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What is already known on the subject?

- In the UK, an integrated clinical academic training programme was designed to provide a more defined career structure for doctors, allowing them to combine clinical and academic training.
- Concerns have been raised that, particularly for certain groups of doctors, there are barriers perceived in both applying to, and continuing or progressing in academic medicine.
- We sought to better understand the distribution of academic posts in the UK, demographics of the academic trainee population, and their reported experiences of clinical training.

Main messages of the study

- Academic trainees are more likely to be male and the gender divide begins prior to graduation.
- There are very low numbers of International Medical Graduates (IMG) and less than full-time (LTFT) academic trainees.
- A small number of UK universities produce a greater prevalence of doctors successfully appointed to academic posts; subsequent academic training also clusters around these institutions.
- At more senior levels, academic trainees are significantly more likely to be of white ethnicity, although amongst UK graduates, no ethnicity differences were seen.
- Foundation academic trainees report a poorer experience of some aspects of their clinical training placements, with high workloads reported by all academic trainees.
- To truly embed research into clinical practice, we must first explore why differences in access to research and training opportunities across the UK exist, how we can reduce inequities throughout academic training, improve inclusivity and increasingly engage doctors in research.

Abstract (211 words)

Background:

Involvement in research plays an integral role in the delivery of high-quality patient care, benefitting doctors, patients, and employers. It is important that access to clinical academic training opportunities are inclusive and equitable.

Methods:

To better understand the academic trainee population, distribution of academic posts, and their reported experience of clinical training, we analysed 53,477 anonymous responses from General Medical Council (GMC) databases and the 2019 National Training Survey (NTS).

Results:

Academic trainees are more likely to be male and the gender divide begins prior to graduation. There are very low numbers of International Medical Graduates (IMG) and less than full-time (LTFT) academic trainees. A small number of UK universities produce a greater prevalence of doctors successfully appointed to academic posts; subsequent academic training also clusters around these institutions. At more senior levels, academic trainees are significantly more likely to be of white ethnicity, although amongst UK graduates, no ethnicity differences were seen. Foundation academic trainees report a poorer experience of some aspects of their clinical training placements, with high workloads reported by all academic trainees.

Conclusions:

Our work highlights important disparities in the demographics of the UK clinical academic trainee population, and raises concerns that certain groups of doctors face barriers accessing and progressing in UK academic training pathways.

Introduction

 Involvement in research plays an integral role in the delivery of high-quality patient care and can bring benefits to doctors, patients, and NHS employers[1]. Some doctors aspire to a career in clinical academic medicine combining clinical practice with interests in either research, education, or healthcare leadership.

Medical students, with an interest in exploring an academic career, can apply to undertake an Specialised Foundation Programmes (SFP) for newly qualified doctors^a. These posts facilitate early development of research, teaching or leadership skills whilst also enabling trainees to acquire the essential foundation programme clinical competencies[2]. Within England, the National Institute for Health Research Integrated Academic Training (IAT) pathway has also been developed, offering 3-year (4-years for GPs and dentists) Academic Clinical Fellowships (ACF), and 4-year Clinical Lectureships (CL) for more senior trainees. During an ACF, doctors spend 25% of their time undertaking academic work whilst continuing clinical training alongside. Following completion of a higher degree, trainee doctors can apply for a CL, during which they spend 50% of their time acquiring higher specialty training clinical competencies and 50% of their time undertaking postdoctoral academic activities. Similar academic pathways to the IAT scheme exist in Scotland, Wales and Northern Ireland.

SFP and ACF programmes are attractive entry routes into academic training. They offer access to protected academic time, as well as educational, pastoral and possible financial support. Completing an ACF has been shown to positively impact ability to secure grant funding and subsequent academic career progression[3]. Whilst not the only route to a clinical academic career, the IAT programme was designed to provide a more defined career structure for doctors and dentists, allowing them to combine their clinical and academic training[2, 3].

The UK medical workforce is very diverse[4], and it is important that access to academic training opportunities are inclusive and equitable. Concerns have been raised that barriers are perceived in both applying to an academic training pathway[5] and continuing or progressing in academic medicine, particularly for certain groups of trainees [6, 7]. To better understand

^a Previously known as Academic Foundation Programme

<text>

Methods

Data acquisition

The annual General Medical Council (GMC) national training survey (NTS) monitors the quality of postgraduate medical education and training in the UK, to fulfil its statutory function under the Medical Act (1983). It is circulated annually to over 45,000 doctors in training across the four UK nations with a response rate that is usually above 90%. Data from the 2019 survey was analyzed anonymously. As such, ethical approval was not required.

Clinical academic trainees were identified through their response to the survey question *"Which, if any, of the following academic trainee roles do you currently hold?"* (Figure 1). This cohort was subsequently divided into those in the foundation programme (SFP) and those in core/higher specialty training (ACF/CL).

For each trainee responding to the NTS, data from the list of registered medical practitioners (LRMP) was used to gain an understanding of their medical school of qualification; the NTS to identify the employing trust and working patterns; the GMC register to gain an understanding of their gender; and the Higher Education Statistics Agency (HESA)/NTS to give information regarding their ethnicity. Trainees were grouped into one of three cohorts based on their ethnicity: 'White', 'Missing' or 'Black, Asian and minority ethnic'. As PMQ and ethnicity may be considered to be inter-related factors, we explored their interaction. Data were aggregated due to the number of responses received. Using NTS indicator scores, we were able to explore reported clinical training experiences.

Statistical analysis

Statistical analysis was undertaken using SPSS-24 software (Statistical Package for the Social Sciences, Chicago, IL, USA). Categorical variables were considered and represented as a proportion (percentage) of all trainees. Pearson's Chi-Squared Test was used to determine significance (2-sided). NTS indicator scores for a given cohort (academic/ non-academic) were expressed as a mean with 95% confidence intervals; the absence of over overlap between these intervals, when comparing groups, was used as a determinant of significance.

Results

Survey response rate

53,477 trainees responded to the 2019 NTS (94.8% of eligible trainees). 2,750 (5.1%) of trainees were in academic training (Figure 1).

Demographics of academic trainees

There were significantly more males than females in clinical academic training (Table 1). In academic foundation training: men (n=521, 52.7%) vs women (n=468, 47.3%) chi-squared =25.52, p<0.01; after foundation level, men (n=835, 54.1%) vs women (n=709, 45.9%); chi-squared =52.11, p<0.01.

Location of primary medical qualification (PMQ) had statistically significant influences on the likelihood of being successfully appointed into academic training; at foundation level chi-squared= 11.11, p=0.004; at post foundation level, chi-squared 12.08, p=0.002 (Table 1). Doctors with a UK PMQ were most likely to undertake the academic foundation programme whereas at post-foundation level, a relatively higher proportion of doctors with an EEA PMQ and lower proportions of IMG or UK PMQ doctors were in academic positions, compared to proportions seen in SFP (Table 1). There were very low numbers of International Medical Graduates (IMG) and less than full-time (LTFT) trainees in SFP.

During SFP, there was no significant variation in the proportion of trainees from different ethnic groups: chi-squared =0.113, p=0.737 (Table 1). At post foundation level, academic trainees were significantly more likely to be of white ethnicity: chi-squared =4.723, p=0.03 (Table 1).

Looking at UK graduates alone, we found no statistically significant variance in the proportion of doctors from different ethnic groups in academic training. At foundation level, 7.12% of BAME doctors (n=318) vs. 7.13% of white doctors (n=606) were in academic training, chi-squared =0.000, p=0.892. Post foundation, 3.92% of BAME doctors (n=364) vs. 4.09% of white doctors (n=822) were in academic training, chi-squared =0.510, p=0.475. Exploring the statistical significance of intersectionality other sites of PMQ and ethnicity could not be achieved due to small population numbers.

Which UK medical schools produce clinical academic trainees?

Analysis of the UK medical schools from which trainees obtained their primary medical qualifications, demonstrated that some universities had a greater proportion of their graduates in an academic training pathway. Graduates from the Universities of Oxford, Cambridge and Imperial College London were most likely to be academic trainees, with 17%, 15.5% and 7.8% of graduates in academic training, respectively (Table 2).

Where do clinical academics train?

In 2019, Cambridge University Hospitals NHS Foundation Trust had the greatest proportion of all postgraduate trainees in academic pathways, working in its hospitals. Additionally, the trust had a relatively high proportion of academic training posts compared to standard training posts, when referenced to other trusts (Table 3).

Trusts with the greatest proportion of doctors in academic training programmes, (Table 3), tended to be located near to the universities with high proportions of their medical graduates entering academic pathways (Table 2).

The experience of academic trainees

For trainees in the foundation programme, there was statistically significant variation in the domains of: adequate experience, curriculum coverage, educational supervision, feedback, induction, overall satisfaction, educational governance, supportive environment and workload between academic and non-academic trainees. Academic trainees scored their clinical placements lower (i.e. worse) compared to standard trainees, in all of these indicators (Figure 2).

In the post foundation programme cohort, there was statistically significant variation in the domains of: curriculum coverage, feedback, overall satisfaction, rota gaps, study leave, and workload between academic and non-academic trainees. Academic trainees scored their clinical placements higher (i.e. better) compared to standard trainees, for all indicators except workload, for which they scored the clinical placements lower (i.e. worse) (Figure 2).

Discussion

This study describes the demographics of the current UK academic trainee workforce using GMC data and explores the experiences of clinical academic training compared to trainees in standard training programmes. Our work highlights important disparities in the demographics of the UK academic trainee population.

Gender inequities exist from the outset of academic training

The significant under-representation of females within academic medicine is long-recognised and particularly marked at senior levels[8-10]. Previous work has suggested that by the end of the first year after graduation, fewer female doctors intend to pursue a career in academic medicine than male doctors and historically, the academic pathway has been described as a "leaky pipeline"[11]. We found that from the very outset of academic training, females are under-represented and the academic gender divide appears to begin prior to graduation. From our work it is not clear if there is a disproportionate success of male trainees in being appointed, or whether fewer females are applying to these roles. Further work is needed to explore whether barriers in applying to and progressing in clinical academia exist at an undergraduate level.

Furthermore, we found that very few LTFT trainees hold academic training posts. This may be confounded by gender, as LTFT trainees are predominantly female. Further analysis was limited by small numbers. Within the wider workforce, increasing numbers of trainees are now opting to go part-time[12, 13] and this will need to be better accommodated within the SFP and IAT pathways.

Our study also confirms the under-representation of female clinical academics in more senior positions (post SFP level): 6.05% of female foundation trainees were in an academic position, but this dropped to only 3.32% at ACF/CL level. Data is needed to explore whether fewer females apply for senior academic training posts (and if so, why this might be) and whether current recruitment policies adequately recognise the additional barriers that female early career researchers may experience (e.g. maternity leave). Disappointingly, our work highlights that despite widespread awareness and a number of high-profile initiatives [14, 15], there has

been slow progress towards closing the gender gap in UK clinical academic medicine. More recently, there is the suggestion that COVID-19 has further exacerbated gender disparities, with a reduction in female productivity and authorship, particularly for those who have had additional childcare commitments [16]. This will need to be closely monitored over the next few years, to ensure female applicants to academic training are not further disadvantaged by the COVID-19 pandemic.

IMG are under-represented in academic training, whereas doctors with an EEA PMQ had a high proportion in IAT positions

We found that very low numbers of IMG are academic trainees and less likely to be appointed to senior training positions. It is not clear if this variation is consistent with the number of applicants, in which case there needs to be a focus on ensuring the programmes are advertised in an inclusive manner (and on a practical level, application deadlines for some academic fellowships are earlier than for non-academic training posts: a lack of awareness of these academic opportunities and the timelines involved may penalise IMG doctors). If variation is generated during the selection process, there will need to be a focus on how to provide all applicants the opportunity for role models and experience to help them through the process.

We found a high proportion of EEA PMQ doctors in academic training at IAT level. EEA academics may be particularly attracted to apply for these posts, as there may not be similar academic training pathways in Europe. However now the Brexit transition period has ended, the automatic recognition of EEA professional qualifications in the UK no longer exists[17], which may have a significant impact on the demographics of UK IAT workforce going forwards. There is growing evidence that diversity amongst academic teams results in improved performance, creativity and impactful research[10, 18, 19] and it is extremely important that the academic training pathways encourage a diverse pool of applicants.

BAME trainees were significantly less likely to hold IAT positions

We found BAME trainees were significantly less likely to hold IAT positions suggesting difficulties progressing or barriers discouraging these trainees from advancing through the

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academic training pathway. Racial and ethnic disparities in academic medicine have been previously highlighted: systemic barriers and a lack of visible role models may contribute additional challenges for BAME trainees when pursuing an academic career [20-22]. Whilst encouragingly, amongst UK graduates we found no significant difference in the likelihood of BAME and non-BAME trainees holding an IAT position, it has previously been found that a higher percentage of Asian doctors than White doctors want long-term careers as clinical academics[11], therefore this figure may not accurately portray the challenges non-White doctors face in realising their career ambitions. Whilst this study didn't look at ethnicity at a more granular level, further analysis may have benefit, to determine specifically which ethnic groups may be experiencing disparity.

The term "sticky floor" has been used to describe how fewer women are promoted or given institutional resources during their early careers compared to their male counterparts [7], however this phenomenon appears equally applicable and relevant to underrepresented ethnic groups. Further work is needed to explore barriers to progression during the IAT programme, to ensure systemic factors do not disadvantage certain trainees from succeeding in clinical academia, including looking at the intersection of ethnicity and gender differences.

Location of primary medical qualification has a significant influence on subsequent career trajectory

A small number of UK universities have a far greater prevalence of their graduates successfully appointed to academic training posts (Table 2). This may reflect that these institutions have a strong focus on academia and graduates are more inclined to apply for academic training, and notably four of the five universities have a mandatory requirement for undertaking an intercalated degree. The impact of medical school on subsequent career trajectory has been recognised previously[23]. Lambert and colleagues demonstrated that career specialty choice was influenced by medical school attended[24], but this study is the first to link medical school attended with likelihood of success in being awarded an academic training post. It also highlights the importance of ensuring diverse representation at all medical schools. However, as appointment to ACF posts can have a high impact on subsequent career progression[12], it is important that doctors from less represented (and new) medical schools

are also made aware of SFP /IAT opportunities and benefits, and have access to role models who can guide them through the application process.

Experiences of clinical academic trainees

Although numbers in this analysis are small, foundation academic trainees, appear to report a poorer experience of some aspects of their clinical training placements, with high workloads reported by all academic trainees. This may reflect the difficult and often competing balance that this group must achieve between their clinical and academic training priorities [3, 5, 6]. Green et al. noted that academic trainees require very high levels of motivation to acquire both their clinical and academic competencies, particularly in procedurally-based specialties[5]. They reported that often supervisors did not understand the dual role of academic training with requests to cover clinical duties during their assigned research time. Conversely academic staff could expect unrealistic turnaround times or replies to messages[5]; such situations may influence academic trainees perception of the clinical working environment.

High quality education and training requires good induction and appropriate supervision which is more complex for the academic trainee group[25]. Supervisors should be trained to deliver this multifaceted role and ideally have a good understanding of clinical and academic training[5]. Liez

Levelling up

Differential attainment has been reported in in some aspects of medical training and in clinical academia[10, 26, 27]. Whilst reassuringly we have shown there is no statistical variation in the proportion of academic trainees based on ethnicity in the foundation programme, nor amongst UK graduates at all levels, we found significant variation in the proportions of doctors holding IAT positions based on gender, ethnicity and PMQ.

Whilst determining the underlying reasons for this was outside the scope of this study, Woolf et al. reported that IMG doctors have more difficulty forming supportive relationships with supervisors and senior clinicians than white UK graduates[26], and that IMG doctors may not

 be given the additional support and opportunities enabling them to access the UK academic training pathway[27]. We must ensure positive supportive learning environments, mentorship and role models exist for all trainees, tailoring support to individual needs.

Our work would also suggest that barriers to advancement in clinical academia begin earlier than previously anticipated, and levelling up must also occur at an undergraduate / early career stage. Selection into SFP and IAT is based on measures of prior academic achievement, which favours applicants who already possess an intercalated or higher degree. Increasing access to undertake these degrees across different institutions could help improve opportunities for interested medical students.

Attrition of certain groups of trainees, along the clinical academic pathway also remains a concern. Exact reasons for this are unclear, but academic training is often perceived as a complex and inflexible pathway[5] and may not be meeting the needs of under-represented groups. In addition to actual barriers faced by under-represented groups, there may be perceptions of bias in the selection process. Thus reducing the likelihood of under-represented groups from applying to academic training pathways and compounding inequities in demographics seen further. Recruitment of doctors to academic pathways from less represented medical schools and those who work in more rural or district general hospital settings is important, to ensure equality of access to academic training programmes and to better represent our diverse medical workforce.

Strengths and Limitations of the study

With over 53,000 trainee responses including 2750 academic trainees, the GMC NTS is one of the largest annual studies of trainees worldwide. The consistently high response rate (94.8% in 2019) means our data is high quality and there is limited non-response bias[29]. That said, only doctors who were in a clinical placement at the time of the NTS survey were invited to take part in the study i.e. trainees who were in their protected research blocks will not have been enrolled. Lastly. the cross-sectional nature of the data mean causality cannot be inferred from the data presented.

Conclusions

This study highlights a number of concerns in demographic disparities of the UK academic trainee population, and suggests the recruitment pathway may need to be reviewed, to improve inclusivity of access to this valuable programme.

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Author contributions

HB: Draft manuscript, Data interpretation, Draft finalisation

VS: Draft manuscript, Data interpretation, Draft finalisation

AM: Draft manuscript, Data interpretation, Draft finalisation

MGB: Draft manuscript, Data interpretation, Draft finalisation

AK: Draft manuscript, Data analysis, Data interpretation, Draft finalisation

BI: Draft manuscript, Data interpretation, Draft finalisation

SC: Draft manuscript, Data interpretation, Draft finalisation

Conflicts of interest

SC is Deputy Medical Director of the GMC. AK and SC are GMC employees. VS and AM are UK National Medical Director Clinical Fellows who are working at the GMC. BI is an employee within Health Education England. HB and MGB have been integrated academic trainees.

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Table 1 Characteristics of trainees in clinical academic training programmes compared to those in standard training programmes in the 2019 General Medical Council National **Training Survey**

		Foundat	ion progra	mme tr	ainees onl	у		Post For	undation p	rogramme	trainees only	y	
Total			Academic	Trainee	•	Total	Statistical significance		Academ	ic Trainee	;	Total	Statistical
Total		N	0		Yes	Total	a	N	lo	Y	Yes	Total	significance ^a
		n	%	n	%			n	%	n	%		
		13061	92.96	989	7.04	14050		37378	96.03	1544	3.97	38922	
	Man	5798	44.39	521	52.68	6319	p<0.001	16727	44.75	835	54.08	17562	p<0.001
Gender	Woman	7263	55.61	468	47.32	7731	X ² =25.52 1 d.f	20651	55.25	709	45.92	21360	X ² =52.11 1 d.f
	EEA	424	3.25	17	1.72	441	0.004	1698	4.54	90	5.83	1788	0.000
PMQ	IMG	244	1.87	10	1.01	254	p=0.004 $X^2=11.11$	6305	16.87	219	14.18	6524	p=0.002 $X^2 = 12.08$
	UK	12393	94.89	962	97.27	13355	2 d.f	29375	78.59	1235	79.99	30610	2 d.f
	BAME	4548	34.82	334	33.77	4882	0.727	14960	40.02	578	37.44	15538	0.02
Ethnicity	Missing	388	2.97	44	4.45	432	p=0.737 $X^{2}*=0.113$	1601	4.28	61	3.95	1662	p=0.03 $X^2 *=4.723$
	White	8125	62.21	611	61.78	8736	1 d.f	20817	55.69	905	58.61	21722	1 d.f
Working on a Less	No	12828	98.22	980	99.09	13808		31162	83.37	1316	85.23	32478	
Than Full Time (LT FT**) basis,	Yes	233	1.78	9	0.91	242	p=0.042 X ² =4.147 1 d.f	6216	16.63	228	14.77	6444	p=0.054 X ² =3.726 1 d.f

^a = Chi-squared test

d.f= Degree of freedom

PMQ = Primary Medical Qualification

EEA= European Economic Area

IMG= International Medical Graduate

BAME= Black, Asian and minority ethnic UK= United Kingdom

Ns= not significant *Missing data excluded

** LTFT is any arrangement in which a doctor has reduced working. Data included where LTFT training has been approved by the deanery/HEE local team Liezoni

Table 2: UK Medical schools with the highest proportion of their graduates in clinical academic training programmes

Medical School	Number of trainees, in standard posts	% of trainees, in standard posts	Number of trainees, in academic posts	% of trainees, in academic posts	Number of graduates in training	
Oxford University	877	83.00	180	17.00	1057	
University of Cambridge	945	84.50	173	15.50	1118	
Imperial College London	2036	92.20	172	7.80	2208	
University of East Anglia	697	92.60	56	7.40	753	
University of Edinburgh	1409	93.10	105	6.90	1514	
includes the 217 train Note: Historical Awa	rding Bodies not i	included				

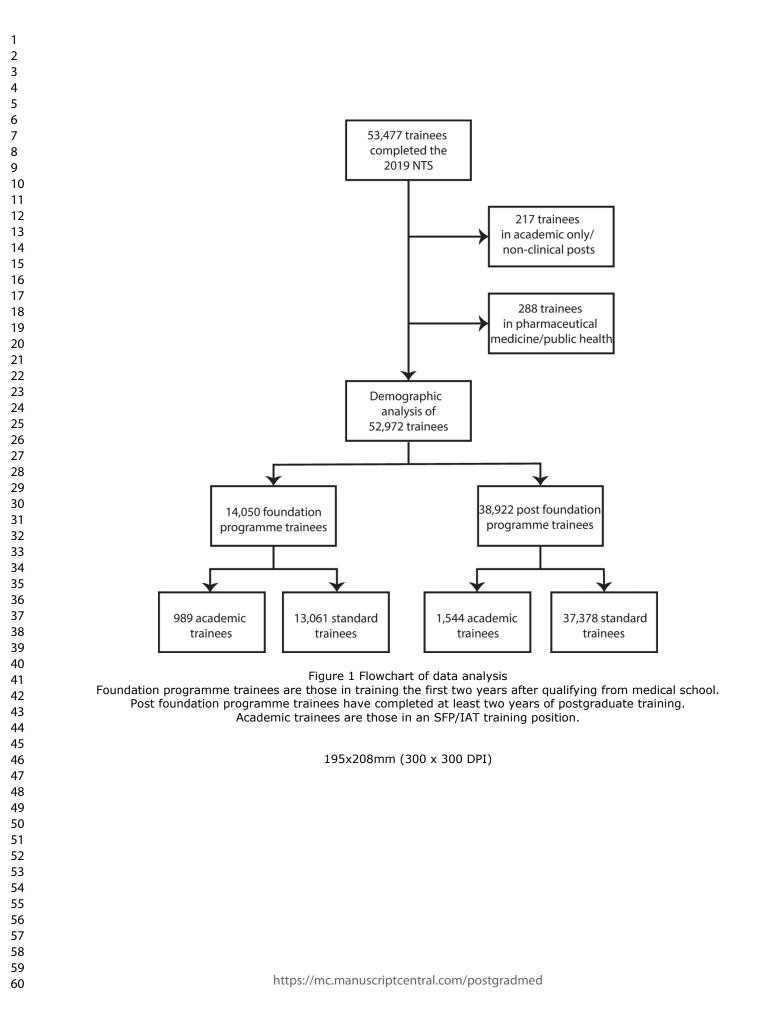
Table 3: The five UK NHS hospital trusts employing the highest proportion of all trainees undertaking clinical academic training programmes (2019 NTS)

Cambridge University Hospitals NHS 4.50 0.80 Greater Glagsow and Clyde 3.30 3.00 Imperial College Heakheare NHS Trust 3.20 1.30 Oxford University Hospitals NHS 3.10 1.10 Lethian 2.70 1.90	Trust/Board	% of all academic trainees	% of all standard trainees	
Greater Glasgow and Clyde 3.30 3.00 Imperial College Healthcare NHS Trust 3.20 1.30 Oxford University Hospitals NHS 3.10 1.10 Lothian 2.70 1.90		4.50	0.80	
Doford University Hospitals NHS 3.10 1.10 oundation Trust 2.70 1.90		3.30	3.00	
oundation Trust 5.10 1.10 othian 2.70 1.90	nperial College Healthcare NHS Trust	3.20	1.30	
ochian 2.70 1.90	Coundation Trust			
	Lothian	2.70	1.90	

Figure 2: Average NTS indicator responses regarding clinical placement experience for Foundation and Post-Foundation academic trainees vs trainees in standard training programmes across all programme specialties (2019 NTS)^{a,b,c}

<text><text> ^a Only indicators for which there was a statistically significant variation (as determined by the lack of overlap in the 95% confidence intervals around the mean scores between academic and non-academic trainees, for a given NTS indicator) are represented. ^b The differences in the number of trainees in the different indicator groups is because it is possible for indicators to not be scored for some trainees- typically because of a "Not applicable" response being provided in one or more of the questions that form the indicator. See https://www.gmc-uk.org/-/media/documents/2019-bn3-annex-a_pdf-77829140.pdf for a breakdown of indicators, questions and responses.

^c The 217 academic trainees in completely non-clinical posts were not included in this analysis



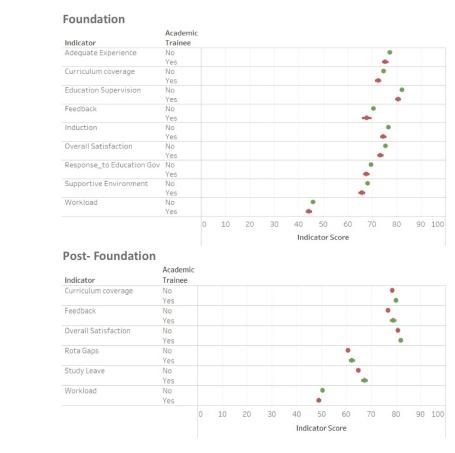


Figure 2: Average NTS indicator responses regarding clinical placement experience for Foundation and Post-Foundation academic trainees vs trainees in standard training programmes across all programme specialties (2019 NTS)a,b,c

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