

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Lalani (2019)	Canada and USA	NR-NR	Cohort study	Post-training radiation oncologists, mixed academic levels	221 (146:75)	NR
Laliberte (2016)	Canada	2013-2013	Cohort study	Psychiatry residents. Academic level NR	205 (62:143)	142 Caucasian
Lambert (2015)	UK	2007-2012	Survey within a cohort but authors state qualitative methods used for analysis	Post-training doctors. Academic level and speciality NR	124 (59:65)	NR
Lander (2010)	Canada	2000-2008	Mixed methods	Post-training mixed speciality groups including immunology. Academic level NR	4522 in quantitative data (NR), 16 (NR) first interview, 10 (NR) second interview	NR
Lanzon (2012)	USA	2010-2010	Cohort study	Oral maxillofacial surgery residents. Academic level NR	257 (163:37)	69% European American, 10% Asian American, 7% Middle Eastern, 4% African American, 3% Hispanic
Leigh (2019)	Canada	2017-2017	Qualitative	Trainees and post-trainees in critical care medicine, mixed academic levels	48 (23:25)	36 non-French Canadian Caucasian, 6 French Canadian Caucasian, 6 other
Levine (2011)	USA	2007-2008	Qualitative	Post-training faculty from different specialities including internal medicine, pathology & psychiatry, mixed academic levels	20 (0:20)	NR
Levy (2018)	Canada	NR-NR	Qualitative	Family medicine faculty within 5 years of first faculty post. Academic level NR	13 (5:8)	NR
Lieff (2013)	Canada	2009-2010	Qualitative	Full professor department chairs in mixed specialities	21 (14:7)	NR

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Lin (2018)	USA	2016-2017	Cohort study	Family medicine residents. Academic level NR	95 (19:76)	57 non-Hispanic White, 16 Asian, 7 Hispanic/Latino, 7 Black/African American, 8 other
Lingard (2017)	Canada	2015-2015	Qualitative (interviews/focus groups), narrative review	Post-training Specialities and academic level NR	16 (NR)	NR
Lopes (2017)	UK	2015-2016	Cohort study	Mixed grade, medically qualified doctoral students	320 (174:142)	NR
Mahoney (2008)	USA	2005-2005	Qualitative	Post-training staff at school of medicine. Mixed academic levels, speciality NR	36 (16:20)	18 African American, 15 Hispanic/Latino, 3 Asian/Pacific Islander
Mascarenhas (2017)	Canada	1999-2016	Mixed methods	Post-training, academic levels mixed. Specialities NR	206 (144:61) quantitative data and 21 (10:11) interviews	NR
McCarthy (2016)	Canada	NR-NR	Mixed methods	Post-training. Specialities and academic levels NR	57 (NR)	NR
McDonald (2012)	Australia /New Zealand	2011-2011	Cohort study	Trainees in obstetrics and gynaecology. Academic level NR	58 (12:46)	NR
McFarlane (2019)	UK	2007-2016	Cohort study	Gastroenterology trainees, pre-doctoral	452 (195:79 in 2007 & 111:67 in 2016)	NR
McLaughlin (2019)	USA	2017-2017	Qualitative	Mixed grade paediatric surgeons. Academic level NR	14 (NR)	NR
McLean (2013)	USA	2009-2009	Cohort study	Post-training mixed specialities, mixed academic levels	351 (0:351)	NR
McMains (2018)	USA	NR-NR	Cohort study	Post-training mixed specialities including internal medicine and paediatrics. Academic level NR	104 (70:34)	NR

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Meyer (2019)	USA	NR-NR	Qualitative	Post-training in otolaryngology. Academic level NR	20 (0:20)	NR
Michelson (2020)	USA	2016-2016	Cohort study	Trainees in paediatric emergency medicine, mixed academic levels	231 (145 female)	NR
Mills (2019)	Australia /New Zealand	2014-2014	Cohort study	Trainees and post-training, mixed academic levels. Specialities NR	427 (238:189)	NR
Mumma (2017)	USA	2016-2016	Cohort study	Post-training in emergency medicine, mixed academic levels	103 (NR)	NR
Myint (2006)	UK	2004-2004	Cohort study	Trainees in geriatric medicine. Academic level NR	122 (NR)	NR
Mylona (2016)	USA	2011-2014	Cohort study	Post-training in mixed specialities, mixed academic levels	12779 (7721:5058)	11313 'majority' ethnic group; 1037 from a 'minority' ethnic group. ('Majority' refers to respondents reported as Asian or White; 'Minority' refers to respondents reported as American Indian or Alaska Native, Black or African American, Native Hawaiian or other Pacific Islander, or Hispanic, Latino or of Spanish origin)
Nazarova (2016)	USA	2013-2013	Cohort study	Trainees in dentistry. Academic level NR	287 (159:112)	NR
Oakley (2013)	UK	NR-NR	Cohort study	Trainees and post-training in psychiatry, mixed academic levels	25 heads of department and 127 (57:70) trainees	NR
Oandasan (2013)	Canada	NR-NR	Qualitative	Post-training family medicine. Academic level NR	30 (13:17)	NR
Ogdie (2015)	USA	2014-2014	Cohort study	Post-training academic rheumatologists, mixed academic levels	430 (241 females)	28 URM (Black, Hispanic or Native American)

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Ogdie (2018)	USA	2015-2016	Mixed methods	Mixed grade rheumatologists, mixed academic levels	25 (NR) interviews/focus groups, 187 (72:115) surveys	NR
Onyura (2015)	Canada	2012-2012	Qualitative	Post-training academic physicians. Academic level NR	21 (15:6)	NR
Park (2013)	USA	NR-NR	Cohort study	Post-training in orthopaedic spine surgery. Academic level NR	203 (201:2)	NR
Patel (2015)	UK	2013-2013	Cohort study	Dental clinical academic trainees, mixed academic levels	37 (14:23)	NR
Pattani (2018)	Canada	2016-2016	Qualitative	Post-training in mixed medical specialities, mixed academic levels	43 (14:29)	NR
Paulus (2016)	USA	2012-2012	Cohort study	Post-training in medicine, mixed academic levels	106 (58:39)	NR
Peek (2013)	USA	2009-2009	Mixed methods	Post-training chairs of departments of medicine, mixed academic levels	82 (NR) survey and 18 (NR) interviews	All URM (African American, Native American/American Indian, Mexican American, mainland Puerto Rican or other Asian subgroups)
Perry (2015)	Canada	2013-2014	Cohort study, systematic review	Post-training mixed clinical specialities, mixed academic levels	67 (NR)	NR
Phillips (2019)	USA	2014-2015	Cohort study	Family medicine residents. Academic level NR	6229 (2788:3411)	83% non-URM and 17% URM (American Indian or Alaska Native, Black or African American, Native Hawaiian/Pacific Islander, or Hispanic/Latino)
Pingleton (2016)	USA	2013-2013	Qualitative	Post-training full professors in mixed specialities	26 (0:26)	NR
Pitigoi-Aron (2011)	USA	2007-NR	Mixed methods	Post-training dentists, mixed academic levels	31; 30 (15:15) completed 'supplementary free' questions).	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
					Interviews conducted with 10	
Pollart (2015)	USA	2011-2012	Cohort study	Post-training mixed specialities, mixed academic levels	9600 (5960:3640) in total but subset focused on 6342 (3977 males)	8849 White or Asian, 750 were minority
Pololi (2009)	USA	2006-2007	Qualitative	Post-training, mixed academic levels. Specialities NR	96 (55% women)	79% Caucasian/White, 17% African American/Black, 4% Hispanic/Latino
Pololi (2010a)	USA	2006-2007	Qualitative	Post-training, mixed academic levels. Specialities NR	96 (55% women)	79% Caucasian/White, 17% African American/Black, 4% Hispanic/Latino
Pololi (2010b)	USA	2006-2007	Qualitative	Post-training, mixed academic levels. Specialities NR	96 (55% women)	79% Caucasian/White, 17% African American/Black, 4% Hispanic/Latino
Pololi (2012)	USA	2007-2009	Cohort study	Post-training, mixed academic levels. Specialities NR	1994 (1062 female)	475 URM (American Indian/Alaska Native, Black/African American, Hispanic/Latino, Native Hawaiian or other Pacific Islander)
Pololi (2013)	USA	2007-2009	Cohort study	Post-training, mixed academic levels. Specialities NR	2218 (1172 female)	512 URM (includes American Indian or Alaskan Native, Black or African American, Hispanic/Latino, Native Hawaiian or other Pacific Islander)
Purdy (2017)	USA	2017-2017	Cohort study	Post-training physicians, mixed academic levels	125 (0:125)	107 White, 10 Asian, 3 Black, 1 Hispanic, 3 other, 1 missing
Ragsdale (2014)	USA	NR-NR	Qualitative	Post-training paediatric hospitalists and general paediatricians, mixed academic levels	26 (12:14)	24 White, 2 Asian American

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Ranieri (2018)	UK	2015-2016	Qualitative	Trainee academic physicians in mixed specialities, doctoral	35 (21:14)	NR
Robinson (2016)	USA	2013-2014	Qualitative	Post-doctoral. Grade and specialities NR	40; 20 with independent funding (10:10)	28 White, 7 Asian, 1 Africna American, 4 NR
Roger (2008)	USA	2006-2007	Qualitative	Post-training dentists, mixed academic levels	69 (45:24)	NR
Rosenkrantz (2019)	USA	2017-2017	Cohort study	Post-training medical radiologists, mixed academic levels	89 (0:89)	NR
Roth (2007)	USA	NR-NR	Qualitative	Practice-based researchers. Specialities and academic level NR	11 (NR)	NR
Ryan (2019)	USA	2014-2014	Qualitative	Departments of family medicine. Grade and academic level NR	32 (NR)	NR
Salas-Lopez (2011)	USA	NR-NR	Qualitative	Post-training medics. Academic level NR	8 (0:8)	1 Caucasian, 4 Latina, 1 Asian, 2 African American
Sambuco (2013)	USA	2010-2011	Qualitative	Post-training in academic medicine. Academic level mixed	128 (52:76)	99 White/Caucasian, 7 Black/African American, 18 Asian/Asian American, 3 Hispanic/Latino
Sanchez (2015)	USA	2013-NR	Mixed methods	Mixed speciality healthcare professionals, mixed academic levels	252 (126:120)	184 White, 28 Asian, 24 Hispanic, 19 Black, 7 other. All participants identified as LGBT
Santilli (2008)	USA	2003-2005	Qualitative	Post-training surgeons. Academic level NR	42 (NR)	NR
Sarraf (2011)	USA	2007-2007	Cohort study	Oral and maxillofacial surgery residents. Academic level NR	44 (NR)	NR
Saunders (2008)	Australia /New Zealand	2007-2007	Cohort study	Mixed grade and mixed academic level in surgery, specialities NR	89 (0:89)	NR
Schwarz (2016)	Western Europe	2014-2014	Cohort study	Trainee and post-training surgeons, mixed academic levels	133 (70:63)	NR
Seemann (2016)	Canada	NR-NR	Cohort study	Post-training academic surgeons, mixed academic levels	81 (0:81)	NR

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Shauman (2018)	USA	2010-2010	Qualitative	Post-training, mixed academic levels. Speciality NR	213 (113:100)	174 White, 23 Asian/Asian American, 2 African American
Shea (2011)	USA	2009-2010	Cohort study	Post-training internal medicine chairs and clinical and translational science directors. Academic level NR	89 (NR) in total; 66 chairs, 23 directors	NR
Shollen (2014)	USA	2005-2005	Cohort study	Medical school faculty with mixed specialities, mixed academic levels	354 (238:111)	255 White, 34 Asian, 3 Black, 2 Native American, 8 Hispanic, 4 other
Silberman (2012)	USA	NR-NR	Cohort study	Psychiatry trainees, academic level NR	127 (51.6% women)	NR
Silcox (2006)	Canada	2003-2004	Cohort study	Trainee anaesthesiologists. Academic level NR	283 (NR) residents and 15 programme directors	NR
Silver (2015)	Canada	2014-2014	Qualitative	Post-training academic physicians, mix of specialities, mixed academic levels	16 (8:8)	NR
Silver (2017)	Canada	2014-2015	Mixed methods	Post-training mixed specialities, mixed academic levels	25 (15:10) in focus groups, 362 (218:144) survey data and 26 (NR) interviewees	NR
Silver (2018)	Canada	2008-2015	Qualitative	Post-training departments of medicine, academic level NR	25 (15:10) in focus groups and 53 (30:23) in interviews	NR
Skarupski (2020a)	USA	2017-2017	Cohort study	Post-training mixed faculty including basic scientists, mixed academic levels	2126 (1425:697)	1841 White, 131 Asian, 55 Hispanic/Latino/Spanish, 28 Black or African, 30 other mixed race/ethnicity
Skarupski (2020b)	USA	2017-2017	Cohort study	Post-training faculty affairs deans and leaders, academic level NR	84 (NR)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Stearns (2013)	USA	2012-2012	Cohort study	Post-training family medicine, mixed academic levels	766 (478:260)	681 White, 15 African American, 15 Asian, 50 unreported
Steele (2013)	Canada	NR-NR	Mixed methods	Mixed speciality medical faculty, mixed academic levels	202 (129:73)	NR
Steen (2019)	USA	2015-2015	Cohort study	Surgical faculty. Academic level NR	757 (NR)	NR
Steger (2009)	Western Europe	2005-2005	Cohort study	Mixed specialty hospital physicians. Academic level NR	393 (220:173)	NR
Steinbock (2016)	Western Europe	1992-2012	Mixed methods	Post-training medical faculty. Academic level and speciality NR	1244 (929:315) quantitative data but unclear for interviews	NR
Steiner (2012)	USA	NR-NR	Cohort study	Anesthesiology trainees. Academic level NR	537 (331:206)	NR
Stoykov (2017)	USA	NR-NR	Cohort study	Post-training, mixed academic levels. Specialities NR	44 (20:24)	NR
Strong (2013)	USA	2010-2011	Qualitative	Post-training mixed specialities, mixed academic levels	128 (52:76)	99 White/Caucasian, 7 Black/African-American, 3 Hispanic/Latino, 18 Asian/Asian-American, 5 not reported (note adds more than 100% because participants were allowed to select more than one ethnicity)
Sullivan (2008)	UK	NR-NR	Mixed methods	Trainee and post-trainees in mixed medical specialities, mixed academic levels	Unclear (NR)	NR
Tacconelli (2012)	Western Europe	2011-2011	Cohort study	Trainee and post-training clinical microbiologists & infectious disease professionals, mixed academic levels	1274 (490:784)	NR
Thompson-Burdine (2019)	USA	2017-2017	Qualitative	Post-training surgeons, academic level NR	26 (0:26)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Thomsen (2006)	Western Europe	2004-2004	Qualitative	Trainee and post-training primary care medical researchers, mixed academic levels	33 (21:12)	NR
Tierney (2011)	USA	2009-2009	Cohort study	Post-training Mohs surgeons, academic level NR	455 (334:121)	NR
Titus (2009)	USA	NR-NR	Cohort study	Post-training paediatric emergency medicine clinicians, academic level NR	39 (NR)	NR
Tong (2014)	USA	2013-2013	Cohort study	Post-training cardiologists, academic level NR	218 (71% men)	NR
Trotman (2007)	USA	2007-2007	Cohort study	Post-training dentists, mixed academic level	1748 (66%:34%)	81% Caucasian, 7% Asian, 7% Hispanic & 3% African American
Van den Brink (2011)	Western Europe	2004-2006	Mixed methods	Participants were recruitment scouts for professors	21 for interviews (11:10)	NR
Vargas (2020)	USA	2018-2018	Cohort study	Post-training, clinicians of mixed specialities and mixed academic levels	705 (358:336) (1 neither)	537 White, 85 Asian/Asian American/Pacific Islander, 16 Hispanic/Latino, 16 multiracial/multiethnic, 12 Black/African American, 11 Middle Eastern, 1 Native American/American Indian, 8 none of these categories
Wagner (2005)	USA	NR-2005	Cohort study	Post-training rehabilitation researchers, mixed academic levels	186 in total: 54 (74.1%:25.9%) researchers and 132 (54.2%:45%) academicians	Researchers: 85.2% White, 14.8% other. Academicians: 73.3% White, 26.7% other
Wai (2014)	USA	2011-2012	Cohort study	Post-training surgeons of mixed specialities, mixed academic levels	1308 (1038:270)	93% were from a 'majority' ethnic group (defined as White or Asian)
Walensky (2018)	USA	2016-2016	Cohort study	Post-training, clinical speciality NR; mixed academic levels	553 (308:245)	Grouped as minority vs non-minority (White/Asian): 514:33 respectively

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Waljee (2015)	USA	2008-2012	Cohort study	Post-training, mixed specialities and mixed academic levels	3003 - averaged 1351 2008 = (460:265) 2010 = (481:320) 2012 = (420:286)	2008=556 White, 142 non-White; 2010=590 White, 204 non-White; 2012=539 White, 164 non-White (Non-white consists of Arab, Asian, Black/African American, Hispanic/Latino, and multiple ethnic groups
Warner (2016)	USA	2008-2012	Cohort study	Post-training, mixed specialities, post-doctoral	5787 (3233:2554)	1132 Asian/Pacific Islander, 360 URM (African-American, Hispanic, Native American), 4152 White
Webster (2016)	Canada	NR-NR	Qualitative	Post-training surgeons. Academic level NR	12 (0:12)	NR
Welch (2017)	USA	2014-2014	Cohort study	Post-training emergency medicine clinicians, full professors	39 (35% female)	9.2% minority faculty
White (2016)	Canada	2011-2011	Cohort study	Post-training family medicine. Academic level NR	687 (363:324)	444 White, 45 Chinese, 63 South Asian, 61 other
Wiley (2013)	USA	2012-2012	Cohort study	Trainees in paediatrics. Academic level NR	29 program directors, 96 completed fellowships (NR)	NR
Wingard (2008)	USA	2005-NR	Qualitative	Post-training. Clinician specialty & academic level NR	30 (18:12)	18 URM participants: 11 Hispanics, 5 African-Americans, 1 American-Indian, 1 Pacific Islander
Wyrzykowski (2006)	USA	NR-NR	Cohort study	Post-training academic surgeons, mixed academic levels	270 (0:270)	NR
Yehia (2014)	USA	2010-NR	Mixed methods	Trainees, mixed specialities (primary & non-primary care). Academic level NR	183 (83:95) surveys and 48 (24:22) focus groups	75 Black/African American, 32 Hispanic/Latino, 85 White, 39 Asian/other
Young (2007)	USA	NR-NR	Cohort study	Post-training, family medicine. Academic level NR	298 (NR)	NR

First author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics involved	Number of participants (Male:Female)	Ethnicity
Zetrenne (2008)	USA	2005-2005	Cohort study	Post-training plastic surgeons. Academic level NR	144 (NR)	NR
Zhang (2015)	USA	2013-2013	Cohort study	Post-training surgeons in dermatology, mixed academic levels	236 (NR)	NR

Key: ACF - Academic Clinical Fellowship; GDI - Group on Diversity and Inclusion; GP - General Practitioner; GWIMS - Group on Women in Medicine and Science; NR - not reported; UK – United Kingdom; URM - Underrepresented Minorities (study defined); USA – United States of America. *study also included in the interventions study characteristics table

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Appendix 3: Table of study characteristics for studies exploring interventions to increase recruitment, retention and progression through clinical academic careers

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Studies included within quantitative analysis										
Brandt (2018)	USA	NR- NR	Cohort study. Concurrent & historical control	Orthopaedic surgery residents, academic level NR	329 (NR)	NR	Mentorship programme - junior mentee/senior mentor, Protected research time	Trainees	No	Single centre
Chang (2016)	USA	1988-2009	Cohort study. Concurrent control.	Clinically mixed group, post-training, range of academic levels	65099, of which 3268 in intervention group	NR	Leadership training, Faculty career development program, Not described in detail for individual programs. EWIM & MWIM programs focus on academic skills development; ELAM is leadership training	Junior Faculty, Managers/ leaders/ senior faculty	Gender	National
Daley (2006)	USA	NR- 2005	Cohort study. Concurrent & historical control	Mixed group of faculty (medical, surgical, psychiatry, GP), mixed academic levels	112 (48:64)	15 URM (Hispanic/ Latinos, African Americans, American Indians/ Alaska Natives and Native Hawaiian/ other Pacific Islanders)	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Leadership training, Faculty career development programme, Networking/ collaboration/ social activities, Academic performance counselling	Junior Faculty	Ethnicity, URM	Single centre
Dannels (2008)	USA	2002-2006	Cohort study. Concurrent control	Post-training, post-doctoral. Speciality NR.	250 (0:250)	NR	Leadership training	Managers/ leaders/ senior faculty	Gender	Single centre
Ehlers (2018)	USA	2018-2018	Cohort study. Concurrent control	Pre-doctoral fellows in cardiovascular diseases, gastroenterology and hepatology/ oncology	140 (76:64)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Teaching is focused on research training. E.g. research methods, protocol development, grant writing and manuscript writing,	Trainees, Junior Faculty	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							statistics and epidemiology. Also complete a mentored research project.			
Emans (2008)	USA	2006- NR	Cohort study. Historical control	Academic paediatric faculty. Academic level NR	238 (54%:46%)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Leadership training, Networking/ collaboration/ social activities, 'Community of mentors'. Work-life balance, cultural competency and diversity initiatives	Junior Faculty	Gender, Ethnicity	Single centre
Goldenberg (2012)	USA	NR- NR	Case control. Concurrent control	Trainees in academic haematology/ oncology. Academic level NR	20 (10 females)	NR	Mentorship programme - junior mentee/ senior mentor	Trainees	No	National
Grisso (2017)	USA	2010- NR	Multi-faceted cluster randomised intervention trial.	Assistant professors, speciality NR	132 (0:132)	7.6% African American, 60.3% White, 27.5% Asian, 4.6% Hispanic/ other.	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Grant writing programme, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Manuscript writing programme, also included a "Total Leadership Programme" which address work-life integration/ balance.	Junior Faculty	Gender	Single centre
Harrison (2020)	USA	2007-2017	Cohort study. Historical control	General surgery residents, academic level NR	203 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Annual milestones, research meetings and feedback on completing research projects	Trainees	No	Single centre
Joshua Smith (2014)	USA	NR-NR	Cohort study. Concurrent control	General surgery trainees. Academic level NR	68 (NR)	NR	Research training; Protected research time	Trainees	No	Single centre
Khot (2011)	USA	2007-2007	Cohort study. Concurrent control	Post-training, post-doctoral. Speciality not reported	1577 NIH associates (4 female) who entered academic medicine; 27821 non-associates	NR	Teaching sessions/ lectures, Protected research time, Little detail reported.	Trainees	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Klimas (2017)	Canada	2014-2014	Cohort study. Concurrent control	Trainees in internal medicine, family medicine, public health, psychiatry, mix of academic levels	8 (3:5)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures	Trainees	No	National
Kohlwes (2016)	USA	NR- NR	Cohort study. Concurrent control	Post-training in internal medicine. Academic level NR.	169 (88:81)	88 white, 1 black, 31 Asian Indian, 28 Asian Other, 12 Hispanic, 6 Other	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Participants conduct research projects. Salary support provided for PRIME director and associate director	Trainees	No	Single Centre
Kohlwes (2006)	USA	2001-2004	Cohort study. Concurrent control	Trainees in internal medicine. Academic level NR.	32 (NR)	NR	Mentorship programme - junior mentee/senior mentor, Teaching sessions/ lectures, Protected research time, Small group journal clubs; work in progress sessions; conduct a clinical research project.	Trainees	No	Single Centre
Libby (2016)	USA	2000-2011	Cohort study. Concurrent control	Faculty from many disciplines of medicine/surgery as well as disciplines outside medicine. Post-doctoral.	25 CFSP scholars; 125 comparison faculty (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Teaching sessions/ lectures, Protected research time	Junior Faculty	No	Single centre
Löwe (2008)	Western Europe	2005-2006	Cohort study. Concurrent control	Trainees from Internal Medicine, psychotherapy, psychosomatics, psychiatry, psychology. Academic level NR	44 (17:27)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Teaching sessions held as part of a 'clinical research methods' course. Participants also conducted an individual research project.	Trainees	No	Single centre
Mandel (2018)	USA	NR- NR	Cohort study. Historical control	Post-training plastic surgeons, academic level NR	28 (24:4)	NR	Teaching sessions/lectures, Protected research time, 1-2 year research fellowship, senior mentorship.	Trainees	No	Single centre
Merani (2014)	Canada	1988-2012	Cohort study. Concurrent control	General surgery residents, mixed pre-doctoral and doctoral	323 (NR)	NR	Research training	Trainees	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Mills (2011)	USA	Post 2007-NR	Cohort study. Concurrent control	Paediatric residents and fellows, academic level NR	526 (197:297)	NR	Departmental research day at which paediatrics trainees present submitted research and other scholarly work.	Trainees	No	Single centre
Nasab (2019)	USA	2018-2018	Cohort study. Concurrent control	Obstetricians & Gynecologists, trainees and post-training, range of academic levels	109 attended, 94 pre-course survey, 74 post course survey (NR)	63% white, 9% black, 5% Asian, 3% other, 20% did not disclose	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/lectures, Leadership training, Networking/ collaboration/ social activities, Particular sessions included mock interviews, CV reviews, and grant writing support. 60-minute interactive sessions. Participants also given the opportunity to submit their grant proposals.	Trainees, Junior Faculty	No	Single Centre
Ockene (2017)	USA	NR- NR	Cohort study. Concurrent control	Post-doctoral, post-training, primary care physicians	32 (11:21)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Teaching sessions/ lectures, Networking/ collaboration/ social activities	Junior Faculty	No	Single centre
Patel (2018)	USA	2011-2016	Cohort study. Historical control	General surgery residents and faculty mentors, Mentors post-doctoral	67 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Completion of a defined clinical research project. Other didactic activities included: active participation in the department's weekly clinical research meeting; attend lab meetings with faculty research mentor. Webinars on research and grant writing.	Trainees	No	Single centre
Ries (2012)	USA	Post 2005-2006	Case control. Concurrent control	Assistant professors from mixed specialities	315 (152:163)	26 URM (Hispanic, African American, American Indian)	Mentorship programme - junior mentee/ senior mentor, Networking/ collaboration/ social activities, Faculty career development programme, Performance counselling sessions	Junior Faculty	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Ries (2009)	USA	1988-2006	Cohort study. Concurrent control	Assistant professors in school of medicine. Speciality NR.	839 (520-319)	52 URM (Hispanic, African American and American Indian)	Mentorship programme - junior mentee/ senior mentor, Networking/ collaboration/ social activities, Professional development workshops, performance counselling sessions	Junior Faculty	No	Single centre
Sheridan (2010)	USA	2000-2008	Cohort study. Concurrent control.	Post-training. Speciality NR. Academic level NR.	163 (NR)	NR	Recruitment training (e.g. to reduce bias in interviews)	Junior Faculty, Managers/ leaders/ senior faculty	Gender, Ethnicity, "Individuals from any group that has been historically underrepresented on the faculties of academic health centres"	Single centre
Sweeny (2019)	AUS/ NZ	2015-2018	Cohort study. Historical control	Emergency Medicine, grade and academic level NR	33 Emergency departments (NR)	NR	Networking/ collaboration/ social activities, research support	Clinical researchers in hospital departments	No	National
Valantine (2014)	USA	2011-2011	Cohort study. Concurrent control	Post-training, post-doctoral, speciality NR	Varying number of participants over several time periods	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Leadership training, Protected research time, Networking/ collaboration/ social activities, McCormick faculty awards, Faculty Fellows leadership program - individualised career development planning, skill building workshops, and the Women's faculty networking program. Intervention involved a series of programmes.	Junior Faculty, Managers/ leaders/ senior faculty	Gender	Single centre
Winn (2018)	USA	2013-2016	Cohort study. Historical control	Internal medicine and paediatrics trainees, academic level NR	48 (NR)	NR	Mentorship programme - junior mentee/senior mentor, Mentorship programme - peers, Teaching	Trainees	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							sessions/lectures, Protected research time, “scholarly homes”			
Studies included within qualitative analysis										
Archibald (2017)	Canada	2013-2013	Qualitative	Physicians in family medicine, academic level NR	14 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Protected research time, Assistants and coordinators provide resources and research support, networking/ collaboration/ social activities	All faculty staff	No	Single centre
Caffrey (2016)	UK	2015-2015	Qualitative	Medical school staff, grade NR, mixed academic levels	31 (NR)	NR	Athena SWAN programme	Trainees, Junior Faculty, Managers/ leaders/ senior faculty, Relevant to whole of department	Gender	National
Comeau (2017)	USA	2007-2014	Mixed methods. Quantitative work had no control	Trainees and post-training, mix of specialities, mix of academic levels	46 (16:30)	22 White, 24 Minority (includes 10 URM, including Black, African-Americans, Hispanics or Latinos, American Indians or Alaska Natives, Native Hawaiians and other Pacific Islanders)	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time	Junior Faculty	No	National
Darbyshire (2019)	UK	2014-2014	Mixed methods. Quantitative work had no control	AFP Trainees (survey) and post-training (interviews), mix of specialities, pre-doctoral	34 survey; 7 interviews (NR)	NR	Research training programme; protected research time	Trainees	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
DeCastro (2013a)	USA	2010-2011	Qualitative	Post-training, mix of specialities, mixed academic levels	128 (52:76)	99 White, 7 Black, 3 Hispanic, 18 Asian	Mentorship programme - junior mentee/senior mentor, protected research time, funding award	Junior Faculty	No	National
DeCastro (2013b)	USA	2010-2011	Qualitative	Post-training, mix of specialities, mixed academic levels	128 (52:76)	99 White, 7 Black, 3 Hispanic, 18 Asian	Mentorship programme - junior mentee/senior mentor, protected research time, funding award	Junior Faculty	No	National
Hayward (2011)	Canada	2008-2008	Mixed methods. Quantitative work had no control	Trainees and post-training, mix of specialities, mix of academic levels	211 (survey); 13 (qualitative) (NR)	NR	Teaching sessions/ lectures, Protected research time, Mentorship programme - junior mentees/ senior mentors	Trainees	No	National
Helitzer (2016)	USA	2011- NR	Qualitative (Part of a larger mixed methods study but only qualitative findings reported in this paper.)	Post-training, mix of specialities, mixed academic levels	45 (0:45)	NR	Not described in detail for the three programmes separately. EWIM & MWIM held over three days and involved skills and confidence building. ELAM programme was leadership training. All three are faculty career development programmes.	Junior Faculty, Managers/ leaders/ senior faculty	Gender	National
Iversen (2014)	UK	2010-2010	Mixed methods. Quantitative work had no control	Post-training, mix of specialities, academic level unclear	147 mentees (67% male) & 77 mentors (81% male)	NR	Mentorship programme - junior mentee/ senior mentor	Junior Faculty	No	National
Jones (2019)*	USA	2018-2018	Qualitative study	Early-career or junior physician-scientists, range of specialities, academic level NR	28 (5:23)	11 Non-Hispanic white; 7 Asian; 7 Other; 3 NR	Funding award, Some institutions have also provided access to other forms of support, such as leadership development training, training in academic and career development skills, and/or networking.	Junior Faculty	No, but 85% of awardees are women and tailored more towards those with extraprofessional caregiving demands	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Klimas (2017a)	Canada	2015-2015	Qualitative	Fellowship in addiction medicine. Trainees from Psychiatry, Internal Medicine, and Family Medicine; staff and teaching faculty including Nursing & Social Work. Academic level NR	26 (12:14)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, specialty training	Trainees	No	Single centre
Klimas (2017b)	Canada	2015-2015	Qualitative	Fellowship in addiction medicine. Trainees from Psychiatry, Internal Medicine, and Family Medicine; staff and teaching faculty including Nursing & Social Work. Academic level NR	26 (12:14)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, specialty training	Trainees	No	Single centre
Kraemer (2018)	USA	2014-2016	Mixed methods. Quantitative work had no control	Residents and fellows in medical specialities. Academic level NR	69 (41 residents, 28 fellows)	NR	Teaching sessions/ lectures, Faculty career development programme	Trainees	No	Single centre
Lin (2019)	USA	Post 2009-NR	Qualitative	Post-training, post-doctoral, emergency medicine	17 (0:17)	12 Caucasian; 4 Asian American; 1 African American.	Mentorship programme - junior mentee/ senior mentor, Networking/ collaboration/ social activities, skill enhancement, e.g. negotiating skills	Junior Faculty, Managers/ leaders/ senior faculty	Gender	National
Moss (2008)	Canada	2005-2005	Qualitative	Lecturers and assistant professors in Psychiatry	10 (6:4)	NR	Mentorship programme - peers	Junior Faculty	No	Single centre
Reader (2015)	USA	2009-2009	Mixed methods. Quantitative work had no control	Post-training, speciality NR, mix of academic levels	10 (2:8)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peer, Teaching sessions/ lectures, Protected research time, Faculty career development programme	Junior Faculty, Managers/ leaders/ senior faculty	Designed for “busy clinician educators”	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Stubbe (2008)	USA	NR- NR	Qualitative	Academic Child and Adolescent Psychiatry Residents. Academic level NR	5 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time	Trainees	No	Single centre
Studies included within both quantitative and qualitative analysis										
Campion (2016)	USA	2014-2014	Mixed methods. Quantitative work had concurrent control	Post-doctoral, clinical faculty and school of public health faculty	16 in intervention group (>60% women) 25 people in reference group	30% URM	Mentorship programme - peers, Teaching sessions/ lectures, Protected research time, Networking/ collaboration/ social activities	Junior faculty	No	Single centre
Guevara (2018)	USA	NR- NR	Mixed methods. Quantitative work had concurrent control	Medical residents, junior staff and assistant profs. Academic level unclear	124 (65:59)	91 African American, 29 Hispanic Latino, 4 Native American	Funding award	Trainees, Junior Faculty	Ethnicity, URM	National
Quantitative studies with no control group										
Ahmad (2013)*	USA	2010-2011	Cohort study. No control	Residency program chairs and directors in anesthesia	96 (NR)	NR	Teaching sessions/ lectures, Protected research time	Trainees	No	National
Badawy (2017)	USA	2013-2014	Cohort study. No control	Paediatric haematology/oncology trainees and early career post-training. Academic level NR	40 (15:25)	NR	Mentorship programme - junior mentee/ senior mentor	Trainees, Junior Faculty	No	National
Bauman (2014)	USA	NR- NR	Cohort study. No control	Faculty in medicine and health sciences, academic level unclear	Varying number of participants over time (0%:100%)	NR	Mentorship programme - junior mentee/ senior mentor, Leadership training, Networking/ collaboration/ social activities, Salary support	Trainees, Junior faculty	Gender	Single centre
Berman (2016)	USA	NR- 2015	Cohort study. No control	Post-training rheumatologists, mix of academic levels	60 (47%:53%)	NR	Funding award, Protected research time, Mentorship programme - peers	Junior Faculty, Managers/ leaders/ senior faculty	No	Single centre
Bernstein (2018)	USA	NR- NR	Cohort study. No control	Orthopaedic surgery residents, fellows and young faculty,	229 (196:33)	NR	Career development program	Trainees, Junior faculty	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
				mix of academic levels						
Bhatia (2015)	Canada	NR- NR	Cohort study. No control	Emergency medicine residents, academic level NR	NR (NR)	NR	Mentorship programme - junior mentee/ senior mentor, networking/ collaboration/ social activities, online repository of resources for the residents	Trainees	Gender	Single centre
Bhattachary a (2011)	USA	NR- NR	Cohort study. No control	General surgery trainees, mix of academic levels	73 (NR)	NR	Protected research time	Trainees	No	Single centre
Burns (2015)	USA	2003-2012	Cohort study. No control	Haematology trainees, mix of academic levels	140 (63:77)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Faculty career development programme	Trainees, Junior Faculty	No	National
Butler (2010)	USA	NR- 2009	Cohort study. No control	General surgery residents, mix of academic levels	76 (NR)	All URM	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures	Trainees	URM	Unclear
Byington (2016)	USA	2008-2015	Cohort study. No control	Early career faculty in paediatrics and health sciences. Post-doctoral	116 (45%:53%)	11.6% URM	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Grant writing programme, Teaching sessions/ lectures, Leadership training	Junior Faculty	No	Single centre
Cable (2013)	USA	2008-2011	Cohort study. No control	Post-training medical, academic level NR	16 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Protected research time, Networking/ collaboration/ social activities, Manuscript writing workshops with evening dinners for opportunities to review progress and modifications	Junior Faculty	No	Single centre
Carlson (2016)	USA	NR- 2015	Cohort study. No control	Post-training cardiovascular medicine. Mix of academic levels	162 grants (NR). No. of grants may not correspond with no. of unique participants	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Protected research time	Trainees	No	National
Chen (2016)	USA	2007-2014	Cohort study. No control	Paediatric instructors and assistant professors	211 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Grant writing programme, Teaching sessions/ lectures, Networking/ collaboration/ social activities	Junior Faculty	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Chinn (2010)*	USA	2008-2008	Cohort study. No control	Paediatric dental residents, academic level NR	67 pre-event; 63 post-event (NR)	NR	Interactive presentations and exercises. Presentations focused on leadership opportunities in organized dentistry, private practice, and oral health policy, as well as a hands-on opportunity to debate current oral health issues	Trainees	No	Regional
Clough (2017)*	UK	2006-2015	Cohort study. No control	ACF Trainees, mix of specialities, pre-doctoral	1239 quant, 433 survey responses (54%:46%)	NR	Funding award, Teaching sessions/ lectures, Protected research time, Bursary for participants to attend scientific meetings and conferences.	Trainees	No	National
Cranmer (2018)	USA	NR- NR	Cohort study. No control	Paediatric faculty, academic level NR	Unclear (NR)	NR	Mentorship programme - junior mentee /senior mentor, Teaching sessions/ lectures	Junior Faculty	No	Single centre
Cronholm (2009)	USA	1997-2007	Cohort study. No control	Family medicine trainees, pre-doctoral	15 (9:6)	2 from URM, 2 economically disadvantaged	Faculty career development programme, Intensive Research training - involves participants taking a master's degree, which includes research mentoring. Also do clinical practice in an underserved area	Trainees	No	Single centre
Daley (2011)*	USA	2010-2010	Cohort study. No control	Post-training, mix of specialities, post-doctoral	12 (6:6)	All URM	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Leadership training, Faculty career development programme, Academic performance counselling, networking/ collaboration/ social activities	Junior Faculty	Ethnicity, URM	Single centre
Dannels (2009a)*	US and Canada	2006-2006	Cohort study. No control	Medical school deans	83 (72:11)	NR	Mentorship programme - junior mentee/ senior mentor, Leadership training (ELAM), Networking/ collaboration/ social activities	Managers/ leaders/ senior faculty	Gender	National
Dannels (2009b)*	US and Canada	2006-2006	Cohort study. No control	Dental school deans	33 (29:4)	NR	Mentorship programme - junior mentee/ senior mentor, Leadership training (ELAM), Networking/ collaboration/ social activities	Managers/ leaders/ senior faculty	Gender	National
Deas (2012)	USA	2002-2011	Cohort study. No control	Medical students, residents and faculty	Unclear (NR)	NR	Strategic diversity plans and programs such as pipeline programs, cultural competency training, a women's scholars program, annual diversity colloquium, leadership training for	Trainees, Junior Faculty, Managers/ leaders/	Ethnicity	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							women and minorities, mentoring program for high school and college African american males with an interest in health professions	senior faculty		
Dossett (2019)	USA	2017-2018	Cohort study. No control	Academic surgeons, grade and academic level NR	NR (Women were 55% of recruits and 50% of hires)	URM represented 15% of recruits and 33% of hires	Recruitment training (eg to reduce bias in interviews), In addition to mandatory training, the strategy involved a standing recruitment committee with diverse membership, broad promotion of positions, the introduction of a modified "Rooney rule," the use of panel interviews and standardized interview protocols, as well as a standardized evaluation tool and scoring system, and written evaluations/ranking of candidates	Whole of the department	Gender, Ethnicity	Single centre
Du Coin (2018)	USA	2016 -NR	Cohort study. No control	Gastrointestinal and endoscopic surgery trainees and post-training. Mix of academic levels	75 (NR)	NR	Funding award	Trainees, Junior Faculty, Managers/ leaders/ senior faculty	No	National
Dzirasa (2015)	USA	2009-2014	Case study. No control	Post-doctoral clinical trainee in psychiatry	1 (1:0)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time, intensive research engagement; unyoked clinical and research milestones. Also received a dedicated research space and financial resources to cover research supplies	Trainees	No	Single centre
Eder (2011)	USA	2006-2008	Cohort study. No control	Medical students, trainees and post-training, speciality NR. Mix of academic levels	91 (NR)	NR	Infrastructure support for research (administrative and statistical assistance)	Junior Faculty, (but used by faculty of all academic ranks, as well as students and residents)	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Elliott (2010)	AUS/ NZ	2004-2009	Cohort study. No control	GP registrars, academic level NR	Unclear (NR)	NR	Teaching sessions/ lectures, Registrar research & critical thinking program which involves workshops and a research project (workshop learning objectives include formulating research questions, database searching and critical appraisal); participants also encouraged to complete a placement in a university academic department. Model also includes an organisational support framework and annual research forum	Trainees	No	Regional
Estape (2018)	USA	NR- NR	Cohort study. No control	Mixed group, post-training, mix of academic levels.	173 (59:114)	95 Latino/ Hispanic, 12 Asian/ non-Hispanic, 63 Black or African American/ non-Hispanic, 3 White/ Non-Hispanic	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Phase 1 involves completion of a post-doctoral MSc . Two are described in paper (i) MSc in Clinical and Translational Research at The University of Puerto Rico ii) MSc in Clinical research at Morehouse School of Medicine. CRECD also supports participation in outreach and dissemination activities including seminars	Trainees, Junior Faculty	Ethnicity	National award but outcomes are related to programs at two universities
Fancher (2009)	USA	2005-2009	Cohort study. No control	Interns in internal medicine, academic level NR	78 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Networking/ collaboration/ social activities, Also involves designing a research project to be completed during residency.	Trainees	No	Single centre
Fassiotto (2018)	USA	2012-2014	Cohort study. No control	Faculty from three clinical divisions and a fourth “team” of faculty from five basic science	60 (26:34)	NR	1) integrated career-life planning (coaching to create a customised plan to meet both career and life goals); 2) Time banking (a system to recognise and promote behaviours that benefit team flexibility and	Junior Faculty, Managers/ leaders/ senior faculty	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
				departments, mix of academic levels			success with support that "buys back" an individual's time)			
Files (2008)	USA	2005-2005	Cohort study. No control	Post-training in Women's health internal medicine, academic levels unclear	4 (0:4)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers	Junior Faculty, Managers/ leaders/ senior faculty	Gender	Single centre
Foley (2017)	USA	NR- NR	Cohort study. No control	Post-training in geriatrics and internal medicine, post-doctoral	102 (NR)	NR	Unclear, "Geriatric Academic Career Award (GACA) program"	Junior Faculty	No	National
Gaetke-Udager (2018)	USA	2016-2016	Cohort study. No control	Radiology Trainees and Faculty, mix of academic levels	30 (0:30)	NR	Planned work and social-related activities to connect as a group, including book clubs - form of networking/ collaboration/ social activities	Trainees, Junior Faculty, Managers/ leaders/ senior faculty	Gender	Single centre
Garrod (2016)	AUS/ NZ	2014- NR	Cohort study. No control	General, plastic and reconstructive surgery trainees, post-doctoral	41 (NR)	NR	Funding award	Trainees	No	National
Girod (2016)	USA	2012-2013	Cohort study. No control	Medical faculty. Academic level NR	281 (163:118)	191 White, 82 Asian/ Pacific Islander, 6 Hispanic/ Latino, 1 African American, 1 Native American/ Alaska Native	Teaching sessions/ lectures, Recruitment training	Managers/ leaders/ senior faculty	No	Single centre
Gordon (2007)	USA	NR- NR	Cohort study. No control	Mixed group, mainly dentists, mix of academic levels	11 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, didactic curriculum includes epidemiologic and clinical research methods, ethical issues and human subject safety, biostatistics, monitoring patient-oriented research and regulatory issues, preparing and	Trainees	No, but geared towards enabling part-time study	National

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							funding a clinical research project, and scientific writing			
Hales (2009)	USA	2003-2007	Cohort study. No control	Trainee and post-training psychiatrists/ psychologists, mix of academic levels	41 (NR)	NR	Faculty practice plan which give faculty financial credits for performing research and educational activities and community service	Junior Faculty, Managers/ leaders/ senior faculty	No	Single centre
Harris (2012)	USA	2007-2008	Cohort study. No control	Psychiatry students, residents and junior faculty, academic level NR	NR (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures	Trainees, Junior Faculty	Ethnicity	Regional
Hassan (2013)	USA	NR- NR	Cohort study. No control	Surgical trainees, academic level NR	31 (18:13)	NR	Funding award, Protected research time, Mentorship programme - junior mentee/ senior mentor	Trainees	No	National
Howell (2008)	USA	NR- NR	Cohort study. No control	Internal medicine faculty, academic level NR	NR (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Protected research time	Junior Faculty	No	Single centre
Hurst (2019)	USA	NR- NR	Cohort study. No control	Paediatric trainees, pre-doctoral	NR (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Funding award, Teaching sessions/ lectures, Protected research time, Networking/ collaboration/ social activities, Additional program resources such as funds for travel and computer software	Trainees	No	Single centre
Jagsi (2007)	USA	NR- 2006	Cohort study. No control	Post-training, mix of specialities, mix of academic levels	40 (0:40)	NR	Funding award	Junior Faculty	Gender	Single centre
Jagsi (2011)	USA	2009-2009	Cohort study. No control	Post-training, mix of specialities, post-doctoral	588 (377:211)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Protected research time	Trainees, Junior Faculty	No	National
Jones (2011)	USA	2010-2010	Cohort study. No control	Trainees and post-training cardiothoracic surgery, academic level NR	107 awards (80%:20%); 70 survey responses	For 75 respondents: white (65%), Asian (28%), Hispanic (3%), African American (1%), other (3%).	Mentorship programme - junior mentee/ senior mentor, Funding award	Trainees, Junior Faculty	Multiple awards, one aimed at gender	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Kaplan (2019)	USA	2001-2017	Cohort study. No control	Post-training colorectal surgeons, mix of academic level	54 (35:19)	NR	Funding award, Mentorship programme - junior mentees/ senior mentors	Junior Faculty	No	National
Kapoor (2011)	USA	NR- NR	Cohort study. No control	Trainees, specialty NR, academic level NR	25 (15:10)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, As part of formal teaching, all participants are enrolled in the 'Program in Clinical Effectiveness'. Individuals who demonstrate significant progress with their research project and strong commitment to clinical research, are then provided with the opportunity to study for a MPH	Trainees	No	Single centre
Katz (2009)	USA	2002-2008	Cohort study. No control	Mixed specialities, post-training. Academic level NR	72 (NR)	NR	Funding award, Networking/ collaboration/ social activities, Faculty career development programme, Leadership training	Junior Faculty	No	National
Kibbe (2015)	USA	2007-2007	Cohort study. No control	Post-training vascular surgeons, mix of academic levels	29 (26:3)	NR	Funding award, Protected research time, Mentorship programme - junior mentee/ senior mentor	Junior Faculty	No	National
King (2016)	USA	2014-2015	Cohort study. No control	Haematology fellows (79%) and faculty (21%), academic level NR	115 responded to survey, demographics based on n=109 (52:57)	69% Caucasian; 28% Asian; 3% African American; 3% Hispanic	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Developing and conducting a research project. Participants also have 'small group reunions' at which they provide updates related to their projects and career development	Trainees, Junior Faculty	No	National
Kupfer (2009)	USA	2007- NR	Cohort study. No control	Final year residents and junior faculty in academic psychiatry, mix of academic levels	77 (39:38)	17% represented racial and ethnic minority groups (n=13)	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Teaching sessions/ lectures, Faculty career development programme, Networking/ collaboration/ social activities. In addition to a multiday career development institute workshop, program entails follow up booster sessions and annual	Trainees, Junior Faculty	Whilst open to all, emphasis on women and ethnic minority groups.	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							assessment of the long-term value in research and career success			
Kupfer (2016)	USA	2012-2014	Cohort study. No control Follow-up of Kupfer (2009)	Final year residents and junior faculty in academic psychiatry, mix of academic levels	16 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Teaching sessions/lectures, Faculty career development programme, Mentoring is virtual and provided by faculty staff and successful past program graduates act as peer mentors. Online training program via webinars. Participants also attend a 4 day in person workshop. Grant writing support	Trainees, Junior Faculty	No	National
Landrigan (2019)	USA	2017-2017	Cohort study. No control	Paediatric Environmental Health trainees, academic level NR	55 (20:35)	71% Caucasian, 20% Asian; 5% Latino; 2% African American; 2% Native American	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, networking/ collaboration/ social activities, Research training and development	Trainees	No	National
Landrigan (2007)	USA	2006-2007	Cohort study. No control	Environmental paediatrics fellows, pre-doctoral	15 (8:7)	8 white, 1 African American, 2 Latino, 6 Asian	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Networking/ collaboration/ social activities, Mentored research experience. All trainees have to write a thesis. Evidence-based advocacy training. Annual 3-day retreat for presenting and reviewing each other's research work	Trainees	No	National
Lin (2017)	USA	2016-2016	Cohort study. No control	Family medicine students, residents and fellows, academic level NR	75 in intervention, 62 pre-test questionnaires, 58 post-test (18:44, pre-test)	63% White, 13% Asian, 10% Hispanic/ Latino, 8% Black/ African American, 6.5% Other	Teaching sessions/ lectures, Mentorship programme - junior mentees/ senior mentors	Trainees	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Lyons (2010)	UK	2008-2008	Cohort study. No control	AFP Trainees, mixed specialities, mix of academic levels (35% MSc or PhD)	92 (44:48)	NR	Teaching sessions/ lectures, Protected research time	Trainees	No	National
Masterson Creber (2019)	USA	2018-2018	Cohort study. No control	Trainees and post-training, mixed specialities, 11 MD, 4 PhD	15 (12:3)	10 White; 4 Asian; 1 Hispanic/ Latino	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Teaching sessions/ lectures, Networking/ collaboration/ social activities	Trainees, Junior Faculty	No	National
Mayer (2014)	USA	2008-2011	Cohort study. No control	Post-training, medicine, psychiatry, GP, post-doctoral	33 recruited. 23 pre-intervention, 19 post-intervention, 16 did both (0%:100%)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Networking/ collaboration/ social activities	Junior Faculty	Gender	Single centre
McKinney (2019)	USA	NR- NR	Cohort study. No control	Post-training hospitalists and internal medicine physicians, academic level NR	49 (NR)	NR	Academic research coach	Trainees, Junior Faculty	No	Single centre
Moniz (2020)	USA	2010-2014	Cohort study. No control	Trainees and post-training, mixed specialities, mix of academic levels	1066 (573:493)	White (female=70%, male=71%); Asian (female=21%, male=22%); Other (female=9%, male=7%)	Funding award, Protected research time	Trainees, Junior Faculty, Managers/ leaders/ senior faculty	No	National
Muslin (2009)	USA	2000-2008	Cohort study. No control	Internal medicine residents. Post-doctoral	48 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, teaching sessions/ lectures, research/ clinical training, e.g attending outpatient departments half-days every week. Also says that participants get to talk about granting programs, grant application etc. and attend an annual research symposium	Trainees	No	Single centre

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Nigrovic (2014)	USA	2013-2013	Cohort study. No control	Paediatric rheumatology fellows and junior faculty, mix of academic levels	37 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Networking/ collaboration/ social activities, Networking sessions also have an educational component, with each session including a keynote talk from a senior faculty member	Trainees, Junior Faculty	No	National
Nowling (2018)	USA	2017-2017	Cohort study. No control	Post-training, speciality NR. Mix of academic levels	137 (0:137)	NR	Leadership training, Faculty career development programme, Networking/ collaboration/ social activities	Junior Faculty	Gender	Single centre
Oakley (2012)	USA	NR- NR	Cohort study. No control	Post-training dentists. Post-doctoral	4 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Two years senior mentorship, then 2 years working with new recruits. Educational activities include learning how to perform a literature search.	Junior Faculty	No	Single centre
O'Hara (2010)	USA	2002-2008	Cohort study. No control	Psychology and psychiatry trainees, post-doctoral	58 (50%:50%)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Aims to submit a career development grant at the end of fellowship. Design and conduct their own research investigation. Academic conferences and poster presentations	Trainees	No	National
Olde Hartman (2008)	Western Europe	2000-2005	Cohort study. No control	Family physician trainees. Academic level NR	40 (NR)	NR	Teaching sessions/ lectures; Combined vocational and research training program is a 6-year combined program incorporating family-physician training and research training using academic, statistical and epidemiological courses - this programme results in a PhD and family physician qualification	Trainees	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Ologunde (2018)	UK	2017-2017	Cohort study. No control	Trainees, mix of specialities, pre-doctoral	56 (52% female)	NR	Teaching sessions/ lectures, Protected research time	Trainees	No	National
Pachter (2015)	USA	2004-2014	Cohort study. No control	Paediatric trainees and post-training, academic level NR	65 (7:58)	49 African American, 10 Latino, 1 Native American/ Alaskan, 2 other, 3 biracial/ bicultural	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Travel grant for transportation, meeting registration and housing costs during meetings	Trainees	Ethnicity, URM	National
Penrose (2012)	USA	2010-2011	Cohort study. No control	Obstetric and gynaecology trainees, academic level NR	12 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Hiring a full-time postdoctoral researcher to facilitate and coordinate resident research projects, and support clinical faculty in research activities.	Trainees, Junior Faculty	No	Single centre
Phitayakorn (2016)	USA	2015-2015	Cohort study. No control	Post-training surgeons, mix of academic levels	35 (26:9)	NR	Mentorship programme - junior mentee/ senior mentor	Junior faculty	No	Single centre
Posporelis (2014)	USA	2010-2010	Cohort study. No control	Psychiatry residents, academic level NR	11 (NR)	NR	Mentorship programme - peers, Teaching sessions/ lectures, Networking/ collaboration/ social activities	Trainees	No	Single centre
Prendergast (2019)	USA	2011-2017	Cohort study. No control	Emergency medicine, post-training, post-doctoral	22 (14:8)	10 White, 2 Black, 2 Hispanic, 6 Asian/Indian	Mentorship programme - peers, Networking/ collaboration/ social activities	Junior Faculty, Managers/ leaders/ senior faculty	No	Single centre
Reynolds (2007)	USA	1999-2004	Cohort study. No control	Junior faculty in psychiatry, mix of academic levels	22 (NR)	4 URM	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Leadership training, Teaching sessions/ lectures, Protected research time	Junior Faculty	No	Single centre
Roane (2009)	USA	2002-2008	Cohort study. No control	Psychiatry residents, academic level NR	89 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, Protected research time, Residents exposure to all aspects of ongoing research. Training in preparing and delivering	Trainees	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							presentations is given and funding is provided for residents to attend national meetings. Residents are encouraged to prepare and submit peer-reviewed publications.			
Robertson (2007)	USA	2005-2005	Cohort study. No control	General surgery trainees, mix of academic levels	75 (NR)	NR	Unclear	Trainees	No	Single centre
Sanfey (2011)	USA	2004-2008	Cohort study. No control	Faculty from a School of Medicine, post-doctoral	142 (92:50)	NR	Leadership training	Junior Faculty, Managers/ leaders/ senior faculty	No	Single centre
Seritan (2007)	USA	2005-2006	Cohort study. No control	Psychiatry and psychology trainees and post-training, mix of academic levels	NA (not one sample)	NR	Mentorship programme - peers, Networking/ collaboration/ social activities	Junior Faculty	Gender	Single centre
Serwint (2014)	USA	2012-2012	Cohort study. No control	Post-training, post-doctoral academic paediatrics	54 mentees (85% female), 52 mentors (56% female)	NR	Mentorship programme - junior mentee/ senior mentor	Trainees, Managers/ leaders/ senior faculty	No	National
Soto (2019)	UK	2014-2017	Cohort study. No control	paediatric AFP trainees, academic level NR	12 (NR)	NR	Teaching sessions/ lectures, Networking/ collaboration/ social activities, Induction pack providing essential information to support trainees to carry out their role	Trainees	No	National
Spalluto (2017)	USA	NR- NR	Cohort study. No control	Post-training radiologists, mix of academic levels	35 in needs assessment and 30 post-intervention survey (0%:100%)	NR	Faculty career development programme, Networking/ collaboration/ social activities, leadership training	Junior Faculty, Managers/ leaders/ senior faculty	Gender	Single centre
Stewart (2012)	UK	NR- NR	Cohort study. No control	Trainees and post-training from a mix of specialities. Pre-doctoral	40 from 1991, 191 from 1993-2003 cohort (NR)	NR	Funding award, Protected research time	Trainees	No	National
Szilagyi (2011)	USA	2007-2008	Cohort study. No control	Trainee and post-training general	188 in total: 95 (46% female) in cohort 1 and 93	NR	NR (“Academic General Pediatrics (AGP) fellowship program”)	Trainees	No	Regional

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
				paediatricians, post-doctoral	(48% female) in cohort 2					
Thiruthaneeswaran (2014)	AUS/NZ	NR- NR	Cohort study. No control	Radiation oncology trainees, Academic level NR	82 (NR)	NR	Research submission	Trainees	No	National
Thompson (2007)	USA	1999-2005	Cohort study. No control	Post-training vascular surgeons, mix of academic levels	19 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time	Junior Faculty	No	National
Todd (2013)	USA	2012-2012	Cohort study. No control	Post-training, speciality NR, post-doctoral	385 (of 350 - 276:74)	NR	Mentorship programme - junior mentee/ senior mentor, Research and clinical training	Trainees	No	National
Tsai (2013)	USA	2000-2011	Cohort study. No control	Research Residents in General Adult Psychiatry, mix of academic levels	45 (24:21)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time, Attend courses involving lectures, case studies and role-playing simulations. Networking/ collaboration/ social activities opportunities through dinner seminars and retreats with mentors. Individual training plans	Trainees	No	Single centre
Tsikis (2019)	USA	2017-2018	Cohort study. No control	Trainees and post-training surgeons, academic level NR	97 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Teaching sessions/ lectures, Networking/ collaboration/ social activities, Includes project development, personnel recruitment, data security training and IRB processes training	Trainees, Junior Faculty	No	Single centre
Tsimtsiou (2010)	UK	2008-2008	Cohort study. No control	Post-training GPs, pre-doctoral	50 (31:19)	NR	Teaching sessions/ lectures	Trainees	No	Single centre
Tucker (2017)	USA	2016-2016	Cohort study. No control	Trainees in infectious diseases, post-doctoral	41 (22:19)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Protected research time, Had to undertake research in global health and spend at least 3 months supporting research in an oversees research site	Junior Faculty	No	National

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Tudiver (2008)	USA	2006-2006	Cohort study. No control	Post-training family physicians, academic level NR	Unclear (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Grant writing programme, Funding award, Teaching sessions/ lectures, Protected research time, Specific research project and manuscript support	Junior Faculty	No	Single centre
Varkey (2012)	USA	NR- NR	Cohort study. No control	Post-training, speciality NR, post-doctoral	19 mentees, 4 facilitators (all female)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Teaching sessions/ lectures, Networking/ collaboration/ social activities	Junior Faculty	Gender	Single centre
Vega (2015)	USA	2012-2012	Cohort study. No control	Anaesthetic trainees, mix of academic levels	233 (77%:23%)	79% White, 11% Asian, 5% Hispanic, 3% African-American, 2% Native American or other	Unclear ("Foundation for Anesthesia Education and Research (FAER) Resident Scholar Program (RSP)")	Trainees	No	National
Villablanca (2013)	USA	2010-2011	Cohort study. No control	Faculty in School of medicine. Academic level NR	NR (NR)	NR	Teaching sessions/ lectures, Networking/ collaboration/ social activities	Junior Faculty, Managers/ leaders/ senior faculty	No, but emphasis on women's career	Single centre
Villablanca (2011)	USA	2010-2010	Cohort study. No control	Post-training, mix of specialities, post-doctoral	325 (195:120) from school of medicine. Also 83 from School of Veterinary Medicine & 64 from College of Biological Sciences	SOM: 78% Caucasian; 21% Asian; 5% Hispanic & 1% African American	Flexible, and family friendly, career policies, including ones related to childbearing, adoption, parental leave and part-time appointments	Junior Faculty, Managers/ leaders/ senior faculty	No, focused on family friendly policies for both men and women, but does have an emphasis on women's careers	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
Villablanca (2017)	USA	2007-2013	Cohort study. No control	Faculty in School of Medicine. Post-doctoral	Data analysed for 2234 (1529:705) person-year data points (2007–2009) & 2384 (1588:796) person-year data points (2010-2012)	NR	Multi component educational campaign. Key components included grand rounds, presentations and print and electronic communications	Junior Faculty, Managers/ leaders/ senior faculty	No, Aimed at all faculty but with a clear emphasis on women	Single centre
Welch (2012)	USA	2010-2010	Cohort study. No control	Trainees and post-training in Emergency medicine, Academic level NR	46 (0:46)	NR	Mentorship programme - junior mentee/ senior mentor, Mentorship programme - peers, Also included additional events to enhance opportunities such as 4-hour wellness workshops and an annual statewide breakfast with a national female emergency medicine leader - networking/ collaboration/ social activities	Trainees, Junior Faculty	Gender	Single centre
Whyte (2009)	USA	2008-2008	Cohort study. No control	Residents, fellows or junior faculty in rehabilitation medicine, pre-doctoral	21 (NR)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time, Funding for research supplies and travel.	Trainees, Junior Faculty	No	National
Wingard (2019)	USA	2004-2015	Cohort study. No control	Health Sciences faculty, speciality NR, post-doctoral	Unclear (40% female in 2015)	NR	Leadership training, A faculty development program (National Center for Leadership in Academic Medicine, NCLAM); other development programs & workshops; changes in policies and procedures and the routine measuring and dissemination of demographic data.	Junior Faculty	Gender, Ethnicity	Single centre
Wong (2016)	USA	NR- 2013	Cohort study. No control	Trainees in medical specialities, post-doctoral	123 (84:39)	NR	Mentorship programme - junior mentee/ senior mentor, Funding award, Teaching sessions/ lectures, Protected research time	Trainees	No	Single centre
Workman (2019)	Canada	2001-2015	Cohort study. No control	Trainee family physicians, mix of academic levels	40 (14:26)	NR	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures, develop and conduct a research project.	Trainees	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
							Teaching was a structured curriculum in the form of virtual seminars, and included presentations, and a quarterly academic day or retreat.			
Wyatt (2016)	USA	NR- NR	Mixed methods. No control. (Qual data from interviews not extractable from other data sources)	Trainees, mix of specialities, pre-doctoral	11 (NR)	NR	Teaching sessions/ lectures, Protected research time, Networking/ collaboration/ social activities, Training in health sciences education. Development of project upon completion of program	Trainees, Junior Faculty	No	Single centre
Yager (2007)	USA	NR- NR	Cohort study. No control	Trainees and post-training in psychiatry, Academic level NR	Unclear (NR)	All participants were minority ethnic groups	Mentorship programme - junior mentee/ senior mentor, Teaching sessions/ lectures. MRISP involves weekly seminars for individualised and group learning. MRISP also provides administrative support and technical assistance, for example, in data management and analysis, and statistics. MEP is delivered through yearly intensive 1-week training institutes. In addition to a didactic curriculum, also involves informal get-togethers, and peer support groups. Also covers travel, administrative and conference costs - form of networking/ collaboration/ social activities	Junior Faculty	Ethnicity	National
Yedavalli (2019)	USA	2017-2017	Cohort study. No control	Trainees and post-training in radiology. Academic level NR	Results on satisfaction based on 13 resident respondents with 28 mentorship survey	NR	Mentorship programme - junior mentee/ senior mentor, networking/ collaboration/ social activities	Trainees	No	Single centre

First Author (Year of publication)	Country	Years of data collection	Study design	Grade/type of clinical academics included	Number of participants (Male: Female)	Ethnicity	Intervention components	Target population of intervention	Aimed at particular group	Reach
					respondents (NR)					

Key: AFP – Academic Foundation programme; AUS/NZ - Australia and New Zealand; CFSP – Clinical Faculty Scholars Program; ELAM – Executive Leadership in Academic Medicine Program; EWIM – Early-Career Women Faculty Professional Development Program; GP – General Practitioner; MWIM – Mid-Career Women Faculty Professional Development Program; NR - not reported; PhD – Doctor of Philosophy; RCT - Randomised controlled trial; UK – United Kingdom; URM - Underrepresented minorities (defined where study defined); USA – United States of America. *study also included in barriers and facilitators study characteristics table

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Appendix 4: Tables of quality assessment of studies included within synthesis

Table 1: Quality Assessment for the Randomised Control Trial

First author (Year of publication)	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Grisso (2017)	Low risk	Unclear	High risk	Low risk	Low risk	Unclear	High risk

Table 2: Quality Assessment for Non-randomised Case-Control Studies

First author (Year of publication)	Is the case definition adequate?	Representative ness of the cases	Selection of controls	Definition of controls	Comparability of cases and controls on the basis of the design or analysis	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-response rate
Goldenberg (2012)	Yes, e.g. record linkage or based on self-reports	Potential for selection biases or not stated	Community controls	No history of endpoint	Not adjusted for any factor	Written self-report or medical record only	Yes	Same rate for both groups
Ries (2012)	Yes, e.g. record linkage or based on self-reports	Consecutive or obviously representative series of cases	Community controls	No history of endpoint	Study controls for key factors	Secure record	Yes	Same rate for both groups

Table 3: Quality Assessment for Non-randomised Cohort Studies

First author (Year of publication)	Representative ness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow-up of cohorts
Brandt (2018)	Truly representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Record linkage	Yes	No description
Chang (2016)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	Yes	Study controls for key factors	Record linkage	Yes	No description

First author (Year of publication)	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow-up of cohorts
Daley (2006)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	Yes	Not adjusted for any factor	Record linkage and self-report	Yes	No description
Dannels (2008)	Selected group of users, e.g. volunteers	Drawn from the same community as the exposed cohort	Secure record	No	Study controls for key factors	Self-report	Yes	Follow-up rate low and no description of those lost
Ehlers (2018)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	Yes	Study controls for key factors	Record linkage	Yes	Small number lost to follow-up or description provided of those lost
Emans (2008)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Written self-report	No	Not adjusted for any factor	No description	Yes	Follow-up rate low and no description of those lost
Harrison (2020)	Truly representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Record linkage	Yes	No description
Joshua Smith (2014)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Study controls for key factors	Record linkage	Yes	Small number lost to follow-up or description provided of those lost
Khot (2011)	Somewhat representative of the average in the community	Drawn from a different source	Secure record	No	Not adjusted for any factor	Record linkage	Yes	No description

First author (Year of publication)	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow-up of cohorts
Klimas (2017)	No description of the derivation of cohort	Drawn from the same community as the exposed cohort	No description	No	Not adjusted for any factor	Record linkage	No	Complete follow-up - all subjects accounted for
Kohlwes (2006)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Self-report, no description for some outcomes	Yes	Complete follow-up - all subjects accounted for
Kohlwes (2016)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Study controls for key factors	Self-report	No	Small number lost to follow-up or description provided of those lost
Libby (2016)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Study controls for key factors	Record linkage	Yes	No description
Löwe (2008)	Somewhat representative of the average in the community	Drawn from a different source	Secure record	No	Study controls for key factors	Record linkage and self-report	No	Small number lost to follow-up or description provided of those lost
Mandel (2018)	Truly representative of the average in the community	Drawn from the same community as the exposed cohort	Written self-report	No	Not adjusted for any factor	Self-report	Yes	Small number lost to follow-up or description provided of those lost
Merani (2014)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Record linkage	Yes	Small number lost to follow-up or description provided of those lost

First author (Year of publication)	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow-up of cohorts
Mills (2011)	Selected group of users, e.g. volunteers	Drawn from the same community as the exposed cohort	Secure record	No	Study controls for key factors	Record linkage	Yes	No description
Nasab (2019)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Record linkage	No	Follow-up rate low and no description of those lost
Ockene (2017)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	No	Not adjusted for any factor	Record linkage	Yes	Small number lost to follow-up or description provided of those lost
Patel (2018)	Truly representative of the average in the community	Drawn from the same community as the exposed cohort	No description	No	Not adjusted for any factor	No description	Yes	Complete follow-up - all subjects accounted for
Ries (2009)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	Yes	Study controls for key factors	Record linkage	Yes	No description
Sheridan (2010)	No description of the derivation of cohort	Drawn from the same community as the exposed cohort	Secure record	Yes	Not adjusted for any factor	Self-report	Yes	Small number lost to follow-up or description provided of those lost
Sweeny (2019)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	Secure record	Yes	Not adjusted for any factor	Record linkage	Yes	No description
Valantine (2014)	Truly representative	Drawn from a different source	Secure record	No	Not adjusted for any factor	Record linkage and self-report	Yes	Follow-up rate low and no

First author (Year of publication)	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow-up of cohorts
	of the average in the community							description of those lost
Winn (2018)	Somewhat representative of the average in the community	Drawn from the same community as the exposed cohort	No description	No	Not adjusted for any factor	Self-report	Yes	Follow-up rate low and no description of those lost

Table 4: Quality Assessment for the Qualitative Methodology Studies

First author (Year of publication)	Is there congruity between the stated philosophical perspective and the research methodology?	Is there congruity between the research methodology and the research question or objectives?	Is there congruity between the research methodology and the methods used to collect data?	Is there congruity between the research methodology and the representation and analysis of data?	Is there congruity between the research methodology and the interpretation of results?	Is there a statement locating the researcher culturally or theoreticallly?	Is the influence of the researcher on the research, and vice-versa, addressed?	Are participants, and their voices, adequately represented?	Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?
Qualitative methodology only										
Archibald (2017)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
DeCastro (2013a)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
DeCastro (2013b)	Unclear	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Helitzer (2016)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Unclear
Jones (2019)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Klimas (2017a)	Unclear	Yes	Yes	Yes	Yes	No	No	Unclear	Yes	Yes

First author (Year of publication)	Is there congruity between the stated philosophical perspective and the research methodology?	Is there congruity between the research methodology and the research question or objectives?	Is there congruity between the research methodology and the methods used to collect data?	Is there congruity between the research methodology and the representation and analysis of data?	Is there congruity between the research methodology and the interpretation of results?	Is there a statement locating the researcher culturally or theoretically?	Is the influence of the researcher on the research, and vice-versa, addressed?	Are participants, and their voices, adequately represented?	Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?
Klimas (2017b)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Lin (2019)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Moss (2008)	Unclear	Yes	Unclear	Unclear	Yes	No	Yes	No	No	Yes
Stubbe (2008)	Unclear	Unclear	Unclear	Unclear	Unclear	No	No	Yes	No	No
Non-controlled mixed methods studies for which only qualitative elements were assessed										
Comeau (2017)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Darbyshire (2019)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Hayward (2011)	Unclear	Yes	Yes	Unclear	Yes	No	No	No	Yes	Yes
Iversen (2014)	Unclear	Unclear	Yes	Unclear	Yes	No	No	Yes	Yes	Yes
Kraemer (2018)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Reader (2015)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes

Table 5: Quality Assessment for the Realist Evaluation Study

First author (Year of publication)	A realist approach is suitable for the purposes of the evaluation. That is, it seeks to improve understanding of the core questions for realist evaluation	The evaluation question(s) are framed to be suitable for a realist evaluation	A realist principle of generative causation is applied	An initial tentative programme theory (or theories) is identified and developed. Programme theory is 're-cast' and refined as realist programme theory	The evaluation design is described and justified	Ethical clearance is obtained if required	Data collection methods are suitable for capturing the data needed in a realist evaluation	The respondents or key informants recruited are able to provide sufficient data needed for a realist evaluation	The overall approach to analysis is retroductive	Data analyses processes applied to gathered data are consistent with a realist principle of generative causation	A realist logic of analysis is applied to develop and refine theory	The evaluation is reported using the items listed in the RAMESES II reporting standard for realist evaluations	Findings and implications are clear and reported in formats that are consistent with realist assumptions
Caffrey (2016)	Adequate	Adequate	Good	Inadequate	Adequate	Adequate	Adequate	Adequate	Adequate	Inadequate	Inadequate	Good	Adequate

Table 6: Quality Assessment for Non-randomised Controlled Mixed Methods Studies

First author (Year of publication)	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis and interpretation?	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?	Is there an adequate rationale for using a mixed methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Campion (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Can't tell	Yes	Yes	Can't tell	Yes	No
Guevara (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	No	Yes	Yes	Yes	Yes

Appendix 5: Table of outcome data for studies within quantitative analysis

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
Aspiration							
Dannels (2008)	Programme participants	Two control groups: Applied but not accepted non-programme participants & general mid-career faculty women (also non-participants)	Aspiration to higher leadership position within an academic health centre (academic medicine)	55	27 & 178	76.4% vs 63.0% vs 49.4% (chi-squared= 12.903, p=0.002)	Unadjusted but faculty control group matched on academic rank, department chair status, race/ethnicity, discipline, degree type, basic sciences vs clinical department, age, medical school ownership, and awards ranking.
Career Satisfaction							
Campion (2016)	Intervention participants	Reference group (non-participants)	Career satisfaction post-intervention	10	12	N=9 satisfied or very satisfied vs N=12 satisfied or very satisfied (NR)	Unadjusted
Grisso (2017)	Intervention group	Control group (no intervention)	Work self-efficacy change scores	62	70	0.18 vs 0.24 (p=0.642)	Statistical tests were adjusted to account for correlation induced by the clustered design using generalized estimating equations. Both within-person factors (age, years
	Intervention group	Control group (no intervention)	Work-family conflict change (TWIF scores)	62	70	-0.13 vs -0.05 (p=0.541)	
	Intervention group	Control group (no intervention)	Work-family conflict change (SWIF scores)	62	70	-0.20 vs -0.23 (p=0.879)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Intervention group	Control group (no intervention)	CCWAS culture score change	Unclear; 109 in total	Unclear; 109 in total	0.03 vs 0.13 (p=0.274)	in rank, race) and unit-level factors (intervention assignment) were modeled simultaneously
Winn (2018)	Academy participants	Pre-academy participants	Percentage of people who felt that the BCRP have been quite or extremely supportive in helping people to make career decisions	24	22	63% vs 45% (p=0.37)	Unadjusted
	Academy participants	Pre-academy participants	Percentage of people who agree or strongly agree that the BCRP guides and supports residents in pursuing and presenting scholarly projects	25	22	76% vs 63% (p=0.54)	
Skills & Knowledge							
Campion (2016)	Intervention participants	Reference group (non-participants)	Knowledge, Skills, and Attitudes Survey	9	11	No overall estimate. For 13 out of 32 items on the scale, participants showed greater gains than the reference group (NR)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Intervention participants	Reference group (non-participants)	Change in Sense of Community Index score (SCI-2 total score)	10	12	Mean change 10.6 vs 3.83 (p=0.2, SD=13.7 vs 9.40)	
Kohlwes (2006)	Programme residents (PRIME)	Non-PRIME programme residents	Clinical competence score (average on a 9 point scale)	32	2294	8.23 vs 8.09 (p<0.001)	Unadjusted
Löwe (2008)	Intervention residents	Control residents (from two different locations)	Mean change in total methodological research knowledge score from baseline	15	22	8.4 vs 1.2 (effect size =2.5, p<0.001, SD=2.9 vs 2.8)	Unadjusted
	Intervention residents	Control residents (from two different locations)	Mean change in total self-assessment research competence score from baseline	15	22	0.4 vs -0.4 (effect size=1.1, p=0.01, SD=0.9 vs 0.7)	
Winn (2018)	Academy participants	Pre-academy participants	Percentage of people who agree or strongly agree that they have learned how to present a poster through BCRP activities	24	22	50% vs 29% (p=0.07)	Unadjusted
	Academy participants	Pre-academy participants	Percentage of people who agree or strongly agree that they have learned how to give a presentation/talk through BCRP	24	22	75% vs 36% (p=0.02)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
			activities				
	Academy participants	Pre-academy participants	Percentage of people who agree or strongly agree with feeling prepared for non-clinical (scholarly) work after residency	24	22	63% vs 45% (p=0.37)	
Funding							
Goldenberg (2012)	Programme trainees	Non-programme trainees	Annual grant dollars received (excluding fellowship award funding) at 3-4 years post-fellowship	11	9	Median $80,000 vs $23,000 (p=0.2)	Unadjusted
	Programme trainees	Non-programme trainees	Percentage of individuals who obtained K award within 5 years of beginning fellowship	9	8	33% vs 0% (p=0.21)	Unadjusted
Grisso (2017)	Intervention group	Control group (no intervention)	Percentage of individuals with improved grants	62	70	Rate Ratio 0.75 (95% CI: 0.54-1.03, p=0.08)	Statistical tests were adjusted to account for correlation induced by the clustered design using generalized estimating equations. Both within-person factors (age, years in rank, race) and unit-level factors (intervention

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
							assignment) were modeled simultaneously
Guevara (2018)	Interview applications scholars	Interview applications non-scholars	Total number of grants (mean)	76	48	2.0 vs 0.7 (p<0.001, SD=1.5 vs 1.0)	Adjusted for age, gender, race/ethnicity, application year, change of institutions, and rank at time of application
	Interview applications scholars	Interview applications non-scholars	Total grant dollars in thousands (mean)	76	48	$1,463 vs $567 (p=0.02, SD=$2,390 vs $1,507)	
Libby (2016)	Programme participants (assistant professors)	Matched controls (non-programme participants, assistant professors)	Number of grant awards - change in mean before and after intervention	25	125	0.20 to 1.15 vs 0.30 to 0.49 (p<0.01)	Unadjusted but controls matched for key variables such as time in rank and dollars awarded
	Programme participants (assistant professors)	Matched controls (non-programme participants, assistant professors)	Amount of funding associated with grant awards - change in mean before and after intervention	25	125	$21,580 to $105,008 vs $26,742 to $53,716 (p<0.01)	
	Programme participants (assistant professors)	Matched controls (non-programme participants, assistant professors)	Percentage grant success rate (no. awards/no. proposals) - change before and after intervention	25	125	46.9% to 52.9% vs 42.5% to 51.7% (p=0.78)	
Löwe (2008)	Intervention residents	Control residents (from two different locations)	Percentage of people who had grant applications accepted	15	22	33% vs 0% (p=0.007)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
			for funding				
Sweeny (2019)	After programme implementation participants	Before programme implementation participants	Number of grants awarded to new investigators	NR	NR	30 vs 20 (NR)	Unadjusted
Research Participation							
Brandt (2018)	Research residents	Clinical residents	Percentage of participants actively engaged in research after intervention completion	43	284	42% vs 29% (p=0.04)	Unadjusted
Goldenberg (2012)	Programme trainees	Non-programme trainees	Percentage of time spent in research post-fellowship	11	9	Median 80% vs 55% (p=0.01)	Unadjusted
Grisso (2017)	Intervention group	Control group (no intervention)	Change in the number of total hours worked per week	62	70	-3.82 vs -1.39 (p=0.006)	Statistical tests were adjusted to account for correlation induced by the clustered design using generalized estimating equations. Both within-person factors (age, years in rank, race) and unit-level factors (intervention assignment) were modeled simultaneously

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
Harrison (2020)	Participants after intervention implementation	Participants before intervention implementation	Total number of presentations (mean) - *just residents*	Unclear	Unclear	24.6 vs 3.0 (p=0.002, SD=10.24 vs 1.58)	Unadjusted
	Participants after intervention implementation	Participants before intervention implementation	Grant submissions (mean) - *just residents*	Unclear	Unclear	0.8 vs 0.0 (NR)	
	Participants after intervention implementation	Participants before intervention implementation	Total number of presentations (mean) - *just faculty*	Unclear	Unclear	40.0 vs 8.2 (p=0.025, SD=20.51 vs 1.30)	Unadjusted
Kohlwes (2016)	Programme residents (PRIME)	Non-PRIME programme residents	Percentage of alumni who identified their primary role as a clinician investigator	71	98	35.2% vs 28.6% (chi-squared=0.843, p=0.358)	Unadjusted
	Programme residents (PRIME)	Non-PRIME programme residents	Mean percentage of professional time devoted to clinical or translational research	71	98	26.2% vs 20.6% (p=0.255)	
Löwe (2008)	Intervention residents	Control residents (from two different locations)	Percentage of people currently writing a journal article during 1 year program	15	22	86.7% vs 36.4% (p=0.003)	Unadjusted
	Intervention residents	Control residents (from two different locations)	Percentage of people currently writing a book article during 1 year	15	22	6.7% vs 13.6% (p=0.63)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
			program				
	Intervention residents	Control residents (from two different locations)	Percentage of people who did presentations at scientific meetings during the last year	15	22	80% vs 40.9% (p=0.04)	
	Intervention residents	Control residents (from two different locations)	Percentage of people who submitted one or more grant proposal with first authorship in the last year	15	22	6.7% vs 0% (p=0.41)	
	Intervention residents	Control residents (from two different locations)	Percentage of people who submitted one or more grant proposal with co-authorship in the last year	15	22	46.7% vs 4.6% (p=0.004)	
Mandel (2018)**	Graduates after residency programme transition	Graduates before residency programme transition	Percentage of graduates whose research activities were dedicated to clinical research during residency	19	9	84% vs 33% (p=0.013)	Unadjusted
	Graduates after residency programme transition	Graduates before residency programme transition	Percentage of graduates whose research activities were dedicated to full time basic science/translational	19	9	33% vs 22% (p=0.68)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
			research during residency				
	Graduates after residency programme transition	Graduates before residency programme transition	Percentage of graduates whose current practice included clinical research	19	9	79% vs 0% (p<0.001)	
	Graduates after residency programme transition	Graduates before residency programme transition	Percentage of graduates whose current practice included laboratory research	19	9	5% vs 0% (p=1)	
	Graduates after residency programme transition	Graduates before residency programme transition	Percentage of graduates whose current practice included academic practice	19	9	44% vs 0% (p=0.026)	
Sweeny (2019)	After programme implementation participants	Before programme implementation participants	Number of research active emergency healthcare providers	NR	NR	181 vs 23 (NR)	Unadjusted
	After programme implementation participants	Before programme implementation participants	Number of presentations by emergency clinicians	NR	NR	61 vs 6 (NR)	
Retention & Promotion							

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
Chang (2016)	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Retention as assistant professor role (since first year of appointment)	732	4962	Log rank chi-squared 640.95, df=1 (p<0.001)	Adjusted for years in academic medicine, age, tenure track status, degree type, department type
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Likelihood of departure from academic medicine - *just assistant professors*	Unclear	Unclear	HR 0.85 (95% CI: 0.74-0.98)	
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Likelihood of departure from academic medicine - *just associate professors*	Unclear	Unclear	HR 0.76 (95% CI: 0.64-0.93)	
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Likelihood of departure from academic medicine - *just full professors*	Unclear	Unclear	HR 0.68 (95% CI: 0.50-0.92)	
	Attendants from 1 of 3 career development programmes	Matched non-participants (all female)	Departure from academic medicine after 10 years - *just assistant professors*	732	4962	20% vs 33% (NR)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	(all female)						
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Departure from academic medicine after 10 years - *just associate professors*	429	884	10% vs 17% (NR)	
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Departure from academic medicine after 10 years - *just full professors*	215	172	8% vs 17% (NR)	
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Long term retention in academic medicine - *just assistant professors*	732	4962	Intervention participants were less likely to leave academia in the periods 0-13 years after their appointment and 22 years after or longer (NR).	
	Attendants from 1 of 3 career development programmes	Matched non-participants (all female)	Long term retention in academic medicine - *just associate professors*	429	884	Intervention participants were less likely to leave academia in the periods 0-	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	(all female)					10 years after their appointment (NR)	
	Attendants from 1 of 3 career development programmes (all female)	Matched non-participants (all female)	Long term retention in academic medicine - *just full professors*	215	172	Intervention participants were less likely to leave academia in any period after their initial appointment (NR)	
Daley (2006)	Junior faculty after implementation - intervention participants	Junior faculty before implementation - non-intervention participants	Percentage of URM junior staff retained at the faculty	15	12	87% vs 58% (z statistic=1.69, p=0.091)	Unadjusted
	Junior faculty after implementation - intervention participants	Junior faculty before implementation - non-intervention participants	Percentage of URM junior staff retained in academic medicine	15	12	93% vs 75% (z statistic=1.33, p=0.184)	
Ehlers (2018)	Programme participants	Matched non-programme participants	Enter private practice post-programme	70	70	40% vs 38.6% (p=0.862)	Time since matriculation into fellowship was included as a covariate. Matching criteria included fellowship program (CV or GI), gender, years of post-MD graduate training (±1
	Programme participants	Matched non-programme participants	Enter academic practice post-programme	70	70	60% vs 61.4% (p=0.862)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
							year for 65 pairs and ±3 years for 5 pairs), age at the time of starting fellowship training (±3 years), and site of fellowship (2 pairs needed to be matched across sites)
Emans (2008)	Faculty 3 years after implementation	Faculty 3 years before implementation	Number of promotions - *male faculty only*	Unclear	Unclear	17% increase (NR)	Unadjusted
	Faculty 3 years after implementation	Faculty 3 years before implementation	Number of promotions - *female faculty only*	Unclear	Unclear	56% increase (NR)	Unadjusted
	Faculty 3 years after implementation	Faculty 3 years before implementation	Number of promotions - *URM faculty only*	Unclear	Unclear	60% increase (NR)	Unadjusted
	Faculty 3 years after implementation	Faculty 3 years before implementation	Number of promotions - *Asian faculty only*	Unclear	Unclear	60% increase (NR)	Unadjusted
Guevara (2018)	Interview applications scholars	Interview applications non-scholars	Percentage of people who received any kind of position promotion	76	48	67.1% vs 58.3% (p=0.32)	Adjusted for age, gender, race/ethnicity, application year, change of institutions, and rank at time of application
	Interview applications scholars	Interview applications non-scholars	Retention in academic position (% of people)	76	48	84.2% vs 75% (p=0.21)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
Kohlwes (2006)	Programme residents (PRIME)	Other program residents (UCSF internal medicine programs)	Percentage of people asked to be a chief resident	32	185	21.8% vs 9.2% (p=0.03)	Unadjusted
Kohlwes (2016)	Programme residents (PRIME)	Non-PRIME programme residents	Percentage of alumni with an academic appointment	71	98	71.4% vs 67% (chi-squared=0.370, p=0.5430	Unadjusted
	Programme residents (PRIME)	Non-PRIME programme residents	Influence of research experience during residency on career choice (% strongly agree or agree on questionnaire)	71	98	63.4% vs 46.4% (chi-squared=4.757, p=0.029)	
	Programme residents (PRIME)	Non-PRIME programme residents	Influence of success with research during residency on career choice (% strongly agree or agree on questionnaire)	71	98	36.6% vs 23.5% (chi-squared=3.458, p=0.063)	
Ockene (2017)	Programme participants	Non-programme participants	Percentage of people promoted to associate professor	29	188	72% vs 32% (p<0.001)	Adjusted for equivalent time in rank
Ries (2009)	NCLAM programme participants	Non-NCLAM programme participants hired during same period	Faculty retention after 8-year probationary period (univariate analysis)	120	719	HR=1.77 (95% CI: 1.20-2.61, p=0.004)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	NCLAM programme participants	Non-NCLAM programme participants hired during same period	Faculty retention after 8-year probationary period (multivariate analysis)	120	719	HR = 1.67 (95% CI: 1.11-2.50, p=0.01)	Date of hire, gender and URM faculty were included as covariates
Ries (2012)	NCLAM programme participants (1999-2006)	Matched non-NCLAM programme participants (1999-2006)	8-year probationary period retention rate (% of people retained)	113	202	67% vs 56% (p=0.04)	Matched for: (1) gender, (2) academic series (research versus clinical primary job description), (3) initial academic rank/step (academic experience when hired), (4) hire date (within 12 months, to control for temporal changes in internal and external institutional variables), and (5) department
Recruitment							
Brandt (2018)	Research residents	Clinical residents	Percentage of people who entered first job in academic practice	43	284	34% vs 20% (p=0.0001)	Unadjusted
	Research residents (after implementing programme)	Clinical residents (before implementing programme)	Percentage of people who currently or once held a full-time academic appointment	43	87	20% vs 14% (NR)	Unadjusted
Dannels (2008)	Programme participants	Two control groups: Applied but not accepted non-	Highest rank/ position professor	53	25 & 172	69.8% vs 48% vs 68.6% (NR)	Unadjusted but faculty control group matched on academic rank, department

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
		programme participants & general mid-career faculty women (also non-participants)					chair status, race/ethnicity, discipline, degree type, basic sciences vs clinical department, age, medical school ownership, and awards ranking.
	Programme participants	Two control groups: Applied but not accepted non-programme participants & general mid-career faculty women (also non-participants)	Highest rank/ position department chair/ director	52	27 & 160	25% vs 18.5% vs 15.6% (NR)	
	Programme participants	Two control groups: Applied but not accepted non-programme participants & general mid-career faculty women (also non-participants)	Highest rank/ position dean and above	52	27 & 160	11.5% vs 11.1% vs 4.4% (NR)	
	Programme participants	Two control groups: Applied but not accepted non-programme participants & general mid-career	Academic title of chair or above	52	27 & 160	63.5% vs 37.0% vs 22.5% (chi-squared=29.96, p<0.001)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
		faculty women (also non-participants)					
Emans (2008)	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of professors - *female only*	Unclear	Unclear	12% vs 14% (NR)	Unadjusted
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of associate professors - *female only*	Unclear	Unclear	30% vs 21% (p=0.023)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of assistant professors - *female only*	Unclear	Unclear	44% vs 34% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of instructors - *female only*	Unclear	Unclear	58% vs 53% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of professors - *URM only*	Unclear	Unclear	3% vs 3% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of associate professors - *URM only*	Unclear	Unclear	3% vs 2% (NR)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of assistant professors - *URM only*	Unclear	Unclear	4% vs 5% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of instructors - *URM only*	Unclear	Unclear	8% vs 8% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of professors - *Asian only*	Unclear	Unclear	2% vs 0% (NR)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of associate professors - *Asian only*	Unclear	Unclear	6% vs 3% (p=0.023)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of assistant professors - *Asian only*	Unclear	Unclear	16% vs 9% (p=0.001)	
	Faculty 5 years after programme implementation	Faculty year of programme implementation	Percentage of instructors - *Asian only*	Unclear	Unclear	12% vs 12% (NR)	
Goldenberg (2012)	Programme trainees (academic	Non-programme trainees	Time from fellowship entry to assistant professor	11	9	Median 3.5 years vs 7 years (p<0.001)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	practice physicians only)						
Joshua Smith (2014)	Two intervention groups: Residents with protected research time and completing degree, & residents with just protected research time	Residents without protected research time	Percentage of residents for which their first job is an academic appointment	15 & 24	23	93.3% vs 58.3% vs 30.4% (p=0.046 comparing research time, p<0.001 comparing no research time)	Unadjusted
Khot (2011)	NIH associates who entered academic medicine	Non-associates who entered academic medicine (identified from faculty roster database)	Academic rank achieved - full professor	1577	27821	Ratio 1.57 (95% CI: 1.49-1.66, p<0.001)	Unadjusted
	NIH associates who entered academic medicine	Non-associates who entered academic medicine (identified from faculty roster database)	Academic rank achieved - chair	1577	27821	Ratio 2.0 (95% CI: 1.78-2.24, p<0.001)	
	NIH associates who entered academic	Non-associates who entered academic medicine	Academic rank achieved - dean	1577	27821	Ratio 2.97 (95% CI: 2.21-3.98, p<0.001)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	medicine	(identified from faculty roster database)					
	NIH associates who entered academic medicine	Non-associates who entered academic medicine (identified from faculty roster database)	Active faculty appointments in the top 10 schools	626	6038	Ratio 1.34 (95% CI: 1.15-1.56)	
	NIH associates who entered academic medicine	Non-associates who entered academic medicine (identified from faculty roster database)	Active faculty appointments in the top 20 schools	626	6038	Ratio 1.47 (95% CI:1.33-1.63)	
Sheridan (2010)	Intervention-participating departments	Non-intervention participating departments	Percentage of female faculty hired before and after workshop implementation	17	9	Precise estimate not reported - see Figure 1 in paper for details ($p<0.05$)	Unadjusted
Sweeny (2019)	After programme implementation participants	Before programme implementation participants	Number of new principal investigators recruited	NR	NR	55 vs 17 (NR)	Unadjusted
Valantine (2014)	University faculty where programme was	Faculty at 6 peer universities	Change in female faculty as a percentage of total faculty; *including assistant,*	1219	17000	5.8% vs 4.5% ($p=0.011$)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	implemented		*associate, and full professors* (2004-2010)				
	University faculty where programme was implemented	Faculty at 6 peer universities	Change in female faculty as a percentage of total faculty; *just assistant professors* (2004-2010)	420	7362	4.7% vs 5.0% (p=0.573)	
	University faculty where programme was implemented	Faculty at 6 peer universities	Change in female faculty as a percentage of total faculty; *just associate professors* (2004-2010)	370	4546	5.8% vs 5.1% (p=0.385)	
	University faculty where programme was implemented	Faculty at 6 peer universities	Change in female faculty as a percentage of total faculty; *just full professors* (2004-2010)	429	5092	5.2% vs 4.0% (p=0.003)	
	University faculty where programme was implemented	National faculty cohort	Change in female faculty as a percentage of total faculty; *including assistant, associate, and full professors* (2004-2010)	1219	116996	5.8% vs 4.0% (p=0.001)	Unadjusted
	University faculty where programme was implemented	National faculty cohort	Change in female faculty as a percentage of total faculty; *just assistant professors* (2004-2010)	420	56509	4.7% vs 3.6% (p=0.340)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	University faculty where programme was implemented	National faculty cohort	Change in female faculty as a percentage of total faculty; *just associate professors* (2004-2010)	370	27842	5.8% vs 4.1% (p=0.868)	
	University faculty where programme was implemented	National faculty cohort	Change in female faculty as a percentage of total faculty; *just full professors* (2004-2010)	429	31645	5.2% vs 3.7% (p=0.001)	
Publications							
Brandt (2018)	Research residents	Clinical residents	Publication productivity over career	43	284	Median 14 vs 4 (p<0.0001)	Unadjusted
	Research residents	Clinical residents	Publication productivity during residency	43	284	Median 10 vs 2.5 (p<0.0001)	
Ehlers (2018)	Programme participants	Matched non-programme participants	Number of publications at 5-years post-fellowship	70	70	Median 8 vs 5 (p=0.041)	Matching criteria included fellowship program (CV or GI), gender, years of post-MD graduate training (±1 year for 65 pairs and ±3 years for 5 pairs), age at the time of starting fellowship training (±3 years), and site of fellowship (2 pairs needed to be matched across sites)
	Programme participants	Matched non-programme participants	Number of first-author publications at 5-years post-fellowship	70	70	Median 4 vs 2 (p=0.002)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Programme participants	Matched non-programme participants	H-Index (as of year when studies was conducted - January 2018)	70	70	Median 11 vs 7 (p=0.013)	Time since matriculation into fellowship was included as a covariate. Matching criteria included fellowship program (CV or GI), gender, years of post-MD graduate training (±1 year for 65 pairs and ±3 years for 5 pairs), age at the time of starting fellowship training (±3 years), and site of fellowship (2 pairs needed to be matched across sites)
Goldenberg (2012)	Programme trainees	Non-programme trainees	Annual number of peer-reviewed publications 3-4 years post-fellowship	11	9	Median 3.5 vs 1 (p=0.01)	Unadjusted
Grisso (2017)	Intervention group	Control group (no intervention)	Increase in total no. of publications 2009 to 2012	62	70	Rate Ratio 0.80 (95% CI: 0.63-1.02, p=0.07)	Statistical tests were adjusted to account for correlation induced by tustered design using generalized estimating equations. Both within-person factors (age, years in rank, race) and unit-level factors (intervention assignment) were modeled simultaneously
	Intervention group	Control group (no intervention)	Increase in first author publications 2009 to 2012	62	70	Rate Ratio 1.00 (95% CI: 0.67-1.50, p=0.99)	
	Intervention group	Control group (no intervention)	Increase in total no. of peer review publications 2009 to 2012	62	70	Rate Ratio 0.95 (95% CI: 0.68-1.33, p=0.78)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Intervention group	Control group (no intervention)	Increase in first author peer review publications 2009 to 2012	62	70	Rate Ratio 1.06 (95% CI: 0.58-1.95, p=0.85)	
Guevara (2018)	Interview applications scholars	Interview applications non-scholars	Total no. of publications (mean) from point of application to December 2013	76	48	27.2 vs 33.0 (p=0.47, SD=30.0 vs 58.8)	Adjusted for age, gender, race/ethnicity, application year, change of institutions, and rank at time of application
	Interview applications scholars	Interview applications non-scholars	H-Index (as of December 2013)	76	48	12.5 vs 10.9 (p=0.32, SD=7.9 vs 10.2)	
Harrison (2020)	Participants after intervention implementation	Participants before intervention implementation	Mean number of publications (in 5 years) - *residents only*	Unclear	Unclear	7.0 vs 4.4 (p=0.263, SD= 4.47 vs 1.82)	Unadjusted
	Participants after intervention implementation	Participants before intervention programme	Mean number of publications (in 5 years) - *faculty only*	Unclear	Unclear	16.6 vs 12.8 (p=0.197, SD=4.39 vs 4.15)	Unadjusted
Joshua Smith (2014)	Two intervention groups: Residents with protected research time and completing degree, &	Residents without protected research time	Number of publications (mean)	17 & 27	24	10.3 vs 5.30 vs 1.29 (p=0.001 comparing to research time, p<0.001 comparing to no research time)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	residents with just protected research time						
	Two intervention groups: Residents with protected research time and completing degree, & residents with just protected research time	Residents without protected research time	Number of first-author publications (mean)	17 & 27	24	4.06 vs 2.30 vs 0.46 (p=0.017 comparing to research time, p<0.001 comparing to no research time)	
	Two intervention groups: Residents with protected research time and completing degree, & residents with just protected research time	Residents without protected research time	Impact factor of publications (mean)	17 & 27	24	32.3 vs 17.8 vs 2.69 (p=0.001 comparing to research time, p<0.001 comparing to no research time)	
	Two intervention groups: Residents with protected	Residents without protected research time	Adjusted impact factor of publications (mean)	17 & 27	24	65.4 vs 36.1 vs 5.17 (p=0.005 comparing to research time, p<0.001	Adjusted for level of authorship

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	research time and completing degree, & residents with just protected research time					comparing to no research time)	
Klimas (2017)	Programme participants	Non-programme participants	Total number of published papers at the end of the one-year fellowship	4	4	7 vs 1 (p=0.1)	Unadjusted
Kohlwes (2016)	Programme residents	Non-programme residents	Percentage of alumni who published research they had started during residency (first-author peer-review article)	71	92	64.3% vs 40.2% (chi-squared=9.213, p=0.002)	Unadjusted
Löwe (2008)	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more original publications with first authorship in the last year	15	22	46.7% vs 22.7% (p=0.13)	Unadjusted
	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more original publications with co-authorship in the last year	15	22	60% vs 18.2% (p=0.01)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more review or meta-analysis with first authorship in the last year	15	22	0% vs 9.1% (p=0.5)	
	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more review or meta-analysis with co-authorship in the last year	15	22	0% vs 9.1% (p=0.5)	
	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more book article with first authorship in the last year	15	22	26.7% vs 18.2% (p=0.69)	
	Intervention residents	Control residents (from two different locations)	Percentage of people who completed one or more book article with co-authorship in the last year	15	22	20% vs 4.6% (p=0.28)	
Merani (2014)	Additional degree trainees: Masters trainees, & PhD trainees	Clinical-only trainees	Percentage of surgeons involved in research publication during training with any authorship role	72 & 33	218	81.9% vs 100% vs 38.1% (p<0.05)	Unadjusted

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Additional degree trainees: Masters trainees, & PhD trainees	Clinical-only trainees	Percentage of surgeons involved in research publication during training with principal author role	72 & 33	218	58.3% vs 100% vs 27.1% (p<0.05)	
	Additional degree trainees: Masters trainees, & PhD trainees	Clinical-only trainees	Percentage of surgeons involved in research publication during training with senior author role	72 & 33	218	19.4% vs 12.1% vs 5% (p<0.05)	
	Additional degree trainees: Masters trainees, & PhD trainees	Clinical-only trainees	Percentage of surgeons involved in research publication post-training with any authorship role	69 & 32	201	81.2% vs 90.6% vs 44.3% (p<0.05)	
	Additional degree trainees: Masters trainees, & PhD trainees	Clinical-only trainees	Percentage of surgeons involved in research publication post-training with principal author role	69 & 32	201	56.5% vs 71.9% vs 26.4% (p<0.05)	
	Additional degree trainees: Masters trainees, &	Clinical-only trainees	Percentage of surgeons involved in research publications post-training with senior author role	69 & 32	201	37.7% vs 46.9% vs 14.9% (p<0.05)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	PhD trainees						
Mills (2011)	Programme participants	Non-programme participants	Percentage of participants with publication after graduation	232	295	69% vs 34% (p<0.001)	Unadjusted
	Programme participants	Non-programme participants	Median number of publications after graduation	232	295	2 vs 0 (p<0.001)	
	Programme participants	Non-programme participants	Likelihood of publishing in the future	232	295	OR=3.7 (95% CI: 2.5-5.6)	Adjusted for gender and publications prior to programme
Nasab (2019)	Programme participants	Non-programme participants (before implementation of programme)	Number of published papers during course period (2015-2018) - *just junior faculty members*	14	26	Mean 9.21 vs 4 (p=0.003, SD=8.1 vs. 5.21)	Unadjusted
	Programme participants	Non-programme participants (before implementation of programme)	Number of published papers during course period (2015-2018) - *just fellows*	35	11	Mean 4.31 vs 2 (p=0.008, SD=3.44 vs. 1.67)	
	Programme participants	Non-programme participants (before implementation of programme)	Journal impact factor during course period (2015-2018) - *just junior faculty members*	14	26	Mean 3.09 vs 4.57 (p=0.67, SD=1.54 vs. 5.03)	

First author (Year of publication)	Intervention group*	Control group*	Outcome	Sample size for intervention group	Sample size for control group	Estimate (95% CI/ p value/ SD)	Estimate adjusted for
	Programme participants	Non-programme participants (before implementation of programme)	Journal impact factor during course period (2015-2018) - *just fellows*	35	11	Mean 5.46 vs 3.03 (p=0.776, SD=9.81 vs. 1.72)	
Patel (2018)	Programme cohorts (2011/2012 - 2014/2015)	Pre-programme cohorts (2007/2008 - 2010/2011)	Likelihood of publishing one or more clinical research articles (%)	35	36	77% vs 44% (chi-squared=7.9, p=0.005)	Unadjusted
	Programme cohorts (2011/2012 - 2014/2015)	Pre-programme cohorts (2007/2008 - 2010/2011)	Number of published clinical research articles during residency (mean)	35	36	2.09 vs 1.56 (NR)	

Key: BCRP - Boston Combined Residency Programme; CCWAS - Culture that is conducive to women's academic success; CI – Confidence intervals; CV – Curriculum Vitae; MD – Doctor of Medicine; NCLAM - National Center of Leadership in Academic Medicine; NR - Not Reported; OR – Odds ratio; PhD – Doctor of Philosophy; PRIME - Primary Medical Education programme; SD – Standard deviation; SWIF - Strain-based work interference with family; TWIF - Time-based work interference with family; UCSF - University of California San Francisco; URM - Underrepresented Minorities. *Groups are reported as described by authors. **Inconsistent data reported and referred to in tables and text; data represented here is extracted from text.

Introduction

Thank you for considering to take part in this research study. Before you decide whether to participate, there are a few things that are important to understand about the study. This will include why the study is taking place and what participation will involve. Please take time to read the following information carefully and feel free to ask us if there is anything that you do not understand or if you would like more information – you should already have our contact details but they are at the bottom of this sheet. Please also feel free to discuss this with your friends. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

Thank you for taking the time to read this.

1. **Title of the study**

From the sticky floor to the glass ceiling and everything in between: A qualitative review focusing on gender inequalities in clinical academic careers.

2. **What is the purpose of the study?**

Now more than ever, awareness of gender inequalities is at the forefront of clinical education. Understanding the motivators and barriers for those who choose to follow a clinical academic career path is of paramount importance. There is a significant body of work within the clinical field, but many areas for exploration still exist. This study aims to understand the experiences of clinical academic careers from a fully representative sample of those within clinical academic pathways from trainee to senior, including those who may have left or never embarked on a clinical academic pathway.

3. **Why have I been chosen to take part?**

You have generously volunteered for interview and as you have at some time been involved in a clinical academic pathway, this offer has been accepted.

4. **Do I have to take part?**

No, participation is voluntary and you are free to withdraw at any time without explanation by speaking to or contacting the investigator.

5. **What will happen if I take part?**

An in-depth interview will take place, conducted via telephone/ Skype or face-to-face if travel is feasible. The interviews will explore barriers, promoters and contextual factors that impact upon career choice and trajectory.

6. **Expenses and / or payments**

In many cases, travel expenses will not be necessary as the majority of interviews will take place over the telephone or via Skype.

7. **Are there any risks in taking part?**

There are no conceivable risks to your health by taking part in this study. The topics covered in the interview should not be considered sensitive, embarrassing or otherwise uncomfortable. However, if you do have any concerns about the risks, feel free to contact the principal investigator, Professor Gabrielle Finn.

8. **What if I am unhappy or if there is a problem?**

If you are unhappy, or if there is a problem with the interview, please feel free to let us know by contacting the principal investigator. If you remain unhappy or have a complaint which

you feel you cannot come to us with then you should contact the HYMS Research Support Office directly (01904 321780 or research@hyms.ac.uk).

9. Will my participation be kept confidential?

Recordings from the interview will be anonymised and stored without any identifiable information. They will be destroyed upon your withdrawal or at your specific request. If neither of these occur, the recordings and other documents will be destroyed five years after the study concludes. Although unlikely, if something is said that could raise a potential concern about fitness to practice and/or safeguarding, specific details will be gathered and shared with the principal investigator. The investigator will then follow HYMS guidelines on fitness to practice and/or safeguarding concerns and they will navigate subsequent escalation to the relevant individuals and committees.

10. What happens if I am harmed by taking part in this study?

In the extremely unlikely event that you are harmed during the interview, the interview will stop and the incident documented and reported to both the principal investigator and HYMS.

11. What will happen to the results of the study?

The anonymised results will be used to formulate the conclusions of the study. This may eventually end up in the public domain.

12. What will happen if I want to stop taking part?

You always retain the right to withdraw from the project at any time, for any reason, without the need to explain. If you are happy for this to be done, results up to the period of withdrawal may be used. If not, you may request that they are destroyed and no further use is made of them. To do so, contact the principal investigator.

13. Who can I contact if I have further questions?

The investigator is the first point of contact. Questions should be addressed to the investigator initially.

Principal Investigator	**Co-Principal Investigator**
Professor Gabrielle Finn	Dr Jessica Morgan
Gabrielle.Finn@hyms.ac.uk	Jess.morgan@york.ac.uk

Please write your initials next to each check-box.

Project title: **From the sticky floor to the glass ceiling and everything in between: A qualitative review focusing on gender inequalities in clinical academic careers**

Name of researcher: Professor Gabrielle Finn

Participant ID number:

I confirm I have read the Participant Information Sheet in its entirety, and understand its contents. ☐ _____

I confirm I have had the opportunity to ask questions about my involvement in this project. ☐ _____

I understand that my involvement is entirely voluntary and that I am free to withdraw from the project at any time, without giving reason or excuse. ☐ _____

I understand that I will be expected to participate in a 30-40 minute interview via telephone/Skype, and that my involvement is voluntary. ☐ _____

I understand that audio from the interview will be recorded and stored securely, and then transcribed. I understand that anonymised recordings and transcriptions may be kept so long as there are deemed to be of academic use for up to five years. ☐ _____

I agree to take part in this research as an interviewee. ☐ _____

Initials: _____ **Date:** _____ **Signature:** _____

Appendix 8: Interview stems

Semi-structured approach thus will be guided by participants.

1. **Introductions**

2. **Please describe your role and career path to date -** *both clinical and academic*

3. **What are your experiences of clinical academia?**

4. **What factors impacted upon your decision to pursue (or not pursue) a career in clinical academia?**

   What factors make clinical academia an attractive career?

5. **What has your experience with NIHR awards/ funding been like? (if any)**

- *Application process? (facilitators/barriers)*
- *Support through process*
- *Why did/didn't continue? (e.g. after PhD why didn't do lectureship?)*
- *If not applied, why not?*
- *Did this experience influence your choice in career pathway?*

6. **What barriers and enablers have you faced within clinical academia?**

- *What made you continue/not continue?*
- What stops people returning to clinical academia?
- How do you negotiate the 2 career paths?
- What goes wrong in institutions that funders can help with?
- What worked well/ less well with other funders you have experienced?

7. **What could be done to improve equal representation within clinical academia?**

8. **Describe any interventions to promote access to clinical academia or reduce discrimination that you have experienced.**

- *What worked?*
- *Given your context, what would you recommend?*

9. **What existing or new interventions could help to reduce attrition in clinical academic careers?**

10. **How can organisations support trainees and clinical academics in their career decisions and academic pathways?**

11. ***Would you be willing to complete some short audio diaries for us as part of this research? If so, we will send you a detailed information sheet about this to explain the process.***

Appendix 9: Instructions for completion of audio diary

Thank you for agreeing to complete an audio diary about your experiences in clinical academia.

You will find enclosed in this pack the following documents:

- **Instructions**
- **A prompt sheet**

INSTRUCTIONS

How to complete the diary study:

- You are required to tape record your thoughts about your current work situation, transition between career points/roles, or specific events. You may be going through a particular experience or reaching a transition point between academic and clinical work. We are interested in what influences your decisions to pursue (or not) a clinical academic career over time.
- Ideally, we wish to receive fortnightly recordings over a 3-4 month period. However, these can be as regular as you like, the most important element is that you document any events. These could even be daily.
- Recordings don't need to be for a specific length of time. We just ask that you provide as much detail and context as possible.
- The prompt sheet sets out the issues you may wish to comment on during the tape recordings. For each tape recording, please look at the prompts for guidance. Some of the issues may be more relevant to you than others. You can talk in more detail about the issues which are more relevant to you.

***When to do the tape recordings*:**

It might be helpful to set aside diary time each week in your calendar. We do not specify a day, as we realise you have multiple commitments.

You will be sent a text message or email (as you prefer) to remind you that the tape recording should be carried out for the week. **Please send your recordings as soon as each one is completed.** We can then support you in your following diary entries.

How to record and transfer the files:

If you prefer to use a smartphone app, please email or Whatsapp the file to your named research contact.

PROMPT SHEET

Each time you carry out a tape recording, you may find it helpful to comment on any of the issues below. You can talk in as much or as little detail as you would like.

Some of the issues below may be of more relevance to you than others; therefore, you might spend more time on some prompts than on others.

e.g. Please tell us about a time when a protected characteristic (gender, race, pregnancy etc.) has impacted upon your role in clinical academia? This may not be relevant to you.

You may also wish to reflect on your general (clinical academic) career or **discuss specific experiences** where you may have felt discriminated against, unsupported, or disadvantaged.

- How did this make you feel?

- What was the organisational culture?
- What are the lessons to be learned?
- How satisfied you are with your career circumstances?
- How supported you feel by managers and co-workers?
- Whether you have experienced any discrimination?
- Your opportunities for training and learning?
- How much support you get from those around you?
- How easily you have fitted into your role?
- How you feel about your future employment situation?
- Whether or not you feel stressed (and why/why not)?
- Your workload?
- Any other issues you would like to talk about?

Contact details:

Professor Gabrielle Finn, Dr Amelia Kehoe or Dr Paul Crampton
Health Professions Education Unit
Tel: 07385028936
Email: hpeuresearch@hyms.ac.uk

Appendix 10: Example audio dairy prompts for participants during COVID-19

Example audio dairy prompts for participants during COVID-19		
How has COVID-19 impacted upon your work as a clinical academic?	What have you heard about funding (opportunities, threats, remit etc) post COVID-19?	Has COVID-19 had a detrimental impact on or changed your career plans?
How has the expectation of the impact of COVID-19 differed from the reality?	How have your protected characteristics impacted upon your experience of clinical academia during COVID-19?	BAME participants: Has the emerging data on the enhanced risk to the BAME workforce from COVID-19 had any impact on you?
Has COVID-19 had a detrimental impact on or changed your research?	What barriers and enablers have you faced during COVID-19?	Parents/ carers: How have your responsibilities impacted upon your ability to work?

Appendix 11: Full results of Latent Dirichlet Allocation (LDA topic modelling) with 50 topics

Topic number	Words Associated
1	0.225*"okay" + 0.208*"programme" + 0.135*"saying" + 0.090*"conference" + 0.069*"real" + 0.060*"academy" + 0.057*"running" + 0.039*"offer" + 0.029*"anyone"
2	0.379*"want" + 0.145*"often" + 0.106*"level" + 0.106*"moment" + 0.069*"whatever" + 0.056*"supportive" + 0.049*"junior" + 0.023*"wrong" + 0.019*"phd"
3	0.252*"first" + 0.233*"half" + 0.211*"person" + 0.082*"term" + 0.052*"building" + 0.020*"initial" + 0.014*"manchester" + 0.009*"standing" + 0.005*"candidate"
4	0.280*"try" + 0.222*"health" + 0.105*"money" + 0.069*"together" + 0.066*"skill" + 0.064*"contact" + 0.051*"talking" + 0.028*"proper" + 0.027*"review" + 0.012*"formal"
5	0.404*"would" + 0.163*"probably" + 0.107*"already" + 0.085*"course" + 0.056*"better" + 0.045*"interview" + 0.032*"best" + 0.022*"beginning" + 0.018*"choose" + 0.008*"culture"
6	0.280*"still" + 0.178*"whether" + 0.177*"keep" + 0.152*"issue" + 0.059*"gender" + 0.054*"paper" + 0.017*"cultural" + 0.000*"frown" + 0.000*"terrifically"
7	0.266*"funding" + 0.150*"group" + 0.103*"consultant" + 0.069*"great" + 0.064*"question" + 0.048*"centre" + 0.046*"understanding" + 0.042*"leeds" + 0.032*"self" + 0.027*"answer"
8	0.267*"opportunity" + 0.182*"anything" + 0.139*"masters" + 0.104*"degree" + 0.074*"personal" + 0.057*"team" + 0.039*"drive" + 0.037*"spoke" + 0.015*"potential"
9	0.259*"experience" + 0.257*"laugh" + 0.224*"interest" + 0.126*"easy" + 0.030*"sound" + 0.028*"night" + 0.006*"brain" + 0.002*"closely"
10	0.335*"years" + 0.266*"could" + 0.101*"five" + 0.090*"felt" + 0.069*"data" + 0.039*"honest" + 0.014*"thirty" + 0.013*"practical" + 0.012*"relatively" + 0.005*"supervise"

11	0.234*"doctor" + 0.161*"every" + 0.119*"world" + 0.100*"researcher" + 0.074*"specialist" + 0.073*"competitive" + 0.060*"stress" + 0.020*"quality" + 0.019*"teacher" + 0.010*"leader"
12	0.226*"give" + 0.148*"spend" + 0.133*"rather" + 0.115*"write" + 0.109*"study" + 0.060*"though" + 0.037*"follow" + 0.026*"advance" + 0.026*"extension" + 0.024*"cost"
13	0.253*"place" + 0.235*"take" + 0.101*"absolutely" + 0.090*"registrar" + 0.074*"staff" + 0.047*"friend" + 0.043*"approach" + 0.039*"seeing" + 0.023*"matter" + 0.013*"management"
14	0.394*"clinical" + 0.361*"academic" + 0.097*"maybe" + 0.059*"colleague" + 0.018*"focus" + 0.011*"taking" + 0.010*"notice" + 0.009*"developing" + 0.007*"eighteen" + 0.006*"worse"
15	0.242*"academia" + 0.186*"come" + 0.142*"definitely" + 0.136*"continue" + 0.047*"essentially" + 0.047*"open" + 0.042*"earn" + 0.038*"conversation" + 0.020*"basis" + 0.019*"anymore"
16	0.565*"research" + 0.182*"good" + 0.071*"important" + 0.055*"somebody" + 0.032*"see" + 0.028*"writing" + 0.021*"teach" + 0.005*"valid" + 0.005*"range" + 0.003*"broad"
17	0.540*"training" + 0.070*"early" + 0.055*"remember" + 0.043*"loads" + 0.030*"mean" + 0.027*"along" + 0.026*"advice" + 0.026*"intercalate" + 0.025*"body" + 0.023*"achieve"
18	0.199*"able" + 0.140*"patient" + 0.123*"lots" + 0.059*"stage" + 0.054*"balance" + 0.050*"exam" + 0.047*"pretty" + 0.041*"towards" + 0.028*"tricky"
19	0.413*"difficult" + 0.084*"papers" + 0.083*"available" + 0.071*"everybody" + 0.059*"outside" + 0.055*"second" + 0.034*"name" + 0.028*"employ" + 0.028*"directly" + 0.024*"unless"
20	0.408*"start" + 0.254*"getting" + 0.152*"involve" + 0.060*"undergraduate" + 0.021*"believe" + 0.010*"pure" + 0.006*"rule" + 0.002*"hang" + 0.002*"dead" + 0.000*"uganda"
21	0.451*"apply" + 0.174*"days" + 0.081*"ways" + 0.062*"times" + 0.059*"feeling" + 0.034*"white" + 0.018*"middle" + 0.018*"retire" + 0.008*"elements" + 0.005*"bloke"

22	0.269*"medical" + 0.147*"student" + 0.145*"teaching" + 0.069*"specialty" + 0.067*"science" + 0.048*"impact" + 0.044*"trust" + 0.038*"path" + 0.033*"service" + 0.032*"wellcome"
23	0.354*"practice" + 0.089*"professor" + 0.085*"lecturer" + 0.076*"since" + 0.072*"care" + 0.057*"particular" + 0.044*"primary" + 0.033*"nobody" + 0.032*"knowledge" + 0.025*"starting"
24	0.258*"month" + 0.246*"happen" + 0.215*"little" + 0.075*"left" + 0.064*"mostly" + 0.027*"baby" + 0.015*"thesis" + 0.012*"totally" + 0.000*"paris" + 0.000*"biochemist"
25	0.285*"sure" + 0.241*"change" + 0.088*"fifty" + 0.074*"paediatric" + 0.059*"lectureship" + 0.054*"husband" + 0.040*"scale" + 0.030*"somewhere" + 0.021*"ground" + 0.015*"oncology"
26	0.709*"people" + 0.037*"trial" + 0.037*"progress" + 0.036*"lucky" + 0.032*"kid" + 0.022*"longer" + 0.022*"factor" + 0.015*"setting" + 0.013*"identify" + 0.012*"mention"
27	0.253*"university" + 0.231*"career" + 0.112*"role" + 0.080*"another" + 0.069*"whole" + 0.057*"base" + 0.039*"means" + 0.033*"community" + 0.033*"various" + 0.033*"without"
28	0.378*"need" + 0.272*"feel" + 0.248*"always" + 0.026*"shut" + 0.013*"paperwork"
29	0.247*"stuff" + 0.134*"area" + 0.133*"never" + 0.130*"life" + 0.097*"talk" + 0.089*"reason" + 0.036*"email" + 0.022*"comment" + 0.012*"assume" + 0.009*"describe"
30	0.219*"project" + 0.165*"supervisor" + 0.159*"leave" + 0.155*"fact" + 0.125*"meeting" + 0.039*"beyond" + 0.030*"fairly" + 0.019*"passionate" + 0.008*"immediate"
31	0.227*"help" + 0.168*"woman" + 0.142*"call" + 0.119*"process" + 0.069*"whereas" + 0.049*"publish" + 0.038*"business" + 0.035*"yorkshire" + 0.028*"get" + 0.021*"recruitment"
32	0.620*"time" + 0.149*"part" + 0.081*"long" + 0.029*"difference" + 0.027*"slightly" + 0.022*"effectively" + 0.020*"turn" + 0.007*"suspect" + 0.007*"valuable"

33	0.276*"child" + 0.222*"suppose" + 0.099*"tend" + 0.066*"access" + 0.055*"struggle" + 0.052*"whilst" + 0.034*"therefore" + 0.031*"older" + 0.028*"progression" + 0.021*"cancer"
34	0.225*"senior" + 0.155*"enough" + 0.112*"house" + 0.106*"making" + 0.103*"job" + 0.061*"love" + 0.037*"individual" + 0.025*"influence" + 0.022*"word" + 0.021*"liverpool"
35	0.231*"go" + 0.122*"trainee" + 0.115*"everything" + 0.105*"else" + 0.098*"either" + 0.087*"department" + 0.049*"round" + 0.049*"complete" + 0.040*"putting" + 0.021*"equally"
36	0.350*"year" + 0.205*"point" + 0.133*"scheme" + 0.065*"view" + 0.043*"main" + 0.041*"sort" + 0.035*"ever" + 0.013*"2006" + 0.013*"obvious" + 0.013*"uncertainty"
37	0.145*"salary" + 0.127*"enjoy" + 0.118*"certain" + 0.104*"income" + 0.089*"stop" + 0.074*"know" + 0.073*"look" + 0.064*"amount" + 0.035*"happening" + 0.026*"produce"
38	0.251*"education" + 0.156*"college" + 0.134*"position" + 0.079*"least" + 0.050*"potentially" + 0.041*"asking" + 0.039*"planning" + 0.039*"enable" + 0.036*"acknowledge" + 0.029*"pregnant"
39	0.315*"say" + 0.195*"nihr" + 0.169*"fund" + 0.162*"side" + 0.034*"shift" + 0.027*"capacity" + 0.018*"incredibly"
40	0.410*"post" + 0.132*"next" + 0.119*"looking" + 0.076*"small" + 0.070*"anyway" + 0.041*"line" + 0.039*"decide" + 0.033*"recruit" + 0.015*"manager"
41	0.335*"fellowship" + 0.175*"found" + 0.111*"paediatrics" + 0.084*"forward" + 0.062*"mind" + 0.054*"successful" + 0.050*"organise" + 0.020*"agree" + 0.003*"flipside" + 0.002*"personalise"
42	0.138*"finish" + 0.134*"thought" + 0.134*"medicine" + 0.090*"thinking" + 0.085*"coming" + 0.085*"clinician" + 0.077*"number" + 0.066*"stay" + 0.041*"award" + 0.032*"scientist"
43	0.260*"full" + 0.217*"time" + 0.100*"away" + 0.099*"end" + 0.052*"fall" + 0.048*"telling" + 0.029*"society" + 0.024*"attention" + 0.018*"imposter" + 0.014*"design"

44	0.193*"find" + 0.184*"working" + 0.121*"hard" + 0.113*"tell" + 0.109*"percent" + 0.077*"hours" + 0.055*"realise" + 0.047*"recognise" + 0.019*"afterwards" + 0.019*"discrimination"
45	0.201*"support" + 0.192*"might" + 0.142*"understand" + 0.140*"around" + 0.077*"mentor" + 0.062*"completely" + 0.039*"responsibility" + 0.021*"bit" + 0.015*"amaze" + 0.011*"amongst"
46	0.278*"right" + 0.221*"grant" + 0.192*"sometimes" + 0.111*"application" + 0.048*"weekend" + 0.022*"rota" + 0.020*"third" + 0.013*"rubbish" + 0.012*"massively" + 0.003*"annual"
47	0.274*"different" + 0.208*"school" + 0.114*"hospital" + 0.102*"medical" + 0.085*"challenge" + 0.051*"fine" + 0.030*"forty" + 0.026*"eight" + 0.017*"stick" + 0.016*"anybody"
48	0.516*"work" + 0.116*"do" + 0.111*"terms" + 0.096*"make" + 0.047*"female" + 0.037*"aware" + 0.026*"step" + 0.011*"prove" + 0.006*"boss" + 0.001*"dominate"
49	0.154*"last" + 0.128*"family" + 0.122*"particularly" + 0.099*"public" + 0.092*"train" + 0.070*"system" + 0.057*"plan" + 0.054*"ask" + 0.048*"works" + 0.038*"morning"
50	0.249*"week" + 0.188*"within" + 0.150*"partner" + 0.091*"pay" + 0.067*"twenty" + 0.049*"speak" + 0.034*"perhaps" + 0.033*"generally" + 0.033*"value" + 0.015*"confidence" 0.390*"become" + 0.171*"four" + 0.105*"hear" + 0.092*"young" + 0.071*"create" + 0.032*"impossible" + 0.012*"external" + 0.006*"prof"

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