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Complete List of Authors:	Ong, John; Bedford Hospital NHS Trust, Gastroenterology; NIHR Biomedical Research Centre at Guy's and Saint Thomas' NHS Foundation Trust and King's College, Centre for Stem Cells & Regenerative Medicine, King's College London Swift, Carla; Addenbrooke's Hospital, Gastroenterology Magill, N; King's College London, Biostatistics & Health Informatics Ong, Sharon; Singapore General Hospital, Anaesthesia & Intensive Care Day, Anne; Bedford Hospital NHS Trust, Gastroenterology Al-Naeeb, Yasseen; Bedford Hospital NHS Trust, Gastroenterology Shankar, Arun; Norfolk and Norwich University Hospitals NHS Foundation Trust, Gastroenterology
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Mentoring Is Associated With Better Training Outcomes in Junior Doctors in Medicine: A Cross-sectional study on Core Medical Trainees in the UK

Dr John Ong[1*], Dr Carla Swift[2*], Mr Nicholas Magill[3], Ass. Prof Sharon Ong[4], Dr Anne Day[5], Dr Yasseen Al-Naeeb[6], Dr Arun Shankar[7]

*JO and CS are joint first authors

[1]Specialty Registrar, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[2]Specialty Registrar, Department of Gastroenterology, Addenbrooke's Cambridge University Hospital, Cambridge, CB2 0QQ, UK

[3]Biostatician, Department of Biostatistics and Health Informatics, King's College London, SE5 8AF, UK

[4]Assistant Professor and Consultant, Department of Anaesthesia, Singapore General Hospital, Outram Road, S169608, Singapore

[5]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[6]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[7]Consultant, Department of Gastroenterology, Norfolk & Norwich University Hospital, Colney Lane, NR4 7UY, UK

Corresponding author: Dr John Ong (co-first author), Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, United Kingdom. Email: john.ong@kcl.ac.uk

ABSTRACT

Objective: To determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

Design: Cross-sectional study

Participants: 117 trainees from the East of England Deanery (non-mentored group) and the recently established Royal College of Physicians (RCP) Mentoring scheme (mentored group) who were core medical trainees (CMTs) between 2015 and 2017 completed an online survey. Trainees who received mentoring at the start of higher speciality training, incomplete responses and trainees who were a part of both the East of England deanery and RCP Mentoring scheme were excluded leaving 85 trainees in the non-mentored arm and 25 trainees in the mentored arm. Responses from a total of 110 trainees were analysed.

Main Outcome Measures: Pass rates of the various components of the MRCP(UK) examination (MRCP Part 1, MRCP Part 2 Written and MRCP Part 2 PACES), pass rates at the Annual Review of Competency Progression (ARCP), trainee involvement in significant events, clinical incidents, or complaints and trainee feedback on career progression and confidence.

Results: Mentored trainees reported higher pass rates of the MRCP Part 1 exam versus non-mentored trainees (84.0% vs. 42.4%, $p<0.01$). Mentored international medical graduates (IMGs) had higher pass rates than non-mentored IMGs in the MRCP Part 2 Written exam (80.0% vs. 25.9%, $p<0.05$) and the MRCP Part 2 PACES exam (80.0% vs. 11.1%, $p<0.01$). ARCP pass rates in mentored trainees were higher than non-

mentored trainees (95.8% vs. 69.9%, p<0.01). Rates of involvement in significant events, clinical incidents and complaints in both groups did not show any statistical difference. Mentored trainees reported higher confidence and career progression.

Conclusions: Mentoring of CMTs is positively associated with better training outcomes. Randomised control trials are justified to demonstrate the causative effects of mentoring in postgraduate medical training within the UK.

Strengths and limitations of this study

- Novel quantitative data demonstrating a positive association between mentoring and better training-specific outcomes in core medical trainees.
- Strengthens the limited existing qualitative data on the effects of mentoring in postgraduate medical training within the UK.
- Potential for response bias from participants through self selection.
- Small sample size of International Medical Graduates who received mentoring.
- Provides preliminary evidence to justify further randomised control trials to demonstrate the causative effects of mentoring in UK medical trainees.

INTRODUCTION

Work based mentoring is a growing and encouraged practice in UK postgraduate medical training [1]. Though qualitative data suggests that mentored trainees do generally have a positive experience, there is little quantitative evidence to suggest this directly and positively impacts on training-specific outcomes in postgraduate medicine [2]. Here we studied two groups of junior medical doctors in training and compared

targeted training outcomes in a group of trainees who have received mentorship in a structured mentoring programme versus a non-mentored group. By default, mentoring is not provided to all trainees in the UK.

Mentoring is defined as "a process whereby an experienced, highly regarded, empathic person (the mentor) guides another usually younger individual (the mentee) in the development and re-examination of their own ideas, learning, and personal or professional development" [3]. It describes a voluntary and synergistic relationship which requires commitment from both parties in order to be effective [4]. Its ultimate purpose is to empower an individual to achieve set goals [4], though these goals inevitably evolve over time as the mentee develops [3].

In many studies in literature, failed mentor-mentee relationships are a result of poor communication, lack of commitment, personality differences, competition, conflicts of interest, mentor inexperience [5] and unrealistic mentee expectations [4],[6]. To minimise these problems, we included trainees from the Royal College of Physicians (RCP) Mentoring scheme, an optional and recently established mentoring programme made available to any interested core medical trainee in the UK. Interested trainees apply to join the scheme and choose their mentors based on online mentor profiles to improve mentor-mentee compatibility. Mentors in the scheme comprise senior registrars and consultants from different medical specialties. They have volunteered to be mentors and received formal training in mentorship and effective communication prior to accepting mentees. To avoid unrealistic expectations by mentees, mentors engaged in goal setting (e.g. S.M.A.R.T objectives) during the early stages of the mentor-mentee process.

Easy accessibility and open communication is an important factor for a successful mentor-mentee relationship [5]. To facilitate this, mentors and mentees in the RCP mentoring scheme had the option to conduct mentor-mentee meetings either in person, online or both. Mentees determined the mode, frequency and duration of the meetings. Though some studies question the quality and validity of online mentoring [7],[8], others have argued it can still be effective [9], [10] and provides opportunities for mentoring when it would otherwise not be possible [9]. We have chosen not to investigate the mode of how mentoring was delivered in this study because many mentees within the RCP Mentoring scheme have used a combination of face-to-face meetings, webcam meetings (e.g. Skype or Facetime) and email communications. This makes quantitative analysis difficult and does not answer the research question posed by this study.

METHOD

A questionnaire was designed to enable the quantitative analysis of training-specific outcomes and the qualitative analysis of trainee feedback. Parameters for quantitative analysis were the (i) pass rates of the Membership of the Royal College of Physicians (MRCP UK) exams, (ii) pass rates of the Annual Review of Competence Progression (ARCP) and (iii) the rate of trainee involvement in significant events (SEs), clinical incidents (CIs) and complaints.

The MRCP(UK) exam is a postgraduate exam in general internal medicine which comprises of three parts: MRCP Part 1 Written, MRCP Part 2 Written and the MRCP Part 2 PACES (practical component). The MRCP(UK) diploma is awarded upon completion of all three exams and completion of the MRCP Part 1 Written exam is

required before a trainee can sit for the other two exams. Completion of the MRCP(UK) diploma is expected by the end of core medical training and is a pre-requisite to joining a higher specialty training programme in medicine within the UK. Completion of these examinations is an objective indicator that a trainee has achieved the medical knowledge required for their stage of training.

In postgraduate medical training in the United States, the Accreditation Council for Graduate Medical Education (ACGME) assesses trainee progress in the six domains of patient care, medical knowledge, practice based learning and improvement, interpersonal and communication skills, professionalism and system based practice. Each domain has "milestones" which trainees are expected to achieve at different stages of training. In the UK, a similar approach is adopted and progress is determined by the ARCP review. The ARCP review occurs annually and involves a panel of senior clinical educators and physicians assessing a trainee's progress in the domains of multiple consultant reports, educational supervisor report, advanced life support, supervised learning events, multi-source feedback, research and audit, common procedural competencies, non-procedural competencies (e.g. communication skills, history taking etc), top medical presentations, emergency medical presentations, other medical presentations, clinics and teaching attendance. The trainee submits evidence to the panel to demonstrate the domain requirements have been achieved and an outcome is awarded to the trainee after the entire review process. Outcome 1, the equivalent of a pass, is described as "satisfactory progress - achieving progress and competencies at expected rate". Other outcomes relevant to core medical training are similar to a fail. The ARCP pass rate was chosen as a parameter of interest because it is an indirect but objective indicator of a trainee's all-rounded development in both the educational curriculum and clinical practice.

Further questions were also incorporated into the questionnaire to facilitate the qualitative analysis of a trainee's experience of being mentored and offer a platform for feedback by free text.

The questionnaire was pretested on a small group of medical registrars within the East of England deanery to assess its ability at extracting the information required for the study. Minor revisions were made and the final questionnaire was sent as a link to an online survey to all core medical trainees (CMTs) within the East of England Deanery between 2015 and 2017 (n=540 trainees, non-mentored group), and all CMTs who voluntarily registered with the RCP Mentoring scheme between 2015 and 2017 (n=160, mentored group). All responses were automatically anonymised by the online survey platform and trainees were made aware of this in their invitation email. Of the 700 trainees that the invitations were sent to, responses from 117 trainees were received. Of the 117 responses, trainees who received mentoring at the start of higher speciality training (ST3 or above), incomplete responses and trainees who were both a part of the East of England deanery and the RCP Mentoring scheme were excluded (n=7 in total). Other grades of junior doctors equivalent to CMTs (e.g. CMT grade Clinical Fellows and LAT SHOs) were classed the same as CMTs for analysis since these numbers were relatively small. The final numbers for comparison were 25 trainees in the mentored group and 85 trainees in the non-mentored group (Figure 1A).

Graphpad 7.0 (by PRISM) was used to perform the statistical analyses between the two groups of trainees. When numbers were sufficiently large, $\boldsymbol{X}^2$ test was used to test if mentoring resulted in a significant change in proportions of the test parameter. The Baptista-Pike method was used to calculate the confidence intervals of odds ratios. When trainee numbers were small ($n < 5$), Fisher's exact test was used to calculate p-

values for better accuracy. Statmate 2.0 (PRISM) was used for power calculations in the study.

Qualitative responses were grouped into categories of "positive" or "negative" feedback when applicable and descriptors provided by the trainees were summarised.

RESULTS

Of the 110 trainees in the study (85 non-mentored, 25 mentored), there were slightly more female respondents than male in both arms of the study; 52.0% (13/25) vs. 48.0% (12/25) in the mentored group and 52.9% (45/85) vs. 47.1% (40/85) in the non-mentored group (Figure 1B). There were no statistically significant differences in the career grades of the respondents in both arms of the study (Figure 1C) and the majority of respondents were graduates from the UK (Figure 1D). In terms of age (Figure 1E), there was an incidentally higher proportion of trainees aged 31-35 years in the mentored group compared to the non-mentored group ($X^2 = 9.831$, df=4, p=0.04).

Mentoring is associated with higher pass rates of the MRCP exams (Figure 2A).

The pass rate of the MRCP Part 1 exam is significantly higher in trainees receiving mentorship compared to non-mentored trainees; 84.0% (21/25) vs. 42.4% (36/85), $p < 0.01$ (OR=7.1, 95% CI 2.4-20.3). In sub-population analyses, the pass rates of the MRCP Part 2 (Written) exam and MRCP Part 2 (PACES) exam were significantly higher in mentored, international medical graduates (IMGs) compared to non-mentored IMGs; 80.0% (4/5) vs. 25.9% (7/27), $p<0.05$ and 80.0% (4/5) vs. 11.1% (3/27), $p<0.01$ respectively. Though the pass rates of all components of the MRCP(UK) exams were

higher in the mentored group compared to the non-mentored group, only the categories described above were of statistical significance.

Mentoring is associated with higher ARCP pass rates (Figure 2B).

The ARCP review provides a comprehensive assessment of a trainee's progress in the core medical training educational curriculum and personal clinical practice. In our study, 97 trainees (24 mentored, 73 non-mentored) out of 110 had an ARCP within 12 months. The ARCP pass rate (Outcome 1s) was significantly higher in mentored trainees compared to non-mentored trainees; 95.8% (23/24) vs. 69.9% (51/73), $p<0.01$ (OR=9.9, 95% CI 1.5-107).

Mentoring does not significantly decrease the number of Significant Events (SEs), Clinical Incidents (CIs) or Complaints in core medical trainees (Figure 2C).

The National Patient Safety Agency (NPSA) in the UK defines a significant event as "any event (negative) thought by anyone in the team to be significant in the care of patients or conduct of practice" [11]. The term "clinical incident" is often used to describe an unintentional or unexpected event that is less severe in nature and which does not cause significant harm to a patient or member of staff. As part of the ARCP process, it is mandatory for all trainees to declare any involvement in SEs, CIs or complaints received to the ARCP panel. In our study, though the number of trainee involvement in such events are lower in the mentored group compared to the non-mentored group, 4.0% (1/25) vs. 9.4% (8/85) respectively, this was not statistically significant (p=0.35).

Mentoring is associated with increased trainee confidence and better career progression (Figure 3A and Figure 3B).

69.6% (16/23) of mentored trainees in our study reported that mentoring had improved their confidence and 95.8% (23/24) reported mentoring aided in their career progression in medicine. Exploration of reasons from the mentored trainees who did not find mentoring useful revealed their experience was limited by insufficient time, poor response from mentors and unmet expectations.

The majority of mentored CMTs had a positive experience.

88.0% (22/25) of mentored trainees provided positive feedback when asked for their opinion on their mentoring experience (Figure 3C). 79.1% (87/110) of all mentored and non-mentored trainees agreed with the statement that mentoring should be made available to all CMTs. Only 1.8% (2/110) of responders agreed that mentoring should only be provided to trainees struggling with career progression or clinical work (Figure 3D). This suggested that mentoring does not confer a negative connotation on the mentee by fellow colleagues.

Positive and negative descriptors have been summarised in Figure 3E.

Mentee selection of mentors improves compatibility and increases positive experiences.

Analysis of positive feedback from mentored trainees provided valuable insight into the importance of the specialty and gender of mentors. Two examples are provided below.

> *"I was initially told there was no mentor in my speciality. After a year I was re-contacted because there was a mentor in my specialty. This relationship worked really well. We were able to discuss on Skype and meet in person. It aided my confidence and also structured my career goals into attainable chunks."*

"This was a transformative experience for me. My mentor was an excellent fit for me (I selected the gender of my mentor only and was then allocated. It was important for me to be mentored by another woman) and provided a space, encouragement, acceptance and deep kindness whilst asking good questions. This allowed me to grow from a personal perspective and steer my professional life more effectively. I feel better than I have in years and am carving a path that is right for me."

DISCUSSION

To our knowledge, our study is the first to provide quantitative data showing that mentoring junior medical doctors in the UK is associated with better training outcomes such as higher pass rates of the MRCP(UK) exams and ARCP. Our study has shown a statistically significant higher pass rate among mentored IMG trainees in the MRCP Part 2 exams (Written and PACES) compared to non-mentored IMG trainees, however the authors acknowledge that the sample size is small in the aforementioned group and these results should be interpreted with caution. Further confounding factors such as response bias or self-selection may exist. There were also more trainees aged 31-35 years in the mentored group compared to the non-mentored group and this may have occurred either by chance or response bias. We sought to reduce the latter firstly by keeping all responses anonymous to encourage more trainees to participate. Secondly, we compared results of trainees matched to the same grade of training.

Interestingly, all mentored IMG trainees began their mentoring relationship before core medical training - two trainees received mentorship as Foundation Year 2 doctors and

two as CMT-equivalent Clinical Fellows. Further research is needed to see if an earlier introduction of mentoring (e.g. during Foundation Training) in trainees keen on a career in medicine has any effect on training outcomes.

Although mentoring did not have a statistically significant association with trainee involvement in SEs, CIs or complaints, the vast majority of trainees who participated in mentoring found it to be a positive experience which improved confidence and aided in improved career progression. Similar to current literature, qualitative analysis of feedback from our group of mentored trainees revealed that poor mentor-mentee communication and unmet expectations remain causes of a negative mentor-mentee experience. This could be addressed in the future by more frequent interval communications with the mentee to detect and address incipient problems.

It has been acknowledged that a facilitative approach is needed in order for a mentor-mentee relationship to be successful [3], [12], however this should extend not only to the mentor but also to the mentoring programme that the mentee is engaged in. Although the overall impact of gender specificity of mentors remains a debate in current literature [5], [13], there are clearly female mentees who seek female mentors as role models. It is therefore important for any mentoring programme to allow mentees the option to choose their mentors freely as well as recruit and utilise equal proportions of mentors from both genders.

The benefits of mentoring are not limited to the mentee. Mentoring provides the mentor with personal satisfaction [14], an avenue for reflection and the exchange of experiences [3] which will in turn enhance one's own professional development. It is important however to stress that mentoring should not be a therapeutic exercise for the senior clinician and that altruistic intentions should be coupled with appropriate training in

mentoring, communication and adequate organisational support made accessible to mentors and mentees at any point during the mentoring process.

Mentoring is centred on developing and empowering trainees to realise and achieve their objectives. It should not be restricted to helping trainees in difficulty pass their training, as often in the UK, trainees access mentoring programmes because of compulsory, remedial action or through support offered by higher educational authorities to address exam or domain failures. The majority of CMTs from our survey, together with expert opinions from some RCP Tutors, believed that mentoring should be made available to all trainees. It is therefore important to change perspectives amongst senior medical educators who are opined that mentoring should be encouraged only in trainees who are struggling to progress.

With regard to career progression, our study has also shown that ARCP pass rates were significantly higher in the mentored group though a contributory reason for this may be that successful completion of the MRCP Part 1 exam is one of the pre-requisites for obtaining an Outcome 1 (pass) at ARCP for the first year of core medical training. However, the lower ARCP pass rates in the non-mentored group could also have been a result other domain failures. Therefore, a separate study would be needed to identify specifically the impact of mentoring on progression in the other domains.

Conclusion

Our study provides new quantitative evidence that mentoring junior doctors is associated with better training outcomes in postgraduate training in general medicine within the UK. Both quantitative and qualitative data from our study supports and

reinforces current qualitative literature with similar findings in mentee experiences. Randomised control trials are needed to demonstrate the causative effects of mentoring on the outcomes of postgraduate medical training.

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Competing interests: JO is a voluntary Mentor with the Royal College of Physicians Mentoring scheme described in this manuscript.

Author's contributions: JO and CS designed the study, conducted the literature search, performed the statistical and qualitative analyses, prepared the figures and wrote the

manuscript. NM advised on statistical methods, checked the results of the analyses and edited the manuscript. SO and AD gave their expert opinion on medical education in the training of junior doctors. YA and AS edited the manuscript prior to submission and gave their senior opinion on mentoring in medicine.

Data sharing: No additional data is available

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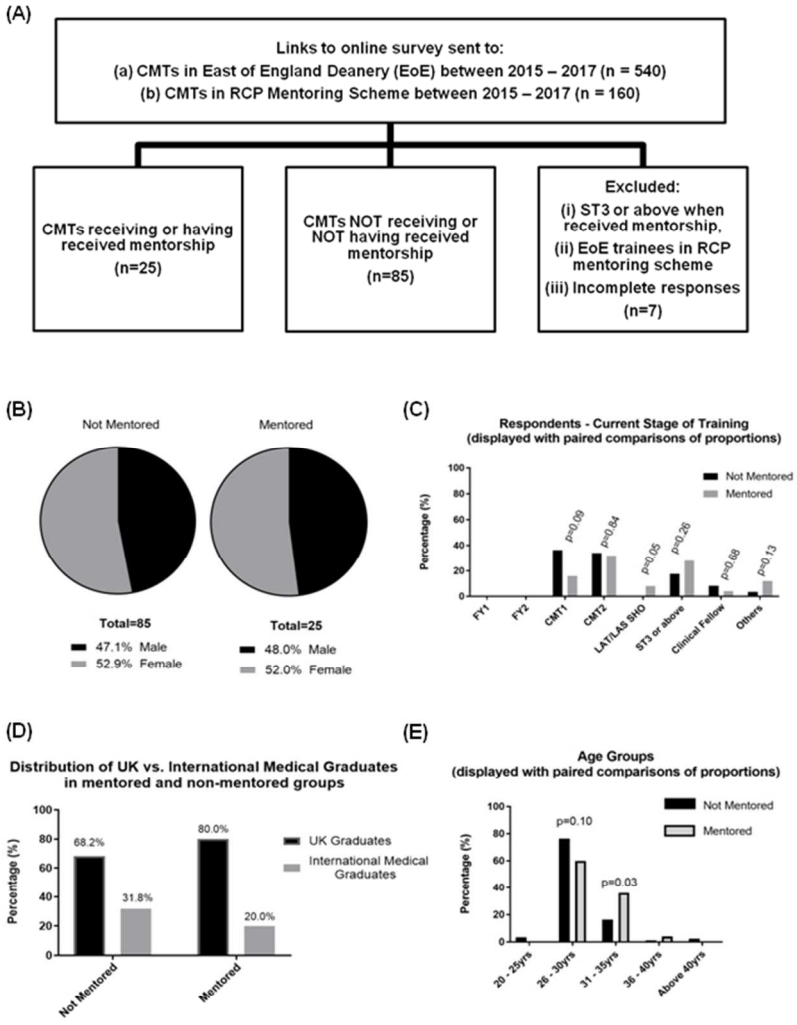
Figure legends:

Figure 1. (A) Distribution of responses received into “mentored”, “not mentored” arms and responses excluded in the study. Demographics of respondents grouped by (B) gender, (C) current stage of training , (D) country of primary medical qualification and

(E) age. The majority of respondents were aged between 26 years to 35 years and graduated from the UK.

Figure 2. (A) Mentoring is associated with higher pass rates of the MRCP(UK) exams in Core Medical Trainees. The positive effects of mentoring is most significant in IMG trainee doctors. (B) Mentoring is associated with higher rates of Outcome 1 at ARCP ($p<0.01$) but has no statistically significant effect on trainee involvement in SEs, CIs, or complaints (C).

Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees. (E) Summary of descriptors from trainee feedback.



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(A)

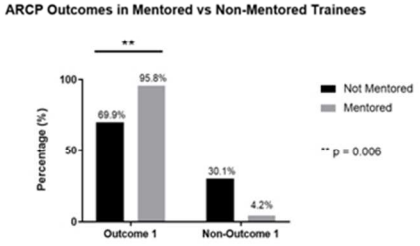
MRCP Pass Rates in Non-Mentored and Mentored Trainees

Examination	*Pass Rate for Non- Mentored Trainees (Total)*	*Pass Rate for Mentored Trainees (Total)*	p value
MRCP Part 1 (Written)	***42.4% (36/85)***	***84.0% (21/25)***	***p < 0.01***
MRCP Part 2 (Written)	30.6% (26/85)	44.0% (11/25)	p = 0.11
MRCP Part 2 (PACES)	29.4% (25/85)	44.0% (11/25)	p = 0.09
MRCP (UK) Diploma	29.4% (25/85)	40.0% (10/25)	p = 0.16

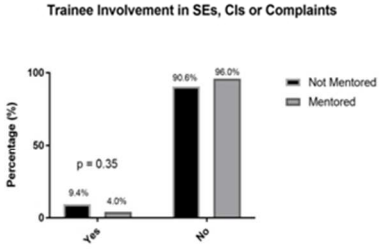
	Pass Rates in UK Graduates		
Examination	Not Mentored	Mentored	p value
MRCP Part 1 (Written)	***46.6% (27/58)***	***85.0% (17/20)***	***p < 0.01***
MRCP Part 2 (Written)	32.8% (19/58)	35.0% (7/20)	p = 0.43
MRCP Part 2 (PACES)	37.9% (22/58)	35.0% (7/20)	p = 0.41
MRCP (UK) Diploma	37.9% (22/58)	30.0% (6/20)	p = 0.26

	Pass Rates in International Medical Graduates		
Examination	Not Mentored	Mentored	p value
MRCP Part 1 (Written)	33.3% (9/27)	80.0% (4/5)	p = 0.07
MRCP Part 2 (Written)	***25.9% (7/27)***	***80.0% (4/5)***	**p < 0.05**
MRCP Part 2 (PACES)	***11.1% (3/27)***	***80.0% (4/5)***	**p < 0.01**
MRCP (UK) Diploma	***11.1% (3/27)***	***80.0% (4/5)***	**p < 0.01**

(B)



(C)



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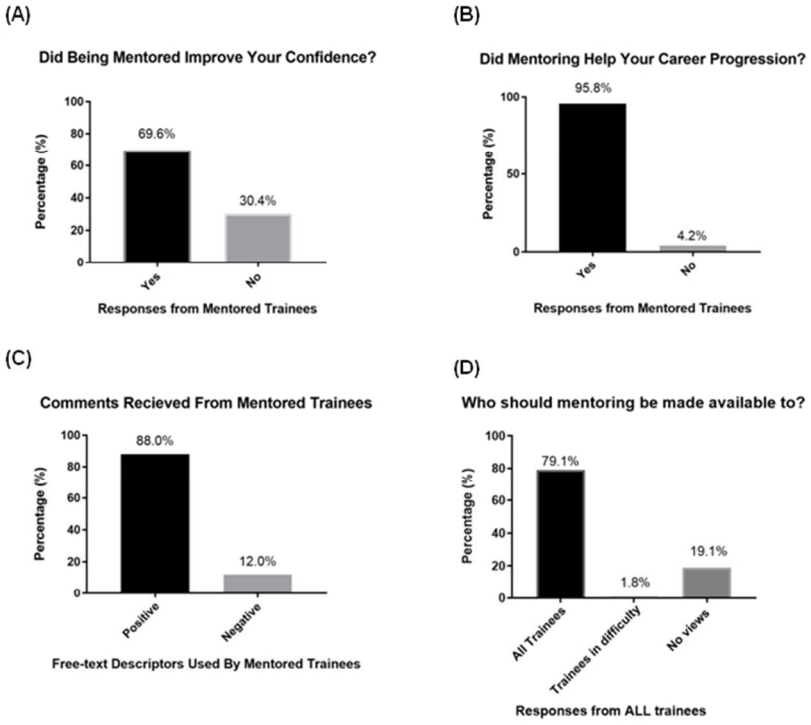

(E)

Positive descriptors	Positive phrases	Negative descriptors	Negative phrases
Useful	'reassuring to know that someone helpful and supportive is available'	Basic	'I did not receive the response from the mentor I requested'
Reassuring		Not helpful	
Enlightening			
Immensely positive	'helped me streamline my focus and made me aware of personal weaknesses'		'limited use due to limited time'
Supportive			
Excellent			
Rewarding	'structured my career goals into attainable chunks'		
Helpful			
Transformative			
Confidence boosting	'made me more proactive'		

Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees. (E) Summary of descriptors from trainee feedback.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1,2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 - 5
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	4 - 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7, 8
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7
		(*e*) Describe any sensitivity analyses	7
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7, 8
		(b) Give reasons for non-participation at each stage	n/a – exclusion criteria listed on p7
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8, figure 1
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	8 – 10, figure 2, figure 3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8 - 10
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Figure 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11 - 13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13, 14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

Dr John Ong[1*], Dr Carla Swift[2*], Mr Nicholas Magill[3], Ass. Prof Sharon Ong[4], Dr Anne Day[5], Dr Yasseen Al-Naeeb[6], Dr Arun Shankar[7]

*JO and CS are joint first authors

[1]Specialty Registrar, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[2]Specialty Registrar, Department of Gastroenterology, Addenbrooke's Cambridge University Hospital, Cambridge, CB2 0QQ, UK

[3]Biostatician, Department of Biostatistics and Health Informatics, King's College London, SE5 8AF, UK

[4]Assistant Professor and Consultant, Department of Anaesthesia, Singapore General Hospital, Outram Road, S169608, Singapore

[5]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[6]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[7]Consultant, Department of Gastroenterology, Norfolk & Norwich University Hospital, Colney Lane, NR4 7UY, UK

Corresponding author: Dr John Ong (co-first author), Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, United Kingdom. Email: john.ong@kcl.ac.uk

ABSTRACT

Objective: To determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

Design: Observational study

Participants: 117 trainees from the East of England Deanery (non-mentored group) and the recently established Royal College of Physicians (RCP) Mentoring scheme (mentored group) who were core medical trainees (CMTs) between 2015 and 2017 completed an online survey. Trainees who received mentoring at the start of higher speciality training, incomplete responses and trainees who were a part of both the East of England deanery and RCP Mentoring scheme were excluded leaving 85 trainees in the non-mentored arm and 25 trainees in the mentored arm. Responses from a total of 110 trainees were analysed.

Main Outcome Measures: Pass rates of the various components of the MRCP(UK) examination (MRCP Part 1, MRCP Part 2 Written and MRCP Part 2 PACES), pass rates at the Annual Review of Competency Progression (ARCP), trainee involvement in significant events, clinical incidents or complaints, and trainee feedback on career progression and confidence.

Results: Mentored trainees reported higher pass rates of the MRCP Part 1 exam versus non-mentored trainees (84.0% vs. 42.4%, $p<0.01$). Mentored international medical graduates (IMGs) reported higher pass rates than non-mentored IMGs in the MRCP Part 2 Written exam (71.4% vs. 24.0%, $p < 0.05$). ARCP pass rates in mentored trainees were observed to be higher than non-mentored trainees (95.8% vs. 69.9%, $p<0.05$).

Rates of involvement in significant events, clinical incidents and complaints in both groups did not show any statistical difference. Mentored trainees reported higher confidence and career progression.

Conclusions: A positive association is observed between the mentoring of CMTs and better training outcomes. Further studies are needed to demonstrate the causative effects of mentoring in postgraduate medical training within the UK.

Strengths and limitations of this study

- Novel quantitative data demonstrating a positive association between mentoring and better training-specific outcomes in core medical trainees.
- Adds to the limited qualitative data on the effects of mentoring in postgraduate medical training within the UK.
- Potential for non-response bias and self-selection bias.
- Small sample size of International Medical Graduates who received mentoring.
- Provides preliminary evidence to support further studies in investigating the causative effects of mentoring in UK medical trainees.

INTRODUCTION

Work based mentoring is a growing and encouraged practice in UK postgraduate medical training [1]. Though qualitative data suggests that mentored trainees do generally have a positive experience, there is little quantitative evidence to suggest this directly and positively impacts on training-specific outcomes in postgraduate medicine [2]. Here we studied two groups of junior medical doctors in training and compared

targeted training outcomes in a group of trainees who have received mentorship in a structured mentoring programme versus a non-mentored group. By default, mentoring is not provided to all trainees in the UK.

Mentoring is defined as "a process whereby an experienced, highly regarded, empathic person (the mentor) guides another usually younger individual (the mentee) in the development and re-examination of their own ideas, learning, and personal or professional development" [3]. It describes a voluntary and synergistic relationship which requires commitment from both parties in order to be effective [4]. Its ultimate purpose is to empower an individual to achieve set goals [4], though these goals inevitably evolve over time as the mentee develops [3].

In many studies in literature, failed mentor-mentee relationships are a result of poor communication, lack of commitment, personality differences, competition, conflicts of interest, mentor inexperience [5] and unrealistic mentee expectations [4],[6]. To minimise these problems, we included trainees from the Royal College of Physicians (RCP) Mentoring scheme, an optional and recently established mentoring programme made available to any interested core medical trainee in the UK. The programme was advertised through RCP newsletters, social media or peer recommendations. Interested trainees accessed and applied to join the scheme online. Once accepted into the programme, mentees chose their mentors based on online mentor profiles to improve mentor-mentee compatibility. Mentors in the scheme comprise senior registrars and consultants from different medical specialties. They were recruited via RCP newsletters, screened then received formal, compulsory training in mentorship and effective communication over two days of training prior to accepting mentees. Mentoring was voluntary and no financial incentives were offered to the mentors.

At the start of the mentor-mentee relationship, mentors engaged in goal setting (e.g. S.M.A.R.T objectives) to avoid unrealistic expectations by mentees. Subsequently, mentors employed effective questioning techniques to encourage mentee reflection, planning and decision making before dispensing advice or intervention depending on which approach was most appropriate (e.g. facilitative or directive). Mentors were also provided with a platform to obtain confidential, third party advice to ensure difficult situations are dealt with appropriately.

As easy accessibility and open communication is an important factor for a successful mentor-mentee relationship [5], mentors and mentees in the RCP mentoring scheme were provided the option to conduct mentor-mentee meetings either in person, online or both. Mentees determined the mode, frequency and duration of the meetings. The most frequent method of communication was email but this was often combined with online conferencing and in-person meetings. Though some studies question the quality and validity of online mentoring [7], [8], others have argued it can still be effective [9], [10] and provides opportunities for mentoring when it would otherwise not be possible [9]. We have chosen not to investigate the mode of how mentoring was delivered in this study because it makes quantitative analysis difficult and does not answer the research question posed by this study.

The objective of our study is to determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

METHODS

Rationale of Study Design

A questionnaire was designed to enable the quantitative analysis of training-specific outcomes and the qualitative analysis of trainee feedback. Parameters for quantitative analysis were the (i) pass rates of the Membership of the Royal College of Physicians (MRCP UK) exams, (ii) pass rates of the Annual Review of Competence Progression (ARCP) and (iii) the rate of trainee involvement in significant events (SEs), clinical incidents (CIs) and complaints.

The MRCP(UK) exam is a postgraduate exam in general internal medicine which comprises three parts: MRCP Part 1 Written, MRCP Part 2 Written and the MRCP Part 2 PACES (practical component). The MRCP(UK) diploma is awarded upon completion of all three exams and completion of the MRCP Part 1 Written exam is required before a trainee can sit for the other two exams. Completion of the MRCP(UK) diploma is expected by the end of core medical training and is a pre-requisite to joining a higher specialty training programme in medicine within the UK. Completion of these examinations is an objective indicator that a trainee has achieved the medical knowledge required for their stage of training.

In postgraduate medical training in the United States, the Accreditation Council for Graduate Medical Education (ACGME) assesses trainee progress in the six domains of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism and system-based practice. Each domain has "milestones" which trainees are expected to achieve at different stages of training. In the UK, a similar approach is adopted and progress is determined by the ARCP review. The ARCP review occurs annually and involves a panel of senior clinical educators and physicians assessing a trainee's progress in the domains of

multiple consultant reports, educational supervisor report, advanced life support, supervised learning events, multi-source feedback, research and audit, common procedural competencies, non-procedural competencies (e.g. communication skills, history taking etc), top medical presentations, emergency medical presentations, other medical presentations, clinics and teaching attendance. The trainee submits evidence to the panel to demonstrate the domain requirements have been achieved and an outcome is awarded to the trainee after the entire review process. Outcome 1, the equivalent of a pass, is described as "satisfactory progress - achieving progress and competencies at expected rate". Other outcomes relevant to core medical training are similar to a fail. The ARCP pass rate was chosen as a parameter of interest because it is an indirect but objective indicator of a trainee's all-rounded development in both the educational curriculum and clinical practice.

Trainees from the RCP mentoring programme were chosen as a positive control because of its nationwide recruitment which reduces the risk of inter-deanery variability if any. East of England trainees were chosen as a negative control because at the time of the study, no mentoring programme for medicine was active within the region. In contrast, other regional deaneries had separate mentoring programmes for junior doctors (e.g. London deanery, Health Education England Thames Valley deanery). This would have limited standardisation of positive and negative controls (e.g. Career grade of mentors, level of training delivered to mentors, mentees from other mentoring programmes responding to our survey etc).

As a second negative control, observed results were also compared to the pass rates for all UK candidates in the 2017 MRCP exams [11] to provide a better representation of the performance of candidates attempting the MRCP exams and reduce bias. Though this cohort contained both non-mentored and mentored trainees, the authors believe the

total number of mentored trainees nationally is small and any contributing effects to this large sample size (n > 1500) is negligible.

Design and Administration of Questionnaire

The questionnaire comprised of 14 binary, non-Likert questions and 1 open question which enabled free text entry for the qualitative analysis of a trainee's experience of being mentored. The qualitative questions within the questionnaire also served as an internal check, so that quantitative results from the survey could be validated against trainee experience (e.g. MRCP or ARCP Pass rates vs. "Did mentoring help your career progression?"). The questionnaire was pretested on a small group of medical registrars not involved with the study to assess its ability at extracting the information required for the study. Minor revisions were made and a final Cronbach alpha score of 0.83 was achieved. The final questionnaire was sent via email as a link to an online survey to all core medical trainees (CMTs) within the East of England Deanery between 2015 and 2017 (n=540 trainees, non-mentored group), and all CMTs who voluntarily registered with the RCP Mentoring scheme between 2015 and 2017 (n=160, mentored group). None of the authors participated in the survey. The survey was subsequently conducted from 14 August 2017 to 15 September 2017 to capture data from trainees at the start of their posts. One reminder email was sent 2 weeks after the invitation email.

Ethics

Prior to designing the survey, the authors completed the Medical Research Council and NHS Health Research Authority decision tool (www.hra-decisiontools.org.uk) which

determined ethical approval from a local research ethics committee (REC) was not required. This decision is attached as Appendix 1.

All participants were automatically anonymised by the online survey platform and trainees were made aware of this in their invitation email. Trainees were also informed the survey was for research purposes and participation was voluntary. Completion of the survey conferred implied consent and the authors only received anonymised responses with no trainee identifiable information. There was no risk posed to participants and participants were not paid for completed questionnaires.

Patient and Public Involvement

This study did not involve any members of the public or patients.

Exclusion Criteria

Of the 700 trainees that the invitations were sent to, responses from 117 trainees were received. Of the 117 responses, trainees who received mentoring at the start of higher speciality training; ST3 or above (n=2), incomplete responses (n=3) and trainees who were both a part of the East of England deanery and the RCP Mentoring scheme were excluded (n=2). Incomplete responses were defined as surveys with less than 50% of answered questions. The survey was conducted as a sequence of questions, one question at a time. The first half of the survey collected demographic data therefore surveys with less than 50% of answered questions were not interpretable. A total of 7 returned surveys were excluded. All of the other 110 surveys were adequately completed.

Other grades of junior doctors equivalent to CMTs (e.g. CMT grade Clinical Fellows and LAT SHOs) were classed "Others" but included in the analysis since these numbers were relatively small. The final numbers for comparison were 25 trainees in the mentored group and 85 trainees in the non-mentored group (Figure 1A).

Statistical and Qualitative Analyses

Graphpad 7.0 (by PRISM) was used to perform the statistical analyses between the two groups of trainees. When numbers were greater than five in a 2x2 contingency table, chi-squared test was used to test if mentoring resulted in a significant change in proportions of the test parameters which were all binary. When trainee numbers were small ($n \leq 5$) in a 2x2 contingency table, Fisher's exact test was used to calculate p-values for better accuracy. The Koopman asymptotic method [12] was used to calculate the confidence intervals of the relative risk (RR) and the Baptista-Pike method was used to calculate confidence intervals for the Odd's Ratio (OR) [13].

MedCalc version 18 was used to perform logistic regression. Older age of respondents may have been a confounding factor to MRCP pass rates if respondents had more time out of training to complete the exams. Lower pass rates of IMGs are usually observed in the MRCP exams and the reason for this phenomenon is likely multi-factorial. For both these reasons, age group (coded as 0=20-25yrs, 1=26-30yrs, 2=31-35yrs, 3=36-40yrs, 4=above 40yrs) and the country of the primary medical degree (coded as UK=1, non-UK=0) of respondents were used as covariates in the regression model together with exposure to mentoring in order to make an assessment of any confounding of the relationship between mentoring and outcome. Since completion of MRCP exams is

expected with career progression, stage of training was not used as a covariate in the regression model.

Qualitative responses were grouped into categories of "positive" or "negative" feedback when applicable and descriptors provided by the trainees were summarised. Examples of the feedback received have also been quoted verbatim in the results section for readers to interpret.

RESULTS

Of the 110 trainees in the study (85 non-mentored, 25 mentored), there were slightly more female respondents than male in both arms of the study; 56.0% (14/25) vs. 44.0% (11/25) in the mentored group and 51.8% (44/85) vs. 48.2% (41/85) in the non-mentored group (Figure 1B). There were no statistically significant differences in the career grades of the respondents in both arms of the study (Figure 1B) and the majority of respondents were graduates from the UK.

Significant differences were observed in the MRCP exam pass rates between mentored and non-mentored trainees (Figure 2A, Figure 2B & Figure 3A).

The pass rate of the MRCP Part 1 exam was observed to be significantly higher in trainees receiving mentorship compared to non-mentored East of England trainees; 84.0% (21/25) vs. 42.4% (36/85), $p < 0.01$ (OR=7.1, 95% CI 2.4 - 20.3 and RR=2.0, 95% CI 1.4 - 2.7). This effect was also observed when the MRCP Part 1 exam pass rates were compared between mentored trainees and all UK candidates attempting the exam in 2017; 84.0% (21/25) vs. 50.6% (2065/4079), $p < 0.01$ (OR= 5.1, CI 1.9 - 13.9 and

RR=1.7, 95% CI 1.3 - 1.9). Logistic regression demonstrated that age and the country of primary qualification did not have any significant influence on the effects observed in mentoring (p = 0.14 and p = 0.62 respectively). The model showed that mentoring was associated with higher pass rates of the MRCP Part 1 exam (p < 0.01) with adjusted OR=7.7, 95% CI 2.4 - 25.2.

The MRCP Part 2 (Written) exam pass rates between mentored trainees and non-mentored East of England trainees showed no significant difference. However, when pass rates in mentored trainees were compared to all candidates attempting the MRCP Part 2 (Written) exam within the UK, an unexpected statistically significant difference was found; 44.0% (11/25) vs. 75.1% (1584/2110), p < 0.01 (OR=0.3, 95% CI 0.1 - 0.6 and RR=0.6, 95% CI 0.4 - 0.8). This difference may be explained by the timing of the survey which captured data from mentored CMT trainees at the start of their post and who may not have yet attempted the exam. In sub-population analyses, the pass rates of the MRCP Part 2 (Written) exam was observed to be significantly higher in mentored, international medical graduates (IMGs) compared to non-mentored IMGs; 71.4% (5/7) vs. 24.0% (6/25), p < 0.05. (Figure 2B). No significant differences were observed when pass rates in mentored IMGs and mentored UK trainees were compared to all UK candidates in 2017. However, in comparing pass rates in the MRCP Part 2 Written exam and the MRCP Part 2 (PACES) exam between non-mentored IMGs and all UK candidates in 2017, a statistically significant difference was detected in the lower pass rates of the former group; 24.0% (6/25) vs. 75.1% (1584/2110), p < 0.01 and 24.0% (6/25) versus 56.1% (1594/2843), p < 0.01.

Higher ARCP pass rates were observed in mentored trainees (Figure 3B).

The ARCP review provides a comprehensive assessment of a trainee's progress in the core medical training educational curriculum and personal clinical practice. In our study, 97 trainees (24 mentored, 73 non-mentored) out of 110 had an ARCP within 12 months. The ARCP pass rate (Outcome 1s) was observed to be significantly higher in mentored trainees compared to non-mentored trainees; 95.8% (23/24) vs. 69.9% (51/73), $p<0.05$ (OR=9.9, 95% CI 1.5 - 107 and RR=1.4, 95% CI 1.1 - 1.7).

Mentoring did not significantly decrease the number of Significant Events (SEs), Clinical Incidents (CIs) or Complaints in core medical trainees (Figure 3C).

The National Patient Safety Agency (NPSA) in the UK defines a significant event as "any event (negative) thought by anyone in the team to be significant in the care of patients or conduct of practice" [14]. The term "clinical incident" is often used to describe an unintentional or unexpected event that is less severe in nature and which does not cause significant harm to a patient or member of staff. As part of the ARCP process, it is mandatory for all trainees to declare any involvement in SEs, CIs or complaints received to the ARCP panel. In our study, though the number of trainee involvement in such events were lower in the mentored group compared to the non-mentored group, 4.0% (1/25) vs. 9.4% (8/85) respectively, this was not statistically significant (p=0.68).

Mentoring is associated with increased trainee confidence and better career progression (Figure 4A and Figure 4B).

In total, 69.6% (16/23) of mentored trainees in our study reported that mentoring had improved their confidence and 95.8% (23/24) reported mentoring had aided in their career progression in medicine. Exploration of reasons from the mentored trainees who did not find mentoring useful revealed their experience was limited by insufficient time, poor response from mentors and unmet expectations.

The majority of mentored CMTs had a positive experience.

When asked for their opinion on their mentoring experience, 88.0% (22/25) of mentored trainees provided positive feedback (Figure 4C). A total of 78.2% (86/110) of all trainees (mentored and non-mentored) agreed with the statement that mentoring should be made available to all CMTs. Only 1.8% (2/110) of responders agreed that mentoring should only be provided to trainees struggling with career progression or clinical work (Figure 4D). This suggests mentoring does not confer a negative connotation on the mentee by fellow colleagues. Positive and negative descriptors have been summarised in Figure 4E.

Mentee selection of mentors improves compatibility and increases positive experiences.

Analysis of positive feedback from mentored trainees provided valuable insight into the importance of the specialty and gender of mentors. Two examples are provided below.

> *"I was initially told there was no mentor in my speciality. After a year I was re-contacted because there was a mentor in my specialty. This relationship worked really well. We were able to discuss on Skype and*

meet in person. It aided my confidence and also structured my career goals into attainable chunks."

"This was a transformative experience for me. My mentor was an excellent fit for me (I selected the gender of my mentor only and was then allocated. It was important for me to be mentored by another woman) and provided a space, encouragement, acceptance and deep kindness whilst asking good questions. This allowed me to grow from a personal perspective and steer my professional life more effectively. I feel better than I have in years and am carving a path that is right for me."

DISCUSSION

To our knowledge, our study is the first UK-specific study to provide quantitative data showing a positive association between mentoring of junior medical doctors and better training outcomes. In this study, the effect of mentoring was assessed against clinically important parameters such as MRCP(UK) pass rates, ARCP pass rates, clinical incidents and significant events which has not been previously attempted in literature. With regards to the MRCP exams, the strongest association of mentoring with higher pass rates was seen in the MRCP Part 1 exams where a statistically significant difference was detected when comparing mentored trainees to two negative controls. Higher pass rates in the MRCP Part 2 Written exam were also observed in mentored IMGs compared to non-mentored IMG trainees, however the authors acknowledge that the sample size is small in the aforementioned group and these results should be interpreted with caution.

Interestingly, non-mentored IMGs (n=25) were observed to have statistically significant lower pass rates in the MRCP Part 2 exams (Written and PACES) compared to UK candidates in 2017 though a statistical difference was not detected in mentored IMGs. Also, most mentored IMG trainees began their mentoring relationship before core medical training - two trainees received mentorship as Foundation Year 2 doctors and two as CMT-equivalent Clinical Fellows. Further research is needed to see if an earlier introduction of mentoring (e.g. during Foundation Training) in trainees keen on a career in medicine has any effect on training outcomes.

Although mentoring did not have a statistically significant association with trainee involvement in SEs, CIs or complaints, the vast majority of trainees who participated in mentoring found it to be a positive experience which improved confidence and aided in improved career progression. This positive feedback, considered cumulatively with current literature and our observed results, suggests that mentoring may have a genuinely positive effect on postgraduate medical education and development. Similar to current literature, qualitative analysis of feedback from our group of mentored trainees revealed that poor mentor-mentee communication and unmet expectations remain causes of a negative mentor-mentee experience. This could be addressed in the future by more frequent interval communications with the mentee to detect and address incipient problems.

It has been acknowledged that a facilitative approach is needed in order for a mentor-mentee relationship to be successful [3], [15], however this should extend not only to the mentor but also to the mentoring programme that the mentee is engaged in. Although the overall impact of gender specificity of mentors remains a debate in current literature [5], [16], there are clearly female mentees who seek female mentors as role models. It is therefore important for any mentoring programme to allow mentees the

option to choose their mentors freely as well as recruit and utilise equal proportions of mentors from both genders.

The benefits of mentoring are not limited to the mentee. Mentoring provides the mentor with personal satisfaction [17], an avenue for reflection and the exchange of experiences [3] which will in turn enhance one's own professional development. It is important however to stress that mentoring should not be a therapeutic exercise for the senior clinician and that altruistic intentions should be coupled with appropriate training in mentoring, communication and adequate organisational support. Platforms that support mentors or mentees in difficulty should be made easily accessible at any point during the mentoring process.

Mentoring is centred on developing and empowering trainees to realise and achieve their objectives. It should not be restricted to helping trainees in difficulty pass their training, as often in the UK, trainees access mentoring programmes because of compulsory, remedial action or through support offered by higher educational authorities to address exam or domain failures. The majority of CMTs from our survey, together with expert opinions from some RCP Tutors, believed that mentoring should be made available to all trainees. It is therefore important to change perspectives amongst senior medical educators who are opined that mentoring should be encouraged only in trainees who are struggling to progress.

With regard to career progression, our study has also shown that ARCP pass rates were significantly higher in the mentored group though a contributory reason for this may be that successful completion of the MRCP Part 1 exam is one of the pre-requisites for obtaining an Outcome 1 (pass) at ARCP for the first year of core medical training. However, the lower ARCP pass rates in the non-mentored group could also have been a

result of other domain failures. Therefore, further studies would be needed to identify specifically the impact of mentoring on progression in the other domains.

Limitations of the study and special considerations for future research.

The main limitations of this study arise through the potential for self-selection bias and non-response bias. Trainees within the mentored group have volunteered to be mentored and as such they may be more motivated and highly engaged than those within the non-mentored arm. This could have resulted in self-selection bias. Equally, the low response rate of the survey may have resulted in non-response bias e.g. mentored trainees could have failed their exams and did not respond to the survey causing a skew in the observed results. Both biases would have been minimised if the survey was compulsory. However, there are ethical considerations in making such a survey compulsory as trainees may not give consent to providing non-essential and personal information, especially if it involves potentially sensitive issues such as clinical incidents or complaints. We sought to address these issues by keeping all responses anonymous and keeping the survey concise. This would have encouraged more trainees to participate and improved response rates so a better representation of the positive and negative control groups could be obtained.

A further limitation of the study was the absence of a perfectly matched negative control group. In theory, the ideal control group for the study would be equally motivated CMTs who had sought mentorship with the RCP but were then matched according to individual attributes and randomised to not receive mentorship. However, this would have been both unethical and against current GMC guidance. We therefore recruited CMTs within the East of England deanery who had not received mentoring as our

negative control though we acknowledge this may have introduced selection bias. Therefore for added rigor, we used a second control group (all UK candidates of the MRCP exams) and have discussed the reasons for doing so above.

Response rates in unpaid, voluntary research surveys are well known to be poor. The only exception to our knowledge is the GMC National Training Survey because its completion is required before attendance at the ARCP interviews. As a result of the low response rate, sample sizes in some subgroups in the study are small. Therefore, caution is advised when interpreting results in subgroups where small sample sizes may have affected statistical calculations and may not be accurately representative of the entire population.

Lastly, our study design was limited and influenced significantly by the lack of a central platform for data collection and the availability of resources to collate the data. Information on the exam pass rates is held by the MRCP(UK) body and information on the ARCP pass rates, significant events, clinical incidents or complaints is held in confidentiality by a separate body (the Joint Royal Colleges of Physicians Training Board, JRCPTB). We found the most cost effective method of collating data from these two bodies was therefore a survey targeted at trainees who are a common join between the two. Other researchers would therefore need to consider these ethical and logistical challenges in designing future studies.

Conclusion

Our study provides new quantitative data in support of a positive association between mentoring junior doctors and better training outcomes in postgraduate training in

general medicine within the UK. Both quantitative and qualitative data from our study supports and reinforces current qualitative literature with similar findings in mentee experiences. Further studies are needed to demonstrate the causative effects of mentoring on the outcomes of postgraduate medical training.

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Author's contributions: JO and CS designed the study, conducted the literature search, performed the statistical and qualitative analyses, prepared the figures and wrote the manuscript. NM advised on statistical methods, checked the results of the analyses and edited the manuscript. SO and AD gave their expert opinion on medical education in the training of junior doctors and contributed to parts of the manuscript. YA and AS edited the manuscript prior to submission and gave their senior opinion on mentoring in medicine.

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Figure legends:

Figure 1. (A) Distribution of responses received into "mentored", "not mentored" arms and responses excluded in the study. (B) Demographics of respondents grouped by gender, current stage of training, country of primary medical qualification and age group. The majority of respondents were aged between 26 years to 35 years and graduated from the UK.

Figure 2. (A) Higher pass rates in the MRCP(UK) Part 1 exam were observed in mentored trainees. (B) Mentored IMG trainees were observed to have higher pass rates in the MRCP(UK) Part 2 Written exams compared to non-mentored trainees. * denotes information unavailable.

Figure 3. (A) In comparing equivalent career grades, higher pass rates in the MRCP(UK) Part 1 exam were observed in mentored CMT Year 1 and CMT Year 2 trainees. (B) Higher rates of Outcome 1 at ARCP was observed in mentored trainees ($p<0.05$) but no statistically significant effect was observed in trainee involvement in SEs, CIs, or complaints (C).

Figure 4. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided

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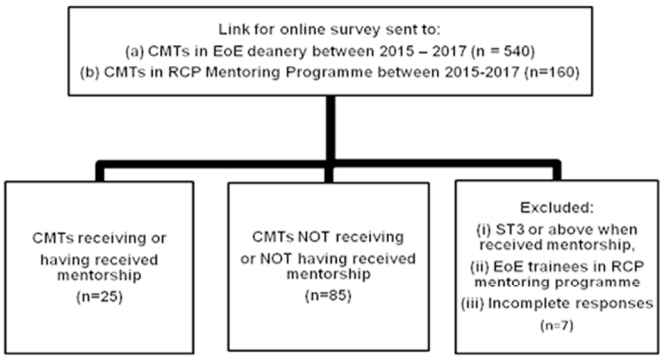
(A)



(B) **Demographics of Respondents**

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
Gender			
Male	44.0% (11/25)	48.2% (41/85)	p=0.71
Female	56.0% (14/25)	51.8% (44/85)	p=0.71
Stage of training			
FY1	0.0% (0/25)	0.0% (0/85)	p=1.00
FY2	0.0% (0/25)	0.0% (0/85)	p=1.00
CMT1	16.0% (4/25)	36.5% (31/85)	p=0.09
CMT2	32.0% (8/25)	34.1% (29/85)	p=0.76
ST3 or above	28.0% (7/25)	17.6% (15/85)	p=0.26
Others	24.0% (6/25)	11.8% (10/85)	p=0.13
Primary degree			
UK trained	72.0% (18/25)	70.6% (60/85)	p=0.89
IMG	28.0% (7/25)	29.4% (25/85)	p=0.89
Age group			
20 – 25yrs	0.0% (0/25)	3.5% (3/85)	p=1.00
26 – 30yrs	76.0% (19/25)	72.9% (62/85)	p=0.76
31 – 35yrs	20.0% (5/25)	20.0% (17/85)	p=1.00
36 – 40yrs	4.0% (1/25)	1.2% (1/85)	p=0.40
Above 40yrs	0.0% (0/25)	2.3% (2/85)	p=1.00

Figure 1. (A) Distribution of responses received into "mentored", "not mentored" arms and responses excluded in the study. (B) Demographics of respondents grouped by gender, current stage of training, country of primary medical qualification and age group. The majority of respondents were aged between 26 years to 35 years and graduated from the UK.

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(A)

MRCP(UK) Pass Rates: Mentored and Non-Mentored Trainees vs 2017 UK Candidates

	Pass Rate for Non-Mentored Trainees (1)	*Pass Rate for Mentored Trainees* (2)	*2017 UK Pass Rates* (3)	*p-value* (1) vs (2)	*p-value* (2) vs (3)
MRCP Part 1 (Written)	42.4% (36/85)	84.0% (21/25)	50.6% (2065/4079)	p < 0.01	p < 0.01
MRCP Part 2 (Written)	30.6% (26/85)	44.0% (11/25)	75.1% (1584/2110)	p = 0.21	p < 0.01
MRCP Part 2 (PACES)	29.4% (25/85)	44.0% (11/25)	56.1% (1594/2843)	p = 0.17	p = 0.23
Full MRCP (UK)	29.4% (25/85)	40.0% (10/25)	*	p = 0.32	*

(B)

MRCP(UK) Pass Rates: International Medical Graduates vs 2017 UK Candidates

	Pass Rate in International Medical Graduates		*2017 UK Pass Rates* (3)	*p-value* (1) vs (2)	*p-value* (2) vs (3)	*p-value* (1) vs (3)
	Non-Mentored (1)	*Mentored* (2)				
MRCP Part 1 (Written)	32.0% (8/25)	71.4% (5/7)	50.6% (2065/4079)	p = 0.09	p = 0.45	p = 0.06
MRCP Part 2 (Written)	24.0% (6/25)	71.4% (5/7)	75.1% (1584/2110)	p < 0.05	p = 0.69	p < 0.01
MRCP Part 2 (PACES)	24.0% (6/25)	57.1% (4/7)	56.1% (1594/2843)	p = 0.17	p = 1.00	p < 0.01
Full MRCP (UK)	24.0% (6/25)	57.1% (4/7)	*	p = 0.17	*	*

Figure 2. (A) Higher pass rates in the MRCP(UK) Part 1 exam were observed in mentored trainees. (B) Mentored IMG trainees were observed to have higher pass rates in the MRCP(UK) Part 2 Written exams compared to non-mentored trainees. * denotes information unavailable.

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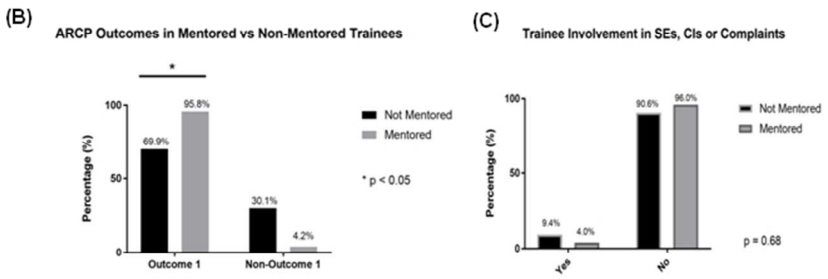
(A) MRCP Exams: Pass Rates by Stage of Training

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
CMT Year 1			
MRCP Part 1 (Written)	100.0% (4/4)	19.4% (6/31)	p < 0.01
MRCP Part 2 (Written)	75.0% (3/4)	6.5% (2/31)	p < 0.01
MRCP Part 2 (PACES)	50.0% (2/4)	3.2% (1/31)	p < 0.05
Full MRCP (UK)	50.0% (2/4)	3.2% (1/31)	p < 0.05
CMT Year 2			
MRCP Part 1 (Written)	100.0% (8/8)	41.4% (12/29)	p < 0.01
MRCP Part 2 (Written)	25.0% (2/8)	31.0% (9/29)	p = 1.00
MRCP Part 2 (PACES)	37.5% (3/8)	31.0% (9/29)	p = 1.00
Full MRCP (UK)	25.0% (2/8)	31.0% (9/29)	p = 1.00
ST3 and above			
MRCP Part 1 (Written)	71.4% (5/7)	86.7% (13/15)	p = 1.00
MRCP Part 2 (Written)	57.1% (4/7)	80.0% (12/15)	p = 0.33
MRCP Part 2 (PACES)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Full MRCP (UK)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Others			
MRCP Part 1 (Written)	66.7% (4/6)	50.0% (5/10)	p = 0.63
MRCP Part 2 (Written)	33.3% (2/6)	30.0% (3/10)	p = 1.00
MRCP Part 2 (PACES)	33.3% (2/6)	30.0% (3/10)	p = 1.00
Full MRCP (UK)	33.3% (2/6)	30.0% (3/10)	p = 1.00



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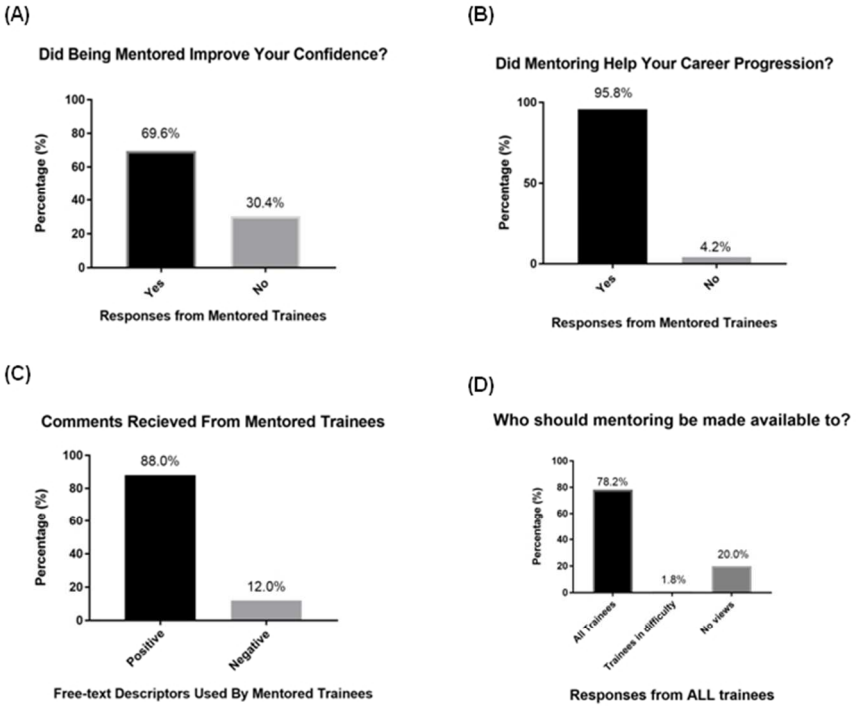

(E)

	Descriptors	Phrases
Positive	Useful	"reassuring to know that someone helpful and supportive is available"
	Reassuring	
	Enlightening	
	Immensely positive	"helped me streamline my focus and made me aware of personal weaknesses"
	Supportive	
	Excellent	
	Rewarding	"structured my career goals into attainable chunks"
	Helpful	
	Transformative	"made me more proactive"
	Confidence boosting	
Negative	Basic	"I did not receive the response from the mentor I requested"
	Not helpful	"limited use due to limited time"

Figure 4. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees. (E) Summary of descriptors from trainee feedback.

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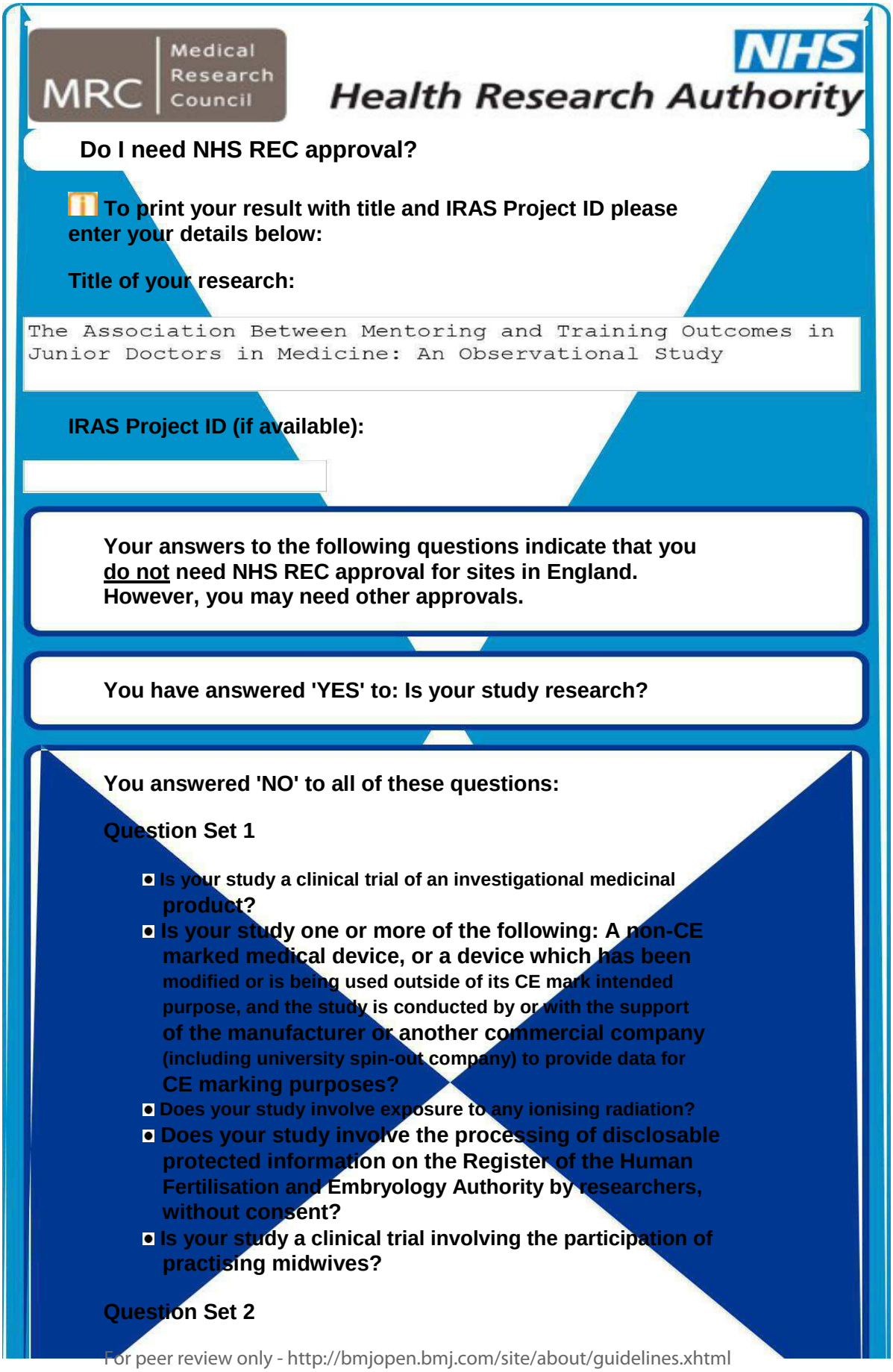
Appendix 1



- **Will your study involve research participants identified from, or because of their past or present use of services (adult and children's healthcare within the NHS and adult social care), for which the UK health departments are responsible (including services provided under contract with the private or voluntary sectors), including participants recruited through these services as healthy controls?**
- **Will your research involve collection of tissue or information from any users of these services (adult and children's healthcare within the NHS and adult social care)? This may include users who have died within the last 100 years.**
- **Will your research involve the use of previously collected tissue or information from which the research team could identify individual past or present users of these services (adult and children's healthcare within the NHS and adult social care), either directly from that tissue or information, or from its combination with other tissue or information likely to come into their possession?**
- **Will your research involve research participants identified because of their status as relatives or carers of past or present users of these services (adult and children's healthcare within the NHS and adult social care)?**

Question Set 3

- **Will your research involve the storage of relevant material from the living or deceased on premises in the UK, but not Scotland, without an appropriate licence from the Human Tissue Authority (HTA)? This includes storage of imported material.**
- **Will your research involve storage or use of relevant material from the living, collected on or after 1st September 2006, and the research is not within the terms of consent from the donors, and the research does not come under another NHS REC approval?**
- **Will your research involve the analysis of DNA from bodily material, collected on or after 1st September 2006, and this analysis is not within the terms of consent for research from the donor?**

Question Set 4

- **Will your research involve at any stage intrusive procedures with adults who lack capacity to consent for themselves, including participants retained in study following the loss of capacity?**
- **Is your research health-related and involving prisoners?**
- **Does your research involve xenotransplantation?**
- **Is your research a social care project funded by the Department of Health?**

If your research extends beyond England find out if you need NHS REC approval by selecting the 'OTHER UK COUNTRIES' button below.

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

Dr John Ong[1*], Dr Carla Swift[2*], Mr Nicholas Magill[3], Ass. Prof Sharon Ong[4], Dr Anne Day[5], Dr Yasseen Al-Naeeb[6], Dr Arun Shankar[7]

*JO and CS are joint first authors

[1]Specialty Registrar, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[2]Specialty Registrar, Department of Gastroenterology, Addenbrooke's Cambridge University Hospital, Cambridge, CB2 0QQ, UK

[3]Biostatician, Department of Biostatistics and Health Informatics, King's College London, SE5 8AF, UK

[4]Assistant Professor and Consultant, Department of Anaesthesia, Singapore General Hospital, Outram Road, S169608, Singapore

[5]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[6]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[7]Consultant, Department of Gastroenterology, Norfolk & Norwich University Hospital, Colney Lane, NR4 7UY, UK

Corresponding author: Dr John Ong (co-first author), Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, United Kingdom. Email: john.ong@kcl.ac.uk

ABSTRACT

Objective: To determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

Design: Observational study

Participants: 117 trainees from the East of England Deanery (non-mentored group) and the recently established Royal College of Physicians (RCP) Mentoring scheme (mentored group) who were core medical trainees (CMTs) between 2015 and 2017 completed an online survey. Trainees who received mentoring at the start of higher speciality training, incomplete responses and trainees who were a part of both the East of England deanery and RCP Mentoring scheme were excluded leaving 85 trainees in the non-mentored arm and 25 trainees in the mentored arm. Responses from a total of 110 trainees were analysed.

Main Outcome Measures: Pass rates of the various components of the MRCP(UK) examination (MRCP Part 1, MRCP Part 2 Written and MRCP Part 2 PACES), pass rates at the Annual Review of Competency Progression (ARCP), trainee involvement in significant events, clinical incidents or complaints, and trainee feedback on career progression and confidence.

Results: Mentored trainees reported higher pass rates of the MRCP Part 1 exam versus non-mentored trainees (84.0% vs. 42.4%, $p<0.01$). Mentored international medical graduates (IMGs) reported higher pass rates than non-mentored IMGs in the MRCP Part 2 Written exam (71.4% vs. 24.0%, $p < 0.05$). ARCP pass rates in mentored trainees were observed to be higher than non-mentored trainees (95.8% vs. 69.9%, $p<0.05$).

Rates of involvement in significant events, clinical incidents and complaints in both groups did not show any statistical difference. Mentored trainees reported higher confidence and career progression.

Conclusions: A positive association is observed between the mentoring of CMTs and better training outcomes. Further studies are needed to investigate the causative effects of mentoring in postgraduate medical training within the UK.

Strengths and limitations of this study

- Novel quantitative data demonstrating a positive association between mentoring and better training-specific outcomes in core medical trainees.
- Adds to the limited qualitative data on the effects of mentoring in postgraduate medical training within the UK.
- Potential for non-response bias and self-selection bias.
- Small sample size of International Medical Graduates who received mentoring.
- Provides preliminary evidence to support further studies investigating the causative effects of mentoring in UK medical trainees.

INTRODUCTION

Work based mentoring is a growing and encouraged practice in UK postgraduate medical training [1]. Though qualitative data suggests that mentored trainees do generally have a positive experience, there is little quantitative evidence to suggest this directly and positively impacts on training-specific outcomes in postgraduate medicine [2]. Here we studied two groups of junior medical doctors in training and compared

targeted training outcomes in a group of trainees who have received mentorship in a structured mentoring programme versus a non-mentored group. By default, mentoring is not provided to all trainees in the UK.

Mentoring is defined as "a process whereby an experienced, highly regarded, empathic person (the mentor) guides another usually younger individual (the mentee) in the development and re-examination of their own ideas, learning, and personal or professional development" [3]. It describes a voluntary and synergistic relationship which requires commitment from both parties in order to be effective [4]. Its ultimate purpose is to empower an individual to achieve set goals [4], though these goals inevitably evolve over time as the mentee develops [3].

In many studies in literature, failed mentor-mentee relationships are a result of poor communication, lack of commitment, personality differences, competition, conflicts of interest, mentor inexperience [5] and unrealistic mentee expectations [4],[6]. To minimise these problems, we included trainees from the Royal College of Physicians (RCP) Mentoring scheme, an optional and recently established mentoring programme made available to any interested core medical trainee in the UK. The programme was advertised through RCP newsletters, social media or peer recommendations. Interested trainees accessed and applied to join the scheme online. Once accepted into the programme, mentees chose their mentors based on online mentor profiles to improve mentor-mentee compatibility. Mentors in the scheme comprise senior registrars and consultants from different medical specialties. They were recruited via RCP newsletters, screened then received formal, compulsory training in mentorship and effective communication over two days of training prior to accepting mentees. Mentoring was voluntary and no financial incentives were offered to the mentors.

At the start of the mentor-mentee relationship, mentors engaged in goal setting (e.g. S.M.A.R.T objectives) to avoid unrealistic expectations by mentees. Subsequently, mentors employed effective questioning techniques to encourage mentee reflection, planning and decision making before dispensing advice or intervention depending on which approach was most appropriate (e.g. facilitative or directive). Mentors were also provided with a platform to obtain confidential, third party advice to ensure difficult situations are dealt with appropriately.

As easy accessibility and open communication are important factors for a successful mentor-mentee relationship [5], mentors and mentees in the RCP mentoring scheme were provided the option to conduct mentor-mentee meetings either in person, online or both. Mentees determined the mode, frequency and duration of the meetings. The most frequent method of communication was email but this was often combined with online conferencing and in-person meetings. Though some studies question the quality and validity of online mentoring [7], [8], others have argued it can still be effective [9], [10] and provides opportunities for mentoring when it would otherwise not be possible [9]. We have chosen not to investigate the mode of how mentoring was delivered in this study because it makes quantitative analysis difficult and does not answer the research question posed by this study.

The objective of our study is to determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

METHODS

Rationale of Study Design

A questionnaire was designed to enable the quantitative analysis of training-specific outcomes and the qualitative analysis of trainee feedback. Parameters for quantitative analysis were the (i) pass rates of the Membership of the Royal College of Physicians (MRCP) UK exams, (ii) pass rates of the Annual Review of Competence Progression (ARCP) and (iii) the rate of trainee involvement in significant events (SEs), clinical incidents (CIs) and complaints.

The MRCP(UK) exam is a postgraduate exam in general internal medicine which comprises three parts: MRCP Part 1 Written, MRCP Part 2 Written and the MRCP Part 2 PACES (practical component). The MRCP(UK) diploma is awarded upon completion of all three exams and completion of the MRCP Part 1 Written exam is required before a trainee can sit for the other two exams. Completion of the MRCP(UK) diploma is expected by the end of core medical training and is a pre-requisite to joining a higher specialty training programme in medicine within the UK. Completion of these examinations is an objective indicator that a trainee has achieved the medical knowledge required for their stage of training.

In postgraduate medical training in the United States, the Accreditation Council for Graduate Medical Education (ACGME) assesses trainee progress in the six domains of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism and system-based practice. Each domain has "milestones" which trainees are expected to achieve at different stages of training. In the UK, a similar approach is adopted and progress is determined by the ARCP review. The ARCP review occurs annually and involves a panel of senior clinical educators and physicians assessing a trainee's progress in the domains of

multiple consultant reports, educational supervisor report, advanced life support, supervised learning events, multi-source feedback, research and audit, common procedural competencies, non-procedural competencies (e.g. communication skills, history taking etc), top medical presentations, emergency medical presentations, other medical presentations, clinics and teaching attendance. The trainee submits evidence to the panel to demonstrate the domain requirements have been achieved and an outcome is awarded to the trainee after the entire review process. Outcome 1, the equivalent of a pass, is described as "satisfactory progress - achieving progress and competencies at expected rate". Other outcomes relevant to core medical training are similar to a fail. The ARCP pass rate was chosen as a parameter of interest because it is an indirect but objective indicator of a trainee's all-rounded development in both the educational curriculum and clinical practice.

The National Patient Safety Agency (NPSA) in the UK defines a significant event (SE) as "any event (negative) thought by anyone in the team to be significant in the care of patients or conduct of practice" [11]. The term "clinical incident" (CI) is often used to describe an unintentional or unexpected event that is less severe in nature and which does not cause significant harm to a patient or member of staff. As part of the ARCP process, it is mandatory for all trainees to declare any involvement in SEs, CIs or complaints received to the ARCP panel. In this study, we also investigated if mentoring or the lack thereof, had any association with trainee involvement in SEs, CIs or complaints.

Trainees from the RCP mentoring programme were chosen as the mentored group because of its nationwide recruitment which reduces the risk of inter-deanery variability if any. East of England trainees were chosen as a control group because, at the time of the study, no mentoring programme for medicine was active within the region. In

contrast, other regional deaneries had separate mentoring programmes for junior doctors (e.g. London deanery, Health Education England Thames Valley deanery). This would have limited standardisation of mentored and non-mentored groups (e.g. Career grade of mentors, level of training delivered to mentors, mentees from other mentoring programmes responding to our survey etc). To provide context to our results, we also provide the pass rates for all UK candidates in the 2017 MRCP exams [12].

Design and Administration of Questionnaire

The questionnaire comprised of 14 binary, non-Likert questions and 1 open question which enabled free text entry for the qualitative analysis of a trainee's experience of being mentored. The qualitative questions within the questionnaire also served as an internal check, so that quantitative results from the survey could be validated against trainee experience (e.g. MRCP or ARCP Pass rates vs. "Did mentoring help your career progression?"). The questionnaire was pretested on a small group of medical registrars not involved with the study to assess its ability at extracting the information required for the study. Minor revisions were made and a final Cronbach alpha score of 0.83 was achieved. The final questionnaire was sent via email as a link to an online survey to all core medical trainees (CMTs) within the East of England Deanery between 2015 and 2017 (n=540 trainees, non-mentored group), and all CMTs who voluntarily registered with the RCP Mentoring scheme between 2015 and 2017 (n=160, mentored group). None of the authors participated in the survey. The survey was subsequently conducted from 14 August 2017 to 15 September 2017 to capture data from trainees at the start of their posts. One reminder email was sent 2 weeks after the invitation email.

Ethics

Prior to designing the survey, the authors completed the Medical Research Council and NHS Health Research Authority decision tool (www.hra-decisiontools.org.uk) which determined ethical approval from a local research ethics committee (REC) was not required. This decision is attached as Appendix 1.

All participants were automatically anonymised by the online survey platform and trainees were made aware of this in their invitation email. Trainees were also informed the survey was for research purposes and participation was voluntary. Completion of the survey conferred implied consent and the authors only received anonymised responses with no trainee identifiable information. There was no risk posed to participants and participants were not paid for completed questionnaires.

Patient and Public Involvement

This study did not involve any members of the public or patients.

Exclusion Criteria

Of the 700 trainees that the invitations were sent to, responses from 117 trainees were received. Of the 117 responses, trainees who received mentoring at the start of higher speciality training; ST3 or above (n=2), incomplete responses (n=3) and trainees who were both a part of the East of England deanery and the RCP Mentoring scheme were excluded (n=2). Incomplete responses were defined as surveys with less than 50% of answered questions. The survey was conducted as a sequence of questions, one question

at a time. The first half of the survey collected demographic data therefore surveys with less than 50% of answered questions were not interpretable. A total of 7 returned surveys were excluded. All of the other 110 surveys were adequately completed.

Other grades of junior doctors equivalent to CMTs (e.g. CMT grade Clinical Fellows and LAT SHOs) were classed "Others" but included in the analysis since these numbers were relatively small. The final numbers for comparison were 25 trainees in the mentored group and 85 trainees in the non-mentored group (summarised in Figure 1).

Statistical and Qualitative Analyses

Graphpad 7.0 (by PRISM) was used to perform the statistical analyses between the two groups of trainees. The chi-squared test was used to examine whether mentoring was associated with outcomes, which were all binary, provided that frequencies within cells of a contingency table were all greater than five. Where this assumption of the chi-squared test was broken and there were fewer than five trainees in one or more cells of a contingency table, Fisher's exact test was used to calculate p-values. . The chi-squared test of association was performed for age, stage of training, qualification status and gender in mentored versus non-mentored groups. The significance level was set to 5% for all tests and all alternative hypotheses were two sided. The Koopman asymptotic method [13] was used to calculate the confidence intervals of the relative risk (RR) and the Baptista-Pike method was used to calculate confidence intervals for the Odd's Ratio (OR) [14]. Since our hypothesis tests were exploratory, we did not consider adjusting for multiple testing to be necessary. Our approach is supported by evidence that suggest making adjustments for multiple comparisons can lead to an increased number of errors of interpretation when data being evaluated are actual observations [15].

MedCalc version 18 was used to perform logistic regression. Older age of respondents may have been a confounding factor to MRCP pass rates if respondents had more time out of training to complete the exams. Lower pass rates of IMGs are usually observed in the MRCP exams and the reason for this phenomenon is likely multi-factorial. For both these reasons, age group (coded as 0=20-30yrs, 1=31-40yrs) and the country of the primary medical degree (coded as UK=1, non-UK=0) of respondents were used as covariates in the regression model together with exposure to mentoring in order to make an assessment of any confounding of the relationship between mentoring and outcome. Since completion of MRCP exams is expected with career progression, stage of training was not used as a covariate in the regression model.

Qualitative responses were grouped into categories of "positive" or "negative" feedback when applicable and descriptors provided by the trainees were summarised. Examples of the feedback received have also been quoted verbatim in the results section for readers to interpret.

RESULTS

Of the 110 trainees in the study (85 non-mentored, 25 mentored), there were slightly more female respondents than male in both arms of the study; 56.0% (14/25) vs. 44.0% (11/25) in the mentored group and 51.8% (44/85) vs. 48.2% (41/85) in the non-mentored group. There were no statistically significant differences in the career grades of the respondents in both arms of the study and the majority of respondents were graduates from the UK (see Table 1).

Table 1. Demographics of respondents grouped by gender, current stage of training, country of primary medical qualification and age group.

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
Gender			p=0.71
Male	44.0% (11/25)	48.2% (41/85)	
Female	56.0% (14/25)	51.8% (44/85)	
Stage of training			p=0.13
FY1	0.0% (0/25)	0.0% (0/85)	
FY2	0.0% (0/25)	0.0% (0/85)	
CMT1	16.0% (4/25)	36.5% (31/85)	
CMT2	32.0% (8/25)	34.1% (29/85)	
ST3 or above	28.0% (7/25)	17.6% (15/85)	
Others	24.0% (6/25)	11.8% (10/85)	
Primary degree			p=0.89
UK trained	72.0% (18/25)	70.6% (60/85)	
IMG	28.0% (7/25)	29.4% (25/85)	
Age group			p=0.96
20 – 30yrs	76.0% (19/25)	76.5% (65/85)	
31 – 40yrs	24.0% (6/25)	23.5% (20/85)	

Significant differences were observed in the MRCP exam pass rates between mentored and non-mentored trainees.

The pass rate of the MRCP Part 1 exam was observed to be significantly higher in trainees receiving mentorship compared to non-mentored East of England trainees; 84.0% (21/25) vs. 42.4% (36/85), $p < 0.01$ (OR=7.1, 95% CI 2.4 - 20.3 and RR=2.0, 95% CI 1.4 - 2.7), see Table 2.

Table 2. MRCP(UK) Pass Rates for All Trainees and UK International Medical Graduates who participated in the study.

	Pass Rate in all Trainees			*Pass Rate in UK International Medical Graduates*			
	Mentored (1)	*Non-Mentored (2)*	*p-value (1) vs (2)*	*Mentored (3)*	*Non-Mentored (4)*	*p-value (3) vs (4)*	*2017 UK Pass Rates*
MRCP Part 1 (Written)	84.0% (21/25)	42.4% (36/85)	$p < 0.01$	71.4% (5/7)	32.0% (8/25)	$p = 0.09$	50.6% (2065/4079)
MRCP Part 2 (Written)	44.0% (11/25)	30.6% (26/85)	$p = 0.21$	71.4% (5/7)	24.0% (6/25)	$p < 0.05$	75.1% (1584/2110)
MRCP Part 2 (PACES)	44.0% (11/25)	29.4% (25/85)	$p = 0.17$	57.1% (4/7)	24.0% (6/25)	$p = 0.17$	56.1% (1594/2843)
Full MRCP (UK)	40.0% (10/25)	29.4% (25/85)	$p = 0.32$	57.1% (4/7)	24.0% (6/25)	$p = 0.17$	*

** denotes information unavailable.*

Logistic regression demonstrated mentoring to be strongly associated with higher pass rates of the MRCP Part 1 exam ($p < 0.001$) with a point estimate of effect size equating to adjusted OR=9.56, 95% CI 2.56 – 35.68 (see Table 3).

Table 3. Logistic Regression Table (All figures approximated to 2 decimal places).

Dependent Variable	***Independent Variables***	***OR***	***SE***	***Wald χ^2***	***p-value***	***95% CI***
MRCP Part 1 Outcome	*Age*	0.99	0.57	0.00	0.98	0.33, 3.00
	Mentoring status	9.56	0.67	11.28	<0.001	2.56, 35.68
	Primary qualification	0.47	0.54	1.89	0.17	0.16, 1.37
MRCP Part 2 (Written)	*Age*	2.01	0.52	1.81	0.18	0.73, 5.53

Outcome	*Mentoring status*	1.67	0.49	1.13	0.29	0.65, 4.33
	Primary qualification	1.08	0.51	0.02	0.88	0.40, 2.90
MRCP Part 2 (PACES) Outcome	*Age*	1.67	0.52	0.97	0.32	0.60, 4.65
	Mentoring status	1.80	0.48	1.47	0.23	0.70, 4.65
	Primary qualification	0.91	0.51	0.03	0.85	0.33, 2.49

The MRCP Part 2 (Written) exam pass rates between mentored trainees and non-mentored East of England trainees showed no significant difference. This was further reflected in the logistic regression model ($p = 0.29$ and adjusted OR 1.67). However, the MRCP Part 2 (Written) pass rate was lower than expected when compared to pass rates in the 2017 UK cohort. This difference may be explained by the timing of the survey which captured data from mentored CMT trainees at the start of their post and who may not have yet attempted the exam. In sub-population analyses, the pass rates of the MRCP Part 2 (Written) exam was observed to be significantly higher in mentored, international medical graduates (IMGs) compared to non-mentored IMGs; 71.4% (5/7) vs. 24.0% (6/25), $p < 0.05$. Supplementary Table 1 provides the MRCP pass rates by stage of training.

For the MRCP Part 2 (PACES) exam, no significant differences were observed between mentored and non-mentored groups. Non-significant results were also observed in the logistic regression model ($p = 0.23$ and adjusted OR 1.80).

Logistic regression demonstrated that age and the country of primary qualification did not have any significant influence on the effects observed in mentoring for all components of the MRCP(UK) exam..

Higher ARCP pass rates were observed in mentored trainees (Figure 2A).

The ARCP review provides a comprehensive assessment of a trainee's progress in the core medical training educational curriculum and personal clinical practice. In our study, 97 trainees (24 mentored, 73 non-mentored) out of 110 had an ARCP within 12 months. The ARCP pass rate (Outcome 1s) was observed to be significantly higher in mentored trainees compared to non-mentored trainees; 95.8% (23/24) vs. 69.9% (51/73), $p<0.05$ (OR=9.9, 95% CI 1.5 - 107 and RR=1.4, 95% CI 1.1 - 1.7).

Mentoring did not significantly decrease the number of Significant Events (SEs), Clinical Incidents (CIs) or Complaints in Core Medical Trainees (Figure 2B).

In our study, though the number of trainee involvement in such events were lower in the mentored group compared to the non-mentored group, 4.0% (1/25) vs. 9.4% (8/85) respectively, this was not statistically significant (p=0.68).

Mentoring is associated with increased trainee confidence and better career progression (Figure 3A and Figure 3B).

In total, 69.6% (16/23) of mentored trainees in our study reported that mentoring had improved their confidence and 95.8% (23/24) reported mentoring had aided in their career progression in medicine. Exploration of reasons from the mentored trainees who did not find mentoring useful revealed their experience was limited by insufficient time, poor response from mentors and unmet expectations.

The majority of mentored CMTs had a positive experience.

When asked for their opinion on their mentoring experience, 88.0% (22/25) of mentored trainees provided positive feedback (Figure 3C). A total of 78.2% (86/110) of all trainees (mentored and non-mentored) agreed with the statement that mentoring should be made available to all CMTs. Only 1.8% (2/110) of responders agreed that mentoring should only be provided to trainees struggling with career progression or clinical work (Figure 3D). This suggests mentoring does not confer a negative connotation on the mentee by fellow colleagues. Positive and negative descriptors have been summarised in Table 4.

Table 4. Summary of descriptors from trainee feedback.

	Descriptors	**Phrases**
Positive	Useful	"reassuring to know that someone helpful and supportive is available"
	Reassuring	
	Enlightening	
	Immensely positive	"helped me streamline my focus and made me aware of personal weaknesses"
	Supportive	
	Excellent	
	Rewarding	"structured my career goals into attainable chunks"
	Helpful	
	Transformative	"made me more proactive"
	Confidence boosting	
Negative	Basic	"I did not receive the response from the mentor I requested"
	Not helpful	"limited use due to limited time"

Of the 22 mentored trainees who provided positive feedback, 81.8% (18/22) had passed MRCP Part 1, 45.5% (10/22) had passed MRCP Part 2 and 45.5% (10/22) had completed MRCP PACES. If compared to the 2017 UK cohort, the MRCP Part 1 pass

rate is statistically significant (p<0.01). 86.4% (19/22) of mentored trainees who had a positive experience had received an outcome 1 for their most recent ARCP and none had been involved in any SEs, CIs or complaints. The qualitative data discussed herein reinforces our observations that mentoring did have a significant effect on trainees in practice. Of the three mentored trainees that provided negative feedback, one trainee described mentoring as "not helpful", one trainee described mentoring as "basic" and one trainee did not provide any further comments.

Mentee selection of mentors improves compatibility and increases positive experiences.

Analysis of positive feedback from mentored trainees provided valuable insight into the importance of the specialty and gender of mentors. Two examples are provided below.

> *"I was initially told there was no mentor in my speciality. After a year I was re-contacted because there was a mentor in my specialty. This relationship worked really well. We were able to discuss on Skype and meet in person. It aided my confidence and also structured my career goals into attainable chunks."*

> *"This was a transformative experience for me. My mentor was an excellent fit for me (I selected the gender of my mentor only and was then allocated. It was important for me to be mentored by another woman) and provided a space, encouragement, acceptance and deep kindness whilst asking good questions. This allowed me to grow from a personal perspective and steer my professional life more effectively. I*

feel better than I have in years and am carving a path that is right for me."

DISCUSSION

To our knowledge, this study is the first UK-specific study to provide quantitative data showing a positive association between mentoring of junior medical doctors and better training outcomes. Here, the effect of mentoring was assessed against clinically important parameters such as MRCP(UK) pass rates, ARCP pass rates, clinical incidents and significant events which has not been previously attempted in literature. With regards to the MRCP exams, the strongest association of mentoring with higher pass rates was seen in the MRCP Part 1 exams where a statistically significant difference was detected when comparing mentored trainees to the non-mentored group. Higher pass rates in the MRCP Part 2 Written exam were also observed in mentored IMGs compared to non-mentored IMG trainees, however the authors acknowledge that the sample size is small in the aforementioned group and these results should be interpreted with caution.

Interestingly, non-mentored IMGs (n=25) were observed to have statistically significant lower pass rates in the MRCP Part 2 exams (Written and PACES) compared to mentored IMGs. Also, most mentored IMG trainees began their mentoring relationship before core medical training - two trainees received mentorship as Foundation Year 2 doctors and two as CMT-equivalent Clinical Fellows. Further research is needed to see if an earlier introduction of mentoring (e.g. during Foundation Training) in trainees keen on a career in medicine has any effect on training outcomes.

Although mentoring did not have a statistically significant association with trainee involvement in SEs, CIs or complaints, the vast majority of trainees who participated in mentoring found it to be a positive experience which improved confidence and aided in improved career progression. This positive feedback, considered cumulatively with current literature and our observed results, suggests that mentoring may have a genuinely positive effect on postgraduate medical education and development. Similar to current literature, qualitative analysis of feedback from our group of mentored trainees revealed that poor mentor-mentee communication and unmet expectations remain causes of a negative mentor-mentee experience. This could be addressed in the future by more frequent interval communications with the mentee to detect and address incipient problems.

It has been acknowledged that a facilitative approach is needed in order for a mentor-mentee relationship to be successful [3], [16], however this should extend not only to the mentor but also to the mentoring programme that the mentee is engaged in. Although the overall impact of gender specificity of mentors remains a debate in current literature [5], [17], there are clearly female mentees who seek female mentors as role models. It is therefore important for any mentoring programme to allow mentees the option to choose their mentors freely as well as recruit and utilise equal proportions of mentors from both genders.

The benefits of mentoring are not limited to the mentee. Mentoring provides the mentor with personal satisfaction [18], an avenue for reflection and the exchange of experiences [3] which will in turn enhance one's own professional development. It is important however to stress that mentoring should not be a therapeutic exercise for the senior clinician and that altruistic intentions should be coupled with appropriate training in mentoring, communication and adequate organisational support. Platforms that support

mentors or mentees in difficulty should be made easily accessible at any point during the mentoring process.

Mentoring is centred on developing and empowering trainees to realise and achieve their objectives. It should not be restricted to helping trainees in difficulty pass their training, as often in the UK, trainees access mentoring programmes because of compulsory, remedial action or through support offered by higher educational authorities to address exam or domain failures. The majority of CMTs from our survey, together with expert opinions from some RCP Tutors, believed that mentoring should be made available to all trainees. It is therefore important to change perspectives amongst senior medical educators who are opined that mentoring should be encouraged only in trainees who are struggling to progress.

With regard to career progression, our study has also shown that ARCP pass rates were significantly higher in the mentored group though a contributory reason for this may be that successful completion of the MRCP Part 1 exam is one of the pre-requisites for obtaining an Outcome 1 (pass) at ARCP for the first year of core medical training. However, the lower ARCP pass rates in the non-mentored group could also have been a result of other domain failures. Therefore, further studies would be needed to identify specifically the impact of mentoring on progression in the other domains.

Limitations of the study and special considerations for future research.

The main limitations of this study arise through the potential for self-selection bias and non-response bias. Trainees within the mentored group have volunteered to be mentored and as such they may be more motivated and highly engaged than those within the non-

mentored arm. This could have resulted in self-selection bias. Equally, the low response rate of the survey may have resulted in non-response bias e.g. mentored trainees could have failed their exams and did not respond to the survey causing a skew in the observed results. Both biases would have been minimised if the survey was compulsory. However, there are ethical considerations in making such a survey compulsory as trainees may not give consent to providing non-essential and personal information, especially if it involves potentially sensitive issues such as clinical incidents or complaints. We sought to address these issues by keeping all responses anonymous and keeping the survey concise. This would have encouraged more trainees to participate and improved response rates so a better representation of the mentored and non-mentored control groups could be obtained.

A further limitation of the study was the absence of a perfectly matched control group. In theory, the ideal control group for the study would be equally motivated CMTs who had sought mentorship with the RCP but were then matched according to individual attributes and randomised to not receive mentorship. However, this would have been both unethical and against current GMC guidance. We therefore recruited CMTs within the East of England deanery who had not received mentoring as our control group though we acknowledge this may have introduced selection bias. For added rigor, we have provided the MRCP performance data from 2017 (UK candidates) for comparison and have discussed the reasons for doing so above.

Response rates in unpaid, voluntary research surveys are well known to be poor. The only exception to our knowledge is the GMC National Training Survey because its completion is required before attendance at the ARCP interviews. As a result of the low response rate, sample sizes in some subgroups in the study are small. Therefore, caution is advised when interpreting results in subgroups where small sample sizes may have

affected statistical calculations and may not be accurately representative of the entire population.

Lastly, our study design was limited and influenced significantly by the lack of a central platform for data collection and the availability of resources to collate the data. Information on the exam pass rates is held by the MRCP(UK) body and information on the ARCP pass rates, significant events, clinical incidents or complaints is held in confidentiality by a separate body (the Joint Royal Colleges of Physicians Training Board, JRCPTB). We found the most cost effective method of collating data from these two bodies was therefore a survey targeted at trainees who are a common join between the two. Other researchers would therefore need to consider these ethical and logistical challenges in designing future studies.

Conclusion

Our study provides new quantitative data in support of a positive association between mentoring junior doctors and better training outcomes in postgraduate training in general medicine within the UK. Both quantitative and qualitative data from our study supports and reinforces current qualitative literature with similar findings in mentee experiences. Further studies are needed to investigate the causative effects of mentoring on the outcomes of postgraduate medical training.

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Author's contributions: JO and CS designed the study, conducted the literature search, performed the statistical and qualitative analyses, prepared the figures and wrote the manuscript. NM advised on statistical methods, checked the results of the analyses and edited the manuscript. SO and AD gave their expert opinion on medical education in the training of junior doctors and contributed to parts of the manuscript. YA and AS edited the manuscript prior to submission and gave their senior opinion on mentoring in medicine.

Data sharing: No additional data is available

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Figure and table legends:

Figure 1. Distribution of responses received into “mentored”, “not mentored” arms and responses excluded in the study.

Figure 2. (A) Higher rates of Outcome 1 at ARCP was observed in mentored trainees ($p<0.05$) but no statistically significant effect was observed in trainee involvement in SEs, CIs, or complaints (B).

Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees.

Supplementary Table 1. In comparing equivalent career grades, higher pass rates in the MRCP(UK) Part 1 exam were observed in mentored CMT Year 1 and CMT Year 2 trainees.

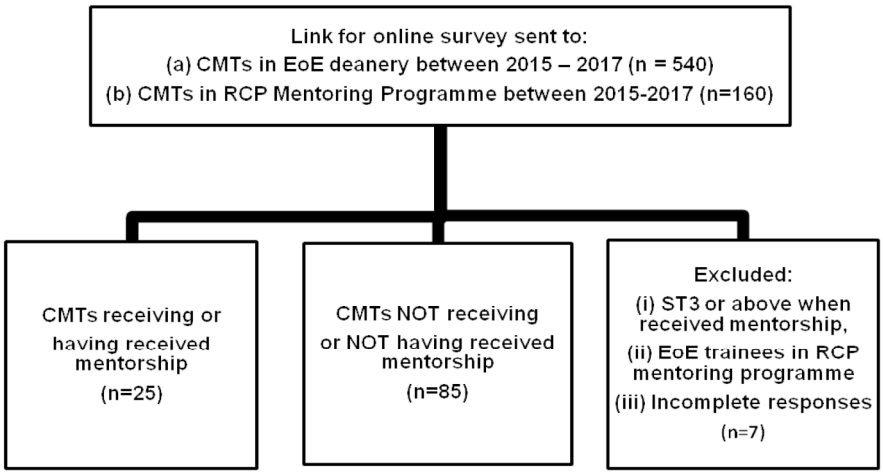

Figure 1. Distribution of responses received into "mentored", "not mentored" arms and responses excluded in the study.

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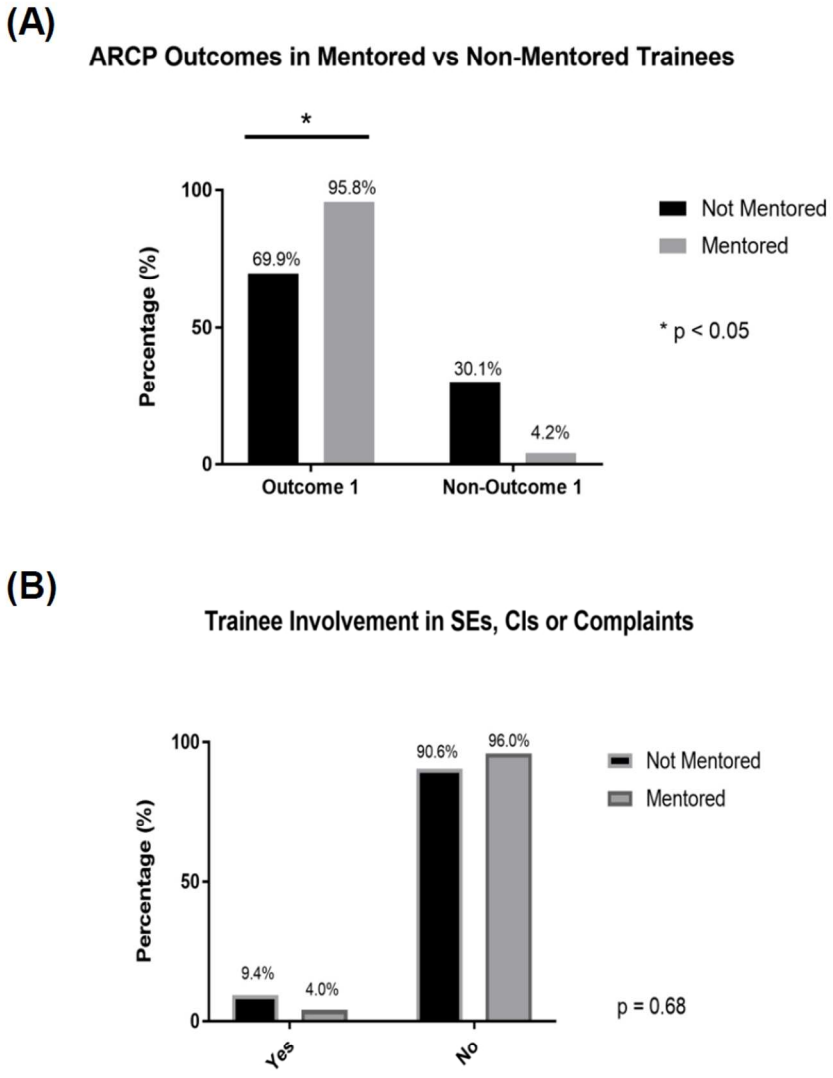


Figure 2. (A) Higher rates of Outcome 1 at ARCP was observed in mentored trainees ($p<0.05$) but no statistically significant effect was observed in trainee involvement in SEs, CIs, or complaints (B).

92x112mm (300 x 300 DPI)

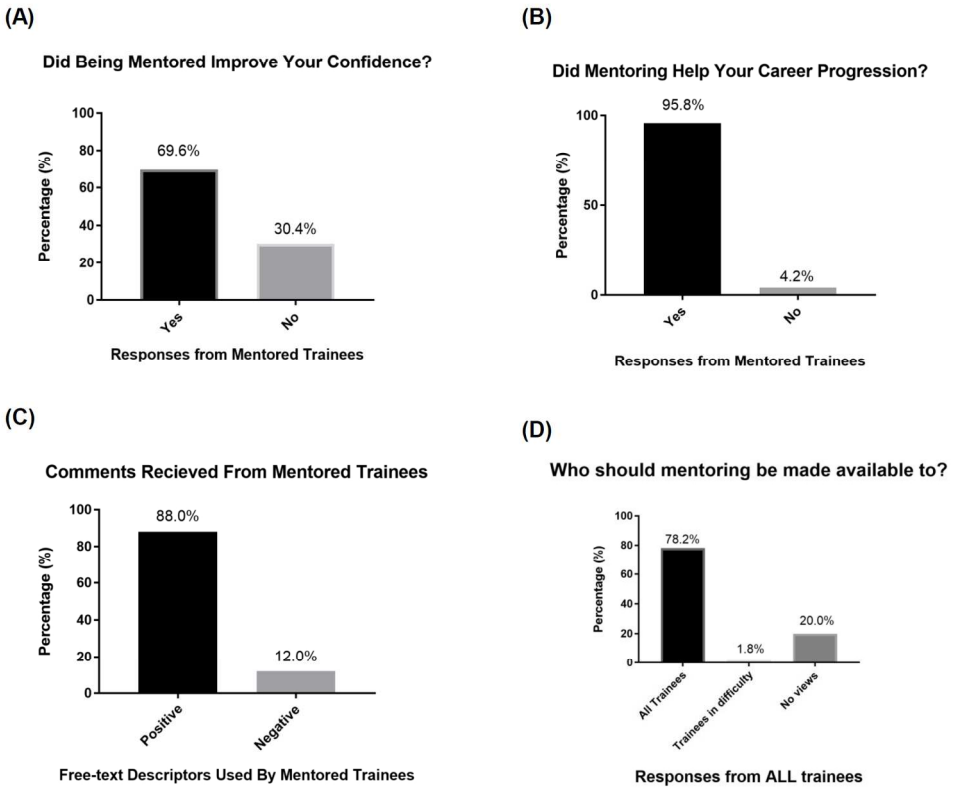
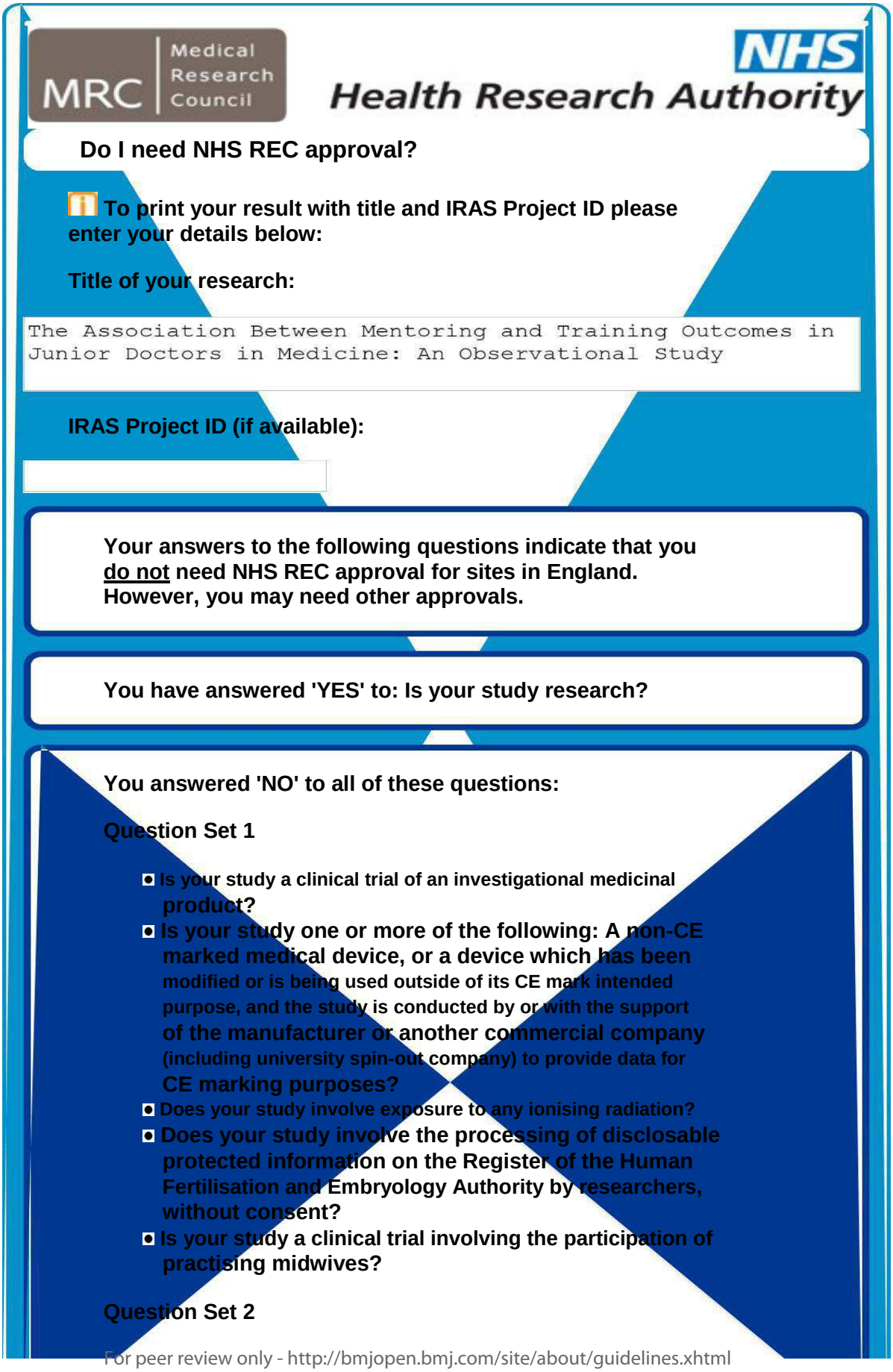


Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees.

173x155mm (300 x 300 DPI)

Appendix 1



- **Will your study involve research participants identified from, or because of their past or present use of services (adult and children's healthcare within the NHS and adult social care), for which the UK health departments are responsible (including services provided under contract with the private or voluntary sectors), including participants recruited through these services as healthy controls?**
- **Will your research involve collection of tissue or information from any users of these services (adult and children's healthcare within the NHS and adult social care)? This may include users who have died within the last 100 years.**
- **Will your research involve the use of previously collected tissue or information from which the research team could identify individual past or present users of these services (adult and children's healthcare within the NHS and adult social care), either directly from that tissue or information, or from its combination with other tissue or information likely to come into their possession?**
- **Will your research involve research participants identified because of their status as relatives or carers of past or present users of these services (adult and children's healthcare within the NHS and adult social care)?**

Question Set 3

- **Will your research involve the storage of relevant material from the living or deceased on premises in the UK, but not Scotland, without an appropriate licence from the Human Tissue Authority (HTA)? This includes storage of imported material.**
- **Will your research involve storage or use of relevant material from the living, collected on or after 1st September 2006, and the research is not within the terms of consent from the donors, and the research does not come under another NHS REC approval?**
- **Will your research involve the analysis of DNA from bodily material, collected on or after 1st September 2006, and this analysis is not within the terms of consent for research from the donor?**

Question Set 4

- **Will your research involve at any stage intrusive procedures with adults who lack capacity to consent for themselves, including participants retained in study following the loss of capacity?**
- **Is your research health-related and involving prisoners?**
- **Does your research involve xenotransplantation?**
- **Is your research a social care project funded by the Department of Health?**

If your research extends beyond England find out if you need NHS REC approval by selecting the 'OTHER UK COUNTRIES' button below.

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MRCP Exams: Pass Rates by Stage of Training

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
CMT Year 1			
MRCP Part 1 (Written)	100.0% (4/4)	19.4% (6/31)	p < 0.01
MRCP Part 2 (Written)	75.0% (3/4)	6.5% (2/31)	p < 0.01
MRCP Part 2 (PACES)	50.0% (2/4)	3.2% (1/31)	p < 0.05
Full MRCP (UK)	50.0% (2/4)	3.2% (1/31)	p < 0.05
CMT Year 2			
MRCP Part 1 (Written)	100.0% (8/8)	41.4% (12/29)	p < 0.01
MRCP Part 2 (Written)	25.0% (2/8)	31.0% (9/29)	p = 1.00
MRCP Part 2 (PACES)	37.5% (3/8)	31.0% (9/29)	p = 1.00
Full MRCP (UK)	25.0% (2/8)	31.0% (9/29)	p = 1.00
ST3 and above			
MRCP Part 1 (Written)	71.4% (5/7)	86.7% (13/15)	p = 1.00
MRCP Part 2 (Written)	57.1% (4/7)	80.0% (12/15)	p = 0.33
MRCP Part 2 (PACES)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Full MRCP (UK)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Others			
MRCP Part 1 (Written)	66.7% (4/6)	50.0% (5/10)	p = 0.63
MRCP Part 2 (Written)	33.3% (2/6)	30.0% (3/10)	p = 1.00
MRCP Part 2 (PACES)	33.3% (2/6)	30.0% (3/10)	p = 1.00
Full MRCP (UK)	33.3% (2/6)	30.0% (3/10)	p = 1.00

130x127mm (300 x 300 DPI)

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2 - 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 - 5
Objectives	3	State specific objectives, including any pre-specified hypotheses	2, 5
Methods			
Study design	4	Present key elements of study design early in the paper	Abstract, 6-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 8
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	7 - 10
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6, 7, 10, 11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6 - 8, 10, 11
Bias	9	Describe any efforts to address potential sources of bias	11, 20-22
Study size	10	Explain how the study size was arrived at	9, 10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7, 8, 10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10, 11
		(*b*) Describe any methods used to examine subgroups and interactions	10, 11
		(*c*) Explain how missing data were addressed	9 - 10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	7, 8, 10, 11

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9, 10
		(b) Give reasons for non-participation at each stage	9, 10
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11, Table 1
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	Not applicable
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Not applicable
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	Not applicable
		Cross-sectional study—Report numbers of outcome events or summary measures	12-17; Tables 2-4, Figures 2 & 3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	18-20
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20-22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-22
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

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The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

Dr John Ong[1*], Dr Carla Swift[2*], Mr Nicholas Magill[3], Ass. Prof Sharon Ong[4], Dr Anne Day[5], Dr Yasseen Al-Naeeb[6], Dr Arun Shankar[7]

*JO and CS are joint first authors

[1]Specialty Registrar, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[2]Specialty Registrar, Department of Gastroenterology, Addenbrooke's Cambridge University Hospital, Cambridge, CB2 0QQ, UK

[3]Biostatician, Department of Biostatistics and Health Informatics, King's College London, SE5 8AF, UK

[4]Assistant Professor and Consultant, Department of Anaesthesia, Singapore General Hospital, Outram Road, S169608, Singapore

[5]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[6]Consultant, Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, UK

[7]Consultant, Department of Gastroenterology, Norfolk & Norwich University Hospital, Colney Lane, NR4 7UY, UK

Corresponding author: Dr John Ong (co-first author), Department of Gastroenterology, Bedford Hospital, Kempston Road, MK42 9DJ, United Kingdom. Email: john.ong@kcl.ac.uk

ABSTRACT

Objective: To determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

Design: Observational study

Participants: 117 trainees from the East of England Deanery (non-mentored group) and the recently established Royal College of Physicians (RCP) Mentoring scheme (mentored group) who were core medical trainees (CMTs) between 2015 and 2017 completed an online survey. Trainees who received mentoring at the start of higher speciality training, incomplete responses and trainees who were a part of both the East of England deanery and RCP Mentoring scheme were excluded leaving 85 trainees in the non-mentored arm and 25 trainees in the mentored arm. Responses from a total of 110 trainees were analysed.

Main Outcome Measures: Pass rates of the various components of the MRCP(UK) examination (MRCP Part 1, MRCP Part 2 Written and MRCP Part 2 PACES), pass rates at the Annual Review of Competency Progression (ARCP), trainee involvement in significant events, clinical incidents or complaints, and trainee feedback on career progression and confidence.

Results: Mentored trainees reported higher pass rates of the MRCP Part 1 exam versus non-mentored trainees (84.0% vs. 42.4%, $p<0.01$). Mentored international medical graduates (IMGs) reported higher pass rates than non-mentored IMGs in the MRCP Part 2 Written exam (71.4% vs. 24.0%, $p < 0.05$). ARCP pass rates in mentored trainees were observed to be higher than non-mentored trainees (95.8% vs. 69.9%, $p<0.05$).

Rates of involvement in significant events, clinical incidents and complaints in both groups did not show any statistical difference. Mentored trainees reported higher confidence and career progression.

Conclusions: A positive association is observed between the mentoring of CMTs and better training outcomes. Further studies are needed to investigate the causative effects of mentoring in postgraduate medical training within the UK.

Strengths and limitations of this study

- Novel quantitative data demonstrating a positive association between mentoring and better training-specific outcomes in core medical trainees.
- Adds to the limited qualitative data on the effects of mentoring in postgraduate medical training within the UK.
- Potential for non-response bias and self-selection bias.
- Small sample size of International Medical Graduates who received mentoring.
- Provides preliminary evidence to support further studies investigating the causative effects of mentoring in UK medical trainees.

INTRODUCTION

Work based mentoring is a growing and encouraged practice in UK postgraduate medical training [1]. Though qualitative data suggests that mentored trainees do generally have a positive experience, there is little quantitative evidence to suggest this directly and positively impacts on training-specific outcomes in postgraduate medicine [2]. Here we studied two groups of junior medical doctors in training and compared

targeted training outcomes in a group of trainees who have received mentorship in a structured mentoring programme versus a non-mentored group. By default, mentoring is not provided to all trainees in the UK.

Mentoring is defined as "a process whereby an experienced, highly regarded, empathic person (the mentor) guides another usually younger individual (the mentee) in the development and re-examination of their own ideas, learning, and personal or professional development" [3]. It describes a voluntary and synergistic relationship which requires commitment from both parties in order to be effective [4]. Its ultimate purpose is to empower an individual to achieve set goals [4], though these goals inevitably evolve over time as the mentee develops [3].

In many studies in literature, failed mentor-mentee relationships are a result of poor communication, lack of commitment, personality differences, competition, conflicts of interest, mentor inexperience [5] and unrealistic mentee expectations [4],[6]. To minimise these problems, we included trainees from the Royal College of Physicians (RCP) Mentoring scheme, an optional and recently established mentoring programme made available to any interested core medical trainee in the UK. The programme was advertised through RCP newsletters, social media or peer recommendations. Interested trainees accessed and applied to join the scheme online. Once accepted into the programme, mentees chose their mentors based on online mentor profiles to improve mentor-mentee compatibility. Mentors in the scheme comprise senior registrars and consultants from different medical specialties. They were recruited via RCP newsletters, screened then received formal, compulsory training in mentorship and effective communication over two days of training prior to accepting mentees. Mentoring was voluntary and no financial incentives were offered to the mentors.

At the start of the mentor-mentee relationship, mentors engaged in goal setting (e.g. S.M.A.R.T objectives) to avoid unrealistic expectations by mentees. Subsequently, mentors employed effective questioning techniques to encourage mentee reflection, planning and decision making before dispensing advice or intervention depending on which approach was most appropriate (e.g. facilitative or directive). Mentors were also provided with a platform to obtain confidential, third party advice to ensure difficult situations are dealt with appropriately.

As easy accessibility and open communication are important factors for a successful mentor-mentee relationship [5], mentors and mentees in the RCP mentoring scheme were provided the option to conduct mentor-mentee meetings either in person, online or both. Mentees determined the mode, frequency and duration of the meetings. The most frequent method of communication was email but this was often combined with online conferencing and in-person meetings. Though some studies question the quality and validity of online mentoring [7], [8], others have argued it can still be effective [9], [10] and provides opportunities for mentoring when it would otherwise not be possible [9]. We have chosen not to investigate the mode of how mentoring was delivered in this study because it makes quantitative analysis difficult and does not answer the research question posed by this study.

The objective of our study is to determine quantitatively if a positive association exists between the mentoring of junior doctors and better training outcomes in postgraduate medical training within the UK.

METHODS

Rationale of Study Design

A questionnaire was designed to enable the quantitative analysis of training-specific outcomes and the qualitative analysis of trainee feedback. Parameters for quantitative analysis were the (i) pass rates of the Membership of the Royal College of Physicians (MRCP) UK exams, (ii) pass rates of the Annual Review of Competence Progression (ARCP) and (iii) the rate of trainee involvement in significant events (SEs), clinical incidents (CIs) and complaints.

The MRCP(UK) exam is a postgraduate exam in general internal medicine which comprises three parts: MRCP Part 1 Written, MRCP Part 2 Written and the MRCP Part 2 PACES (practical component). The MRCP(UK) diploma is awarded upon completion of all three exams and completion of the MRCP Part 1 Written exam is required before a trainee can sit for the other two exams. Completion of the MRCP(UK) diploma is expected by the end of core medical training and is a pre-requisite to joining a higher specialty training programme in medicine within the UK. Completion of these examinations is an objective indicator that a trainee has achieved the medical knowledge required for their stage of training.

In postgraduate medical training in the United States, the Accreditation Council for Graduate Medical Education (ACGME) assesses trainee progress in the six domains of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism and system-based practice. Each domain has "milestones" which trainees are expected to achieve at different stages of training. In the UK, a similar approach is adopted and progress is determined by the ARCP review. The ARCP review occurs annually and involves a panel of senior clinical educators and physicians assessing a trainee's progress in the domains of

multiple consultant reports, educational supervisor report, advanced life support, supervised learning events, multi-source feedback, research and audit, common procedural competencies, non-procedural competencies (e.g. communication skills, history taking etc), top medical presentations, emergency medical presentations, other medical presentations, clinics and teaching attendance. The trainee submits evidence to the panel to demonstrate the domain requirements have been achieved and an outcome is awarded to the trainee after the entire review process. Outcome 1, the equivalent of a pass, is described as "satisfactory progress - achieving progress and competencies at expected rate". Other outcomes relevant to core medical training are similar to a fail. The ARCP pass rate was chosen as a parameter of interest because it is an indirect but objective indicator of a trainee's all-rounded development in both the educational curriculum and clinical practice.

The National Patient Safety Agency (NPSA) in the UK defines a significant event (SE) as "any event (negative) thought by anyone in the team to be significant in the care of patients or conduct of practice" [11]. The term "clinical incident" (CI) is often used to describe an unintentional or unexpected event that is less severe in nature and which does not cause significant harm to a patient or member of staff. As part of the ARCP process, it is mandatory for all trainees to declare any involvement in SEs, CIs or complaints received to the ARCP panel. In this study, we also investigated if mentoring or the lack thereof, had any association with trainee involvement in SEs, CIs or complaints.

Trainees from the RCP mentoring programme were chosen as the mentored group because of its nationwide recruitment which reduces the risk of inter-deanery variability if any. East of England trainees were chosen as a control group because, at the time of the study, no mentoring programme for medicine was active within the region. In

contrast, other regional deaneries had separate mentoring programmes for junior doctors (e.g. London deanery, Health Education England Thames Valley deanery). This would have limited standardisation of mentored and non-mentored groups (e.g. Career grade of mentors, level of training delivered to mentors, mentees from other mentoring programmes responding to our survey etc). To provide context to our results, we also provide the pass rates for all UK candidates in the 2017 MRCP exams [12].

Design and Administration of Questionnaire

The questionnaire comprised of 14 binary, non-Likert questions and 1 open question which enabled free text entry for the qualitative analysis of a trainee's experience of being mentored. The qualitative questions within the questionnaire also served as an internal check, so that quantitative results from the survey could be validated against trainee experience (e.g. MRCP or ARCP Pass rates vs. "Did mentoring help your career progression?"). The questionnaire was pretested on a small group of medical registrars not involved with the study to assess its ability at extracting the information required for the study. Minor revisions were made and a final Cronbach alpha score of 0.83 was achieved. The final questionnaire was sent via email as a link to an online survey to all core medical trainees (CMTs) within the East of England Deanery between 2015 and 2017 (n=540 trainees, non-mentored group), and all CMTs who voluntarily registered with the RCP Mentoring scheme between 2015 and 2017 (n=160, mentored group). None of the authors participated in the survey. The survey was subsequently conducted from 14 August 2017 to 15 September 2017 to capture data from trainees at the start of their posts. One reminder email was sent 2 weeks after the invitation email.

Ethics

Prior to designing the survey, the authors completed the Medical Research Council and NHS Health Research Authority decision tool (www.hra-decisiontools.org.uk) which determined ethical approval from a local research ethics committee (REC) was not required. This decision is attached as Appendix 1.

All participants were automatically anonymised by the online survey platform and trainees were made aware of this in their invitation email. Trainees were also informed the survey was for research purposes and participation was voluntary. Completion of the survey conferred implied consent and the authors only received anonymised responses with no trainee identifiable information. There was no risk posed to participants and participants were not paid for completed questionnaires.

Patient and Public Involvement

This study did not involve any members of the public or patients.

Exclusion Criteria

Of the 700 trainees that the invitations were sent to, responses from 117 trainees were received. Of the 117 responses, trainees who received mentoring at the start of higher speciality training; ST3 or above (n=2), incomplete responses (n=3) and trainees who were both a part of the East of England deanery and the RCP Mentoring scheme (n=2) were excluded. Incomplete responses were defined as surveys with less than 50% of answered questions. The survey was conducted as a sequence of questions, one question

at a time. The first half of the survey collected demographic data therefore surveys with less than 50% of answered questions were not interpretable. A total of 7 returned surveys were excluded. All of the other 110 surveys were adequately completed.

Other grades of junior doctors equivalent to CMTs (e.g. CMT grade Clinical Fellows and LAT SHOs) were classed "Others" but included in the analysis since these numbers were relatively small. The final numbers for comparison were 25 trainees in the mentored group and 85 trainees in the non-mentored group (summarised in Figure 1).

Statistical and Qualitative Analyses

Graphpad 7.0 (by PRISM) was used to perform the statistical analyses between the two groups of trainees. The chi-squared test was used to examine whether mentoring was associated with outcomes, which were all binary, provided that frequencies within cells of a contingency table were all greater than five. Where this assumption of the chi-squared test was broken and there were fewer than five trainees in one or more cells of a contingency table, Fisher's exact test was used to calculate p-values. . The chi-squared test of association was performed for age, stage of training, qualification status and gender in mentored versus non-mentored groups. The significance level was set to 5% for all tests and all alternative hypotheses were two sided. The Koopman asymptotic method [13] was used to calculate the confidence intervals of the relative risk (RR) and the Baptista-Pike method was used to calculate confidence intervals for the Odd's Ratio (OR) [14]. Since our hypothesis tests were exploratory, we did not consider adjusting for multiple testing to be necessary. Our approach is supported by evidence that suggest making adjustments for multiple comparisons can lead to an increased number of errors of interpretation when data being evaluated are actual observations [15].

MedCalc version 18 was used to perform logistic regression. Older age of respondents may have been a confounding factor to MRCP pass rates if respondents had more time out of training to complete the exams. Lower pass rates of IMGs are usually observed in the MRCP exams and the reason for this phenomenon is likely multi-factorial. For both these reasons, age group (coded as 0=20-30yrs, 1=31-40yrs) and the country of the primary medical degree (coded as UK=1, non-UK=0) of respondents were used as covariates in the regression model together with exposure to mentoring in order to make an assessment of any confounding of the relationship between mentoring and outcome. Since completion of MRCP exams is expected with career progression, stage of training was not used as a covariate in the regression model.

Qualitative responses were grouped into categories of "positive" or "negative" feedback when applicable and descriptors provided by the trainees were summarised. Examples of the feedback received have also been quoted verbatim in the results section for readers to interpret.

RESULTS

Of the 110 trainees in the study (85 non-mentored, 25 mentored), there were slightly more female respondents than male in both arms of the study; 56.0% (14/25) vs. 44.0% (11/25) in the mentored group and 51.8% (44/85) vs. 48.2% (41/85) in the non-mentored group. There were no statistically significant differences in the career grades of the respondents in both arms of the study and the majority of respondents were graduates from the UK (see Table 1).

Table 1. Demographics of respondents grouped by gender, current stage of training, country of primary medical qualification and age group.

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
Gender			p=0.71
Male	44.0% (11/25)	48.2% (41/85)	
Female	56.0% (14/25)	51.8% (44/85)	
Stage of training			p=0.13
FY1	0.0% (0/25)	0.0% (0/85)	
FY2	0.0% (0/25)	0.0% (0/85)	
CMT1	16.0% (4/25)	36.5% (31/85)	
CMT2	32.0% (8/25)	34.1% (29/85)	
ST3 or above	28.0% (7/25)	17.6% (15/85)	
Others	24.0% (6/25)	11.8% (10/85)	
Primary degree			p=0.89
UK trained	72.0% (18/25)	70.6% (60/85)	
IMG	28.0% (7/25)	29.4% (25/85)	
Age group			p=0.96
20 – 30yrs	76.0% (19/25)	76.5% (65/85)	
31 – 40yrs	24.0% (6/25)	23.5% (20/85)	

Significant differences were observed in the MRCP exam pass rates between mentored and non-mentored trainees.

The pass rate of the MRCP Part 1 exam was observed to be significantly higher in trainees receiving mentorship compared to non-mentored East of England trainees; 84.0% (21/25) vs. 42.4% (36/85), $p < 0.01$ (OR=7.1, 95% CI 2.4 - 20.3 and RR=2.0, 95% CI 1.4 - 2.7), see Table 2.

Table 2. MRCP(UK) Pass Rates for All Trainees and UK International Medical Graduates who participated in the study.

	Pass Rate in all Trainees			*Pass Rate in UK International Medical Graduates*			
	Mentored (1)	*Non-Mentored (2)*	*p-value (1) vs (2)*	*Mentored (3)*	*Non-Mentored (4)*	*p-value (3) vs (4)*	*2017 UK Pass Rates*
MRCP Part 1 (Written)	84.0% (21/25)	42.4% (36/85)	$p < 0.01$	71.4% (5/7)	32.0% (8/25)	$p = 0.09$	50.6% (2065/4079)
MRCP Part 2 (Written)	44.0% (11/25)	30.6% (26/85)	$p = 0.21$	71.4% (5/7)	24.0% (6/25)	$p < 0.05$	75.1% (1584/2110)
MRCP Part 2 (PACES)	44.0% (11/25)	29.4% (25/85)	$p = 0.17$	57.1% (4/7)	24.0% (6/25)	$p = 0.17$	56.1% (1594/2843)
Full MRCP (UK)	40.0% (10/25)	29.4% (25/85)	$p = 0.32$	57.1% (4/7)	24.0% (6/25)	$p = 0.17$	*

** denotes information unavailable.*

Logistic regression demonstrated mentoring to be strongly associated with higher pass rates of the MRCP Part 1 exam ($p < 0.001$) with a point estimate of effect size equating to adjusted OR=9.56, 95% CI 2.56 – 35.68 (see Table 3).

Table 3. Logistic Regression Table (All figures approximated to 2 decimal places).

Dependent Variable	***Independent Variables***	***OR***	***SE***	***Wald χ^2***	***p-value***	***95% CI***
MRCP Part 1 Outcome	*Age*	0.99	0.57	0.00	0.98	0.33, 3.00
	Mentoring status	9.56	0.67	11.28	<0.001	2.56, 35.68
	Primary qualification	0.47	0.54	1.89	0.17	0.16, 1.37
MRCP Part 2 (Written)	*Age*	2.01	0.52	1.81	0.18	0.73, 5.53

Outcome	*Mentoring status*	1.67	0.49	1.13	0.29	0.65, 4.33
	Primary qualification	1.08	0.51	0.02	0.88	0.40, 2.90
MRCP Part 2 (PACES) Outcome	*Age*	1.67	0.52	0.97	0.32	0.60, 4.65
	Mentoring status	1.80	0.48	1.47	0.23	0.70, 4.65
	Primary qualification	0.91	0.51	0.03	0.85	0.33, 2.49

Note: MRCP Part 2 (Written) and MRCP Part 2 (PACES) outcomes were omitted when MRCP Part 1 Outcome was used as the dependent variable and vice versa.

The MRCP Part 2 (Written) exam pass rates between mentored trainees and non-mentored East of England trainees showed no significant difference. This was further reflected in the logistic regression model ($p = 0.29$ and adjusted OR 1.67). However, the MRCP Part 2 (Written) pass rate was lower than expected when compared to pass rates in the 2017 UK cohort. This difference may be explained by the timing of the survey which captured data from mentored CMT trainees at the start of their post and who may not have yet attempted the exam. In sub-population analyses, the pass rates of the MRCP Part 2 (Written) exam was observed to be significantly higher in mentored, international medical graduates (IMGs) compared to non-mentored IMGs; 71.4% (5/7) vs. 24.0% (6/25), $p < 0.05$. Supplementary Table 1 provides the MRCP pass rates by stage of training.

For the MRCP Part 2 (PACES) exam, no significant differences were observed between mentored and non-mentored groups. Non-significant results were also observed in the logistic regression model ($p = 0.23$ and adjusted OR 1.80).

Logistic regression demonstrated that age and the country of primary qualification did not have any significant influence on the effects observed in mentoring for all components of the MRCP(UK) exam..

Higher ARCP pass rates were observed in mentored trainees.

The ARCP review provides a comprehensive assessment of a trainee's progress in the core medical training educational curriculum and personal clinical practice. In our study, 97 trainees (24 mentored, 73 non-mentored) out of 110 had an ARCP within 12 months. The ARCP pass rate (Outcome 1s) was observed to be significantly higher in mentored trainees (Figure 2A) compared to non-mentored trainees; 95.8% (23/24) vs. 69.9% (51/73), $p<0.05$ (OR=9.9, 95% CI 1.5 - 107 and RR=1.4, 95% CI 1.1 - 1.7).

Mentoring did not significantly decrease the number of Significant Events (SEs), Clinical Incidents (CIs) or Complaints in Core Medical Trainees.

In our study, though the number of trainee involvement in such events were lower in the mentored group compared to the non-mentored group (Figure 2B), 4.0% (1/25) vs. 9.4% (8/85) respectively, this was not statistically significant (p=0.68).

Mentoring is associated with increased trainee confidence and better career progression.

In total, 69.6% (16/23) of mentored trainees in our study reported that mentoring had improved their confidence (Figure 3A) and 95.8% (23/24) reported mentoring had aided

in their career progression in medicine (Figure 3B). Exploration of reasons from the mentored trainees who did not find mentoring useful revealed their experience was limited by insufficient time, poor response from mentors and unmet expectations.

The majority of mentored CMTs had a positive experience.

When asked for their opinion on their mentoring experience, 88.0% (22/25) of mentored trainees provided positive feedback (Figure 3C). A total of 78.2% (86/110) of all trainees (mentored and non-mentored) agreed with the statement that mentoring should be made available to all CMTs. Only 1.8% (2/110) of responders agreed that mentoring should only be provided to trainees struggling with career progression or clinical work (Figure 3D). This suggests mentoring does not confer a negative connotation on the mentee by fellow colleagues. Positive and negative descriptors have been summarised in Table 4.

Table 4. Summary of descriptors from trainee feedback.

	Descriptors	**Phrases**
Positive	Useful	"reassuring to know that someone helpful and supportive is available"
	Reassuring	
	Enlightening	
	Immensely positive	"helped me streamline my focus and made me aware of personal weaknesses"
	Supportive	
	Excellent	
	Rewarding	"structured my career goals into attainable chunks"
	Helpful	
	Transformative	"made me more proactive"
	Confidence boosting	
Negative	Basic	"I did not receive the response from the mentor I requested"
	Not helpful	"limited use due to limited time"

Of the 22 mentored trainees who provided positive feedback, 81.8% (18/22) had passed MRCP Part 1, 45.5% (10/22) had passed MRCP Part 2 and 45.5% (10/22) had completed MRCP PACES. If compared to the 2017 UK cohort, the MRCP Part 1 pass rate is statistically significant ($p<0.01$). 86.4% (19/22) of mentored trainees who had a positive experience had received an outcome 1 for their most recent ARCP and none had been involved in any SEs, CIs or complaints. The qualitative data discussed herein reinforces our observations that mentoring did have a significant effect on trainees in practice. Of the three mentored trainees that provided negative feedback, one trainee described mentoring as "not helpful", one trainee described mentoring as "basic" and one trainee did not provide any further comments.

Mentee selection of mentors improves compatibility and increases positive experiences.

Analysis of positive feedback from mentored trainees provided valuable insight into the importance of the specialty and gender of mentors. Two examples are provided below.

> *"I was initially told there was no mentor in my speciality. After a year I was re-contacted because there was a mentor in my specialty. This relationship worked really well. We were able to discuss on Skype and meet in person. It aided my confidence and also structured my career goals into attainable chunks."*

> *"This was a transformative experience for me. My mentor was an excellent fit for me (I selected the gender of my mentor only and was then allocated. It was important for me to be mentored by another*

woman) and provided a space, encouragement, acceptance and deep kindness whilst asking good questions. This allowed me to grow from a personal perspective and steer my professional life more effectively. I feel better than I have in years and am carving a path that is right for me."

DISCUSSION

To our knowledge, this study is the first UK-specific study to provide quantitative data showing a positive association between mentoring of junior medical doctors and better training outcomes. Here, the effect of mentoring was assessed against clinically important parameters such as MRCP(UK) pass rates, ARCP pass rates, clinical incidents and significant events which has not been previously attempted in literature. With regards to the MRCP exams, the strongest association of mentoring with higher pass rates was seen in the MRCP Part 1 exams where a statistically significant difference was detected when comparing mentored trainees to the non-mentored group. Higher pass rates in the MRCP Part 2 Written exam were also observed in mentored IMGs compared to non-mentored IMG trainees, however the authors acknowledge that the sample size is small in the aforementioned group and these results should be interpreted with caution.

Interestingly, non-mentored IMGs (n=25) were observed to have statistically significant lower pass rates in the MRCP Part 2 exams (Written and PACES) compared to mentored IMGs. Also, most mentored IMG trainees began their mentoring relationship before core medical training - two trainees received mentorship as Foundation Year 2 doctors and two as CMT-equivalent Clinical Fellows. Further research is needed to see

if an earlier introduction of mentoring (e.g. during Foundation Training) in trainees keen on a career in medicine has any effect on training outcomes.

Although mentoring did not have a statistically significant association with trainee involvement in SEs, CIs or complaints, the vast majority of trainees who participated in mentoring found it to be a positive experience which improved confidence and aided in improved career progression. This positive feedback, considered cumulatively with current literature and our observed results, suggests that mentoring may have a genuinely positive effect on postgraduate medical education and development. Similar to current literature, qualitative analysis of feedback from our group of mentored trainees revealed that poor mentor-mentee communication and unmet expectations remain causes of a negative mentor-mentee experience. This could be addressed in the future by more frequent interval communications with the mentee to detect and address incipient problems.

It has been acknowledged that a facilitative approach is needed in order for a mentor-mentee relationship to be successful [3], [16], however this should extend not only to the mentor but also to the mentoring programme that the mentee is engaged in. Although the overall impact of gender specificity of mentors remains a debate in current literature [5], [17], there are clearly female mentees who seek female mentors as role models. It is therefore important for any mentoring programme to allow mentees the option to choose their mentors freely as well as recruit and utilise equal proportions of mentors from both genders.

The benefits of mentoring are not limited to the mentee. Mentoring provides the mentor with personal satisfaction [18], an avenue for reflection and the exchange of experiences [3] which will in turn enhance one's own professional development. It is important

however to stress that mentoring should not be a therapeutic exercise for the senior clinician and that altruistic intentions should be coupled with appropriate training in mentoring, communication and adequate organisational support. Platforms that support mentors or mentees in difficulty should be made easily accessible at any point during the mentoring process.

Mentoring is centred on developing and empowering trainees to realise and achieve their objectives. It should not be restricted to helping trainees in difficulty pass their training, as often in the UK, trainees access mentoring programmes because of compulsory, remedial action or through support offered by higher educational authorities to address exam or domain failures. The majority of CMTs from our survey, together with expert opinions from some RCP Tutors, believed that mentoring should be made available to all trainees. It is therefore important to change perspectives amongst senior medical educators who are opined that mentoring should be encouraged only in trainees who are struggling to progress.

With regard to career progression, our study has also shown that ARCP pass rates were significantly higher in the mentored group though a contributory reason for this may be that successful completion of the MRCP Part 1 exam is one of the pre-requisites for obtaining an Outcome 1 (pass) at ARCP for the first year of core medical training. However, the lower ARCP pass rates in the non-mentored group could also have been a result of other domain failures. Therefore, further studies would be needed to identify specifically the impact of mentoring on progression in the other domains.

Limitations of the study and special considerations for future research.

The main limitations of this study arise through the potential for self-selection bias and non-response bias. Trainees within the mentored group have volunteered to be mentored and as such they may be more motivated and highly engaged than those within the non-mentored arm. This could have resulted in self-selection bias. Equally, the low response rate of the survey may have resulted in non-response bias e.g. mentored trainees could have failed their exams and did not respond to the survey causing a skew in the observed results. Both biases would have been minimised if the survey was compulsory. However, there are ethical considerations in making such a survey compulsory as trainees may not give consent to providing non-essential and personal information, especially if it involves potentially sensitive issues such as clinical incidents or complaints. We sought to address these issues by keeping all responses anonymous and keeping the survey concise. This would have encouraged more trainees to participate and improved response rates so a better representation of the mentored and non-mentored control groups could be obtained.

A further limitation of the study was the absence of a perfectly matched control group. In theory, the ideal control group for the study would be equally motivated CMTs who had sought mentorship with the RCP but were then matched according to individual attributes and randomised to not receive mentorship. However, this would have been both unethical and against current GMC guidance. We therefore recruited CMTs within the East of England deanery who had not received mentoring as our control group though we acknowledge this may have introduced selection bias. For added rigor, we have provided the MRCP performance data from 2017 (UK candidates) for comparison and have discussed the reasons for doing so above.

Response rates in unpaid, voluntary research surveys are well known to be poor. The only exception to our knowledge is the GMC National Training Survey because its

completion is required before attendance at the ARCP interviews. As a result of the low response rate, sample sizes in some subgroups in the study are small. Therefore, caution is advised when interpreting results in subgroups where small sample sizes may have affected statistical calculations and may not be accurately representative of the entire population.

Lastly, our study design was limited and influenced significantly by the lack of a central platform for data collection and the availability of resources to collate the data. Information on the exam pass rates is held by the MRCP(UK) body and information on the ARCP pass rates, significant events, clinical incidents or complaints is held in confidentiality by a separate body (the Joint Royal Colleges of Physicians Training Board, JRCPTB). We found the most cost effective method of collating data from these two bodies was therefore a survey targeted at trainees who are a common join between the two. Other researchers would therefore need to consider these ethical and logistical challenges in designing future studies.

Conclusion

Our study provides new quantitative data in support of a positive association between mentoring junior doctors and better training outcomes in postgraduate training in general medicine within the UK. Both quantitative and qualitative data from our study supports and reinforces current qualitative literature with similar findings in mentee experiences. Further studies are needed to investigate the causative effects of mentoring on the outcomes of postgraduate medical training.

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Competing interests: JO is a voluntary Mentor with the Royal College of Physicians Mentoring scheme described in this manuscript.

Author's contributions: JO and CS designed the study, conducted the literature search, performed the statistical and qualitative analyses, prepared the figures and wrote the manuscript. NM advised on statistical methods, checked the results of the analyses and edited the manuscript. SO and AD gave their expert opinion on medical education in the training of junior doctors and contributed to parts of the manuscript. YA and AS edited the manuscript prior to submission and gave their senior opinion on mentoring in medicine.

Data sharing: No additional data is available

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Figure and table legends:

Figure 1. Distribution of responses received into "mentored", "not mentored" arms and responses excluded in the study.

Figure 2. (A) Higher rates of Outcome 1 at ARCP was observed in mentored trainees ($p<0.05$) but no statistically significant effect was observed in trainee involvement in SEs, CIs, or complaints (B).

Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees.

Supplementary Table 1. In comparing equivalent career grades, higher pass rates in the MRCP(UK) Part 1 exam were observed in mentored CMT Year 1 and CMT Year 2 trainees.

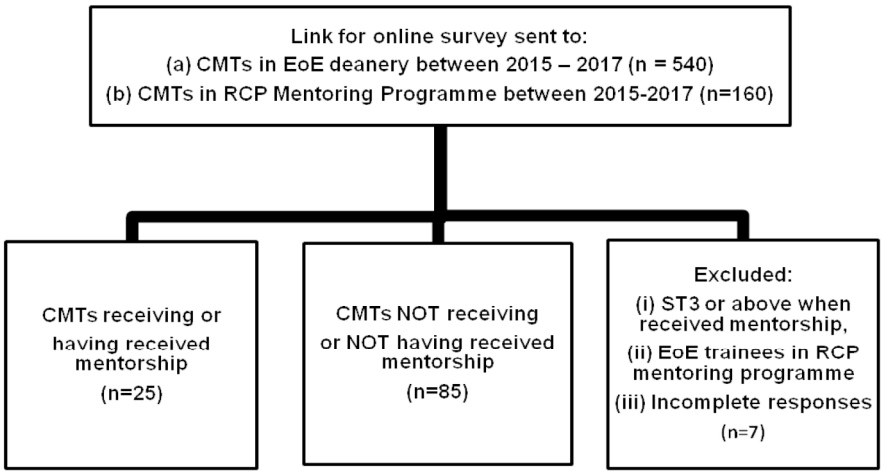

Figure 1. Distribution of responses received into "mentored", "not mentored" arms and responses excluded in the study.

184x110mm (300 x 300 DPI)

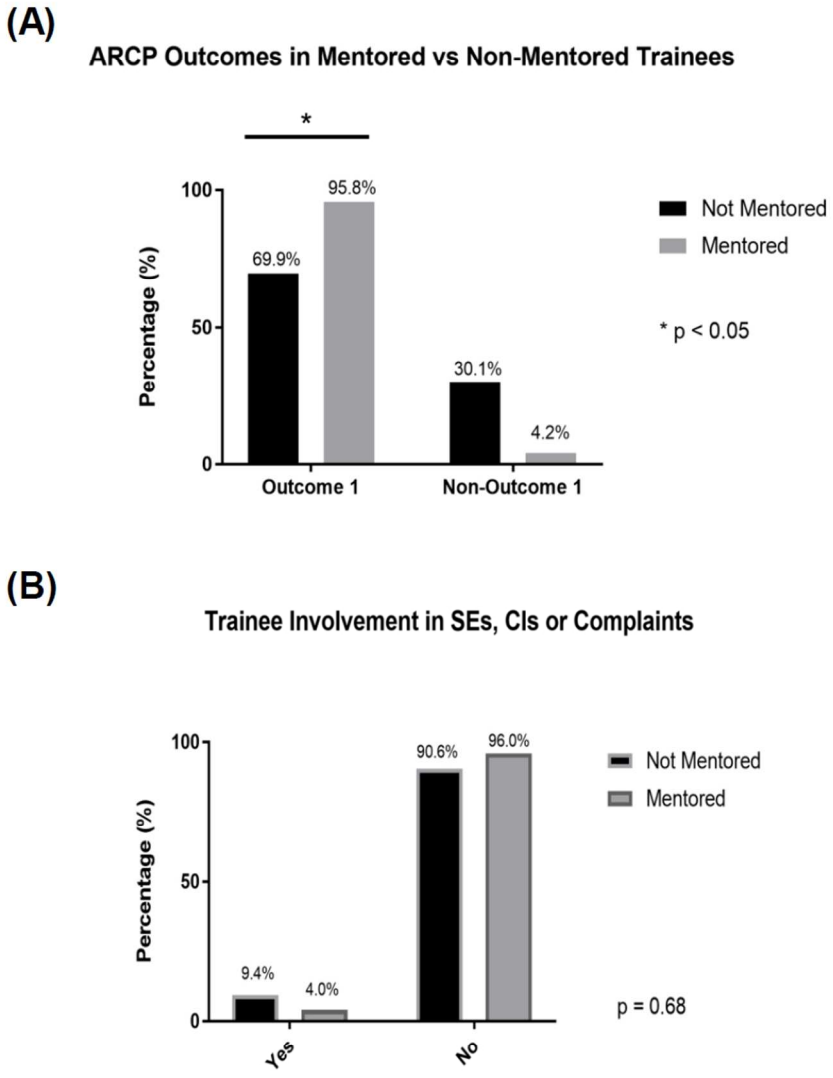

Figure 2. (A) Higher rates of Outcome 1 at ARCP was observed in mentored trainees ($p<0.05$) but no statistically significant effect was observed in trainee involvement in SEs, CIs, or complaints (B).

92x112mm (300 x 300 DPI)

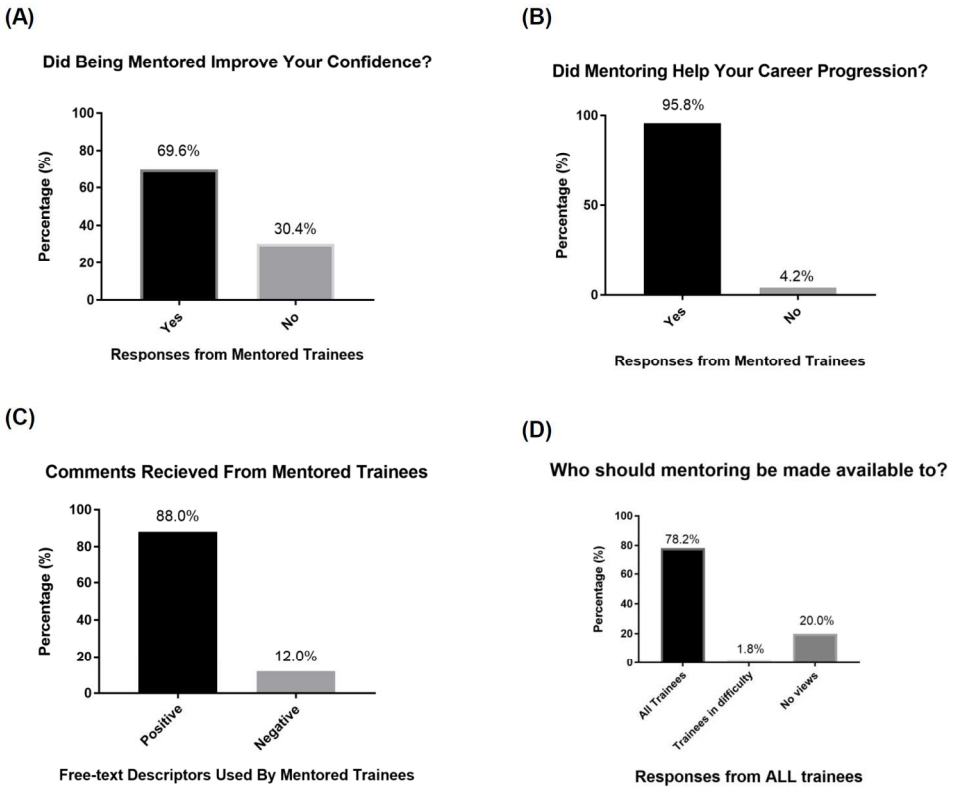

Figure 3. The majority of trainees receiving mentorship reported it did help in their (A) confidence and (B) career progression. (C) The majority of mentored trainees provided positive feedback and (D) most trainees in the study were of the opinion that mentoring should be offered to all trainees.

173x155mm (300 x 300 DPI)

MRCP Exams: Pass Rates by Stage of Training

	Mentored (1)	*Non-mentored (2)*	*p-value (1) Vs (2)*
CMT Year 1			
MRCP Part 1 (Written)	100.0% (4/4)	19.4% (6/31)	p < 0.01
MRCP Part 2 (Written)	75.0% (3/4)	6.5% (2/31)	p < 0.01
MRCP Part 2 (PACES)	50.0% (2/4)	3.2% (1/31)	p < 0.05
Full MRCP (UK)	50.0% (2/4)	3.2% (1/31)	p < 0.05
CMT Year 2			
MRCP Part 1 (Written)	100.0% (8/8)	41.4% (12/29)	p < 0.01
MRCP Part 2 (Written)	25.0% (2/8)	31.0% (9/29)	p = 1.00
MRCP Part 2 (PACES)	37.5% (3/8)	31.0% (9/29)	p = 1.00
Full MRCP (UK)	25.0% (2/8)	31.0% (9/29)	p = 1.00
ST3 and above			
MRCP Part 1 (Written)	71.4% (5/7)	86.7% (13/15)	p = 1.00
MRCP Part 2 (Written)	57.1% (4/7)	80.0% (12/15)	p = 0.33
MRCP Part 2 (PACES)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Full MRCP (UK)	57.1% (4/7)	80.0% (12/15)	p = 0.33
Others			
MRCP Part 1 (Written)	66.7% (4/6)	50.0% (5/10)	p = 0.63
MRCP Part 2 (Written)	33.3% (2/6)	30.0% (3/10)	p = 1.00
MRCP Part 2 (PACES)	33.3% (2/6)	30.0% (3/10)	p = 1.00
Full MRCP (UK)	33.3% (2/6)	30.0% (3/10)	p = 1.00

Appendix 1

MRC Medical Research Council

NHS Health Research Authority

Do I need NHS REC approval?

To print your result with title and IRAS Project ID please enter your details below:

Title of your research:

The Association Between Mentoring and Training Outcomes in Junior Doctors in Medicine: An Observational Study

IRAS Project ID (if available):

Your answers to the following questions indicate that you do not need NHS REC approval for sites in England. However, you may need other approvals.

You have answered 'YES' to: Is your study research?

You answered 'NO' to all of these questions:

Question Set 1

- Is your study a clinical trial of an investigational medicinal product?
- Is your study one or more of the following: A non-CE marked medical device, or a device which has been modified or is being used outside of its CE mark intended purpose, and the study is conducted by or with the support of the manufacturer or another commercial company (including university spin-out company) to provide data for CE marking purposes?
- Does your study involve exposure to any ionising radiation?
- Does your study involve the processing of disclosable protected information on the Register of the Human Fertilisation and Embryology Authority by researchers, without consent?
- Is your study a clinical trial involving the participation of practising midwives?

Question Set 2

- **Will your study involve research participants identified from, or because of their past or present use of services (adult and children's healthcare within the NHS and adult social care), for which the UK health departments are responsible (including services provided under contract with the private or voluntary sectors), including participants recruited through these services as healthy controls?**
- **Will your research involve collection of tissue or information from any users of these services (adult and children's healthcare within the NHS and adult social care)? This may include users who have died within the last 100 years.**
- **Will your research involve the use of previously collected tissue or information from which the research team could identify individual past or present users of these services (adult and children's healthcare within the NHS and adult social care), either directly from that tissue or information, or from its combination with other tissue or information likely to come into their possession?**
- **Will your research involve research participants identified because of their status as relatives or carers of past or present users of these services (adult and children's healthcare within the NHS and adult social care)?**

Question Set 3

- **Will your research involve the storage of relevant material from the living or deceased on premises in the UK, but not Scotland, without an appropriate licence from the Human Tissue Authority (HTA)? This includes storage of imported material.**
- **Will your research involve storage or use of relevant material from the living, collected on or after 1st September 2006, and the research is not within the terms of consent from the donors, and the research does not come under another NHS REC approval?**
- **Will your research involve the analysis of DNA from bodily material, collected on or after 1st September 2006, and this analysis is not within the terms of consent for research from the donor?**

Question Set 4

- **Will your research involve at any stage intrusive procedures with adults who lack capacity to consent for themselves, including participants retained in study following the loss of capacity?**
- **Is your research health-related and involving prisoners?**
- **Does your research involve xenotransplantation?**
- **Is your research a social care project funded by the Department of Health?**

If your research extends beyond England find out if you need NHS REC approval by selecting the 'OTHER UK COUNTRIES' button below.

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STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2 - 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 - 5
Objectives	3	State specific objectives, including any pre-specified hypotheses	2, 5
Methods			
Study design	4	Present key elements of study design early in the paper	Abstract, 6-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 8
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	7 - 10
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6, 7, 10, 11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6 - 8, 10, 11
Bias	9	Describe any efforts to address potential sources of bias	11, 20-22
Study size	10	Explain how the study size was arrived at	9, 10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7, 8, 10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10, 11
		(*b*) Describe any methods used to examine subgroups and interactions	10, 11
		(*c*) Explain how missing data were addressed	9 - 10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	7, 8, 10, 11

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9, 10
		(b) Give reasons for non-participation at each stage	9, 10
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11, Table 1
		(b) Indicate number of participants with missing data for each variable of interest	9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	Not applicable
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Not applicable
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	Not applicable
		Cross-sectional study—Report numbers of outcome events or summary measures	12-17; Tables 2-4, Figures 2 & 3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	18-20
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20-22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-22
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.