BMJ Open

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION)

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-065062
Article Type:	Original research
Date Submitted by the Author:	07-Jun-2022
Complete List of Authors:	Li, CHUNHEI; St George's University Hospitals NHS Foundation Trust, Vascular Surgery ; Cardiff University, School of Medicine ganesananthan, sashiananthan; Chelsea and Westminster Healthcare NHS Trust Pinchemain, Trevor ; Cardiff University School of Medicine Godoi, Amanda ; Cardiff University School of Medicine Lim, Shan Ming ; Cardiff University School of Medicine Baskaran, Ravanth ; Cardiff University School of Medicine Mukhopadhyay, Srinjay ; Cardiff University School of Medicine Foo , Eu Fang ; Cardiff University School of Medicine Ooi, Setthasorn Zhi Yang; Cardiff University School of Medicine, Woo, Timothy ; King's College Hospital Yeo, Vanessa ; Royal Glamorgan Hospital collaborators, VISION; Cardiff University School of Medicine Sweetland, Helen; Cardiff University School of Medicine
Keywords:	MEDICAL EDUCATION & TRAINING, EDUCATION & TRAINING (see Medical Education & Training), International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION)

Chun Hei Li[1,*], Sashiananthan GANESANANTHAN [2,*], Trevor Pinchemain[3], Amanda Godoi[3], Shan Ming Lim[3], Ravanth Baskaran[3], Srinjay Mukhopadhyay[3], Foo Eu Fang[3], Setthasorn Ooi[3], Timothy Woo[4], Vanessa Yeo[5], VISION collaborators, Helen Sweetland[3]

1. St George's University Hospitals NHS Foundation Trust
2. Chelsea and Westminster Hospital NHS Foundation Trust
3. Cardiff University School of Medicine, Cardiff, United Kingdom
4. Kings Colleges University Hospital, London, United Kingdom
5. Royal Glamorgan Hospital, Pontyclun, United Kingdom

*These authors contributed equally and should be considered as joint-first authors

Corresponding author:

CHUNHEI LI submitting on behalf of

Professor Helen Sweetland MD FRCSEd

Cardiff University School of Medicine

UHW Main Building

Heath Park

Cardiff

CF14 4XN

sweetland@cardiff.ac.uk

Keywords: medical education, international students, postgraduate training

ABSTRACT

Objectives

It is estimated that NHS staff consist of over 200 different nationalities, with a reported 30.7% of doctors holding a nationality other than British. Despite this, international medical students represent 7.5% of all medical students studying in the United Kingdom (UK) and pay on average, four-to-six times more in tuition fees when compared to the £9,250 per annum paid by home students.

This is a cross-sectional observational study enquiring about international pre-medical, medical, and medical school graduates' perception of the value of the UK medical degree and factors influencing their decision to study.

Intervention

This questionnaire was circulated to 24 medical schools and 64 secondary schools both internationally and across the UK.

Participants

A total of 352 responses from 56 nationalities were recorded

Results

96% of international students identifying clinical and academic opportunities as the most important factor to study medicine in the UK, closely followed by quality of life (88%). The least important factor was family reasons, with 39% of individuals identifying this factor. Only 4.82% of graduates in our study considered leaving the UK

after training. Overall, 54% of students felt the UK degree was value for money. This belief was significantly higher in pre-medical students compared to existing students and graduates (71% versus 52% and 20%, p<0.001 for all comparisons).

Conclusion

The quality of medical education and international prestige are attractive factors among international students to study medicine in the UK. However, further work is needed to ascertain reasons for the differing perceptions of the value by international students at different stages in their clinical training.

INTRODUCTION

The undergraduate medical degree is a highly popular and competitive degree in the United Kingdom (UK) with over 23,710 applicants (inclusive of British citizens, residents with settled status or overseas students) competing for less than 8,000 places in 2021.[1]

International students traditionally account for a small percentage of medical students, as the annual intake is capped at 7.5% for the full cohort. [2-6] These students have an international fee status, paying higher tuition fees compared to that of home students (British citizens or residents with settled status) studying the same degree in the UK. Home students have fees that are currently capped at £9,250 per annum.[2-4] International fees are four to six-fold higher than the current fees for home students, with the additional burden of having the former subjected to annual inflation a per the Retail Price Index[2,4]. Furthermore, the Additional Cost of Training (ACT) Levy was introduced in Scottish medical schools in 2016,[4] and in 2021, Northern Irish medical schools.[7] Its implementation is now under consultation to be introduced in England and Wales. This may result in a further substantial increase in medical tuition fees of up to an additional £10,000 annually for international medical students[2-7].

A single cohort of international students was found to contribute £3.2 billion to the UK economy over a 10-year period through taxation and National Insurance payments.[8] Following the BREXIT transition in January 2021, the definition of international

students' fee status will apply to a wider population, including students from European Union countries; this policy may potentially impact international medical students' recruitment in the future.[4,9-10] Ultimately, this may create a selection bias towards students who have the financial means to pursue a UK medical degree, ostracising those who may be capable of undertaking the academic rigour of a UK medical degree but are unable to afford the tuition.[2,3]

These circumstances place the UK medical degree in a unique position in the global medical education landscape for aspiring international students. Despite being a costly investment with the current UK medical degree ranking as the most expensive undergraduate degree in the UK ,[1,4,7] it remains highly popular among international students with courses annually oversubscribed.[1] There is currently no unifying data to demonstrate the motivations for international students coming to the UK to pursue medicine while considering, not only the monetary value but the value gained from the quality of life, societal and educational opportunities afforded by these institutions in the UK.

In this study, we aim to evaluate the perception of the cost and value of the UK medical degree for international students and their motivations for pursuing such a degree. To further investigate this, we will analyse how these perceptions and motivations differ between pre-medical students, medical students, and medical school graduates and analyse their perception of the value of obtaining a UK medical degree.

METHODS

Study design

This is an online, multi-centred, cross-sectional study focusing on the perceptions of a UK medical degree among pre-medical students, current medical students and recent medical graduates. The questionnaire was disseminated through collaborating university medical schools and student networks across the UK and internationally, from 1st April 2021 to 31st July 2021. The survey was accessible as a secure online questionnaire on Microsoft Teams.

A novel, 40-item, self-administered questionnaire was developed by medical students from the Cardiff Healthcare International Perspective Society (CHIPS), which is a student-led society at Cardiff University. A review of the existing literature was performed to identify the gaps in knowledge and to look at similar questionnaires and qualitative studies on the perception of prospective, current and recently graduated international students on a UK medical degree. This allowed an understanding of domains and items relevant to determining the aim of the project. The questionnaire included a seven-point Likert scale, checkboxes, multiple-choice, and free-text questions to improve the granularity of the data. A pilot survey was distributed to a group of randomly selected 13 undergraduate international students, and were not involved in study conception or design, to seek feedback, improve clarity and ensure objectivity. A copy of the final questionnaire can be found in Supplementary.

Data processing

Throughout the period of data collection, the information received was kept in a password-protected Excel file. Prior to data analysis, all data was de-identified and stored securely. All relevant information remained non-identifiable throughout this study. A threshold was arbitrarily chosen: any entrant with the average time to

complete the questionnaire less than 45 seconds would be eliminated prior to analysis. Any entrant beyond the two-standard deviation from the average time to complete the questionnaire would be flagged up and the full dataset would be screened individually to decide whether to include or exclude in the analysis by two independent reviewers (CL, SG) .

Study population

Any international student eligible to be included in this study was defined using the definition from the UK Council for International Student Affairs (UKCISA) as 'non-British students (full-time or part-time in education); or students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status'.[11]

The sampled population was divided into three subgroups: pre-medical students, medical students, and medical school graduates. A pre-medical school student was defined as any student who is not currently studying a medical degree and is planning to submit their application to medicine within two years of survey completion. This includes high-school students, students currently taking a gap year and students who are planning to apply for graduate-entry medicine.

A medical student was defined as any student currently studying medicine or a pre-clinical component, where a medical degree is guaranteed. A medical school graduate was defined as any individual who has completed a medical degree in the UK within two years of survey completion.

Outcome and statistical analysis

Outcomes measured were categorised into four domains: 1) factors influencing international students to study medicine in the UK, 2) perception of the UK tuition fees, training cost for a medical degree and Act Levy, 3) concerns about current support for international medical students in the UK, and 4) working in the NHS upon graduation.

A thematic analysis was performed by two independent reviewers (SM,RB) who systematically analysed the free-text responses independently and categorised them into different themes. Any discrepancies in the results were discussed among the two reviewers. If a consensus could not be reached, this was resolved by a third reviewer (SML).

Quantitative data was also analysed independently by two authors (CL,SG) . A Likert scale was used to quantify and rank the order of importance of the factors. The seven-points on the Likert scale ranging from 'strongly agree, agree, somewhat agree, neutral, somewhat disagree, disagree, strongly disagree' were linked to a numerical value of 1 to 7 respectively. The Kruskal-Wallis rank sum test was used for inferential analysis to compare non-parametric data among the three groups: medical student, pre-medical, post-graduate. Dunn test with Bonferroni adjustment was used as post-hoc adjustment. A p-value of less than 0.05 was set to be statistically significant in this study. All statistical analyses were performed in R programme version 3.6 (Boston, MA).

Patient and public involvement

No patient involved

Ethical considerations

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study had been reviewed and approved by the ethical research committee at the School of Medicine at Cardiff University, SMREC reference number 21/22.

RESULTS

The study is reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting cross-sectional studies.

Baseline characteristics

A total of 468 responses were recorded. There were 116 responses which were excluded (85 home students; 31 did not consent). 352 responses were submitted by international students with 251 medical school students (median age 21, IQR: 20 to 23 years old), 76 pre-medical school students (median age 18, IQR: 17 to 19 years

old) and 25 medical school graduates (median age 25, IQR: 24 to 26 years old). The average time to complete the study questionnaire was 9 minutes 41 seconds.

Out of 276 international students who reported their current or previous medical schools, 43 (15.6%) were from Scotland, 4 (1.5%) form NI, 36 (13%) were from Wales and 193 (69.9%) were from England.

A total of 56 nationalities were represented in this study, with most respondents from Asian countries ultimately accounting for 68.2% of total participants, followed by the continents of Europe 10% and North America 9.4% (Table 1). The detailed breakdown in nationalities can be found in the (Supplementary Table 1).

Table 1 - the Nationality of the respondents to the survey

Nationality	Number of Respondent
Asia	239
North America	33
South America	1
Europe	35
Middle East	11
Oceania and Australia	7
United Kingdom (British Passport)	12
Africa	11
Russia	1

29.5% (104/352) of international students studied in the UK prior to applying to medical school; of which 27 were pre-medical students (35.5%, 27/76), 67 were current international medical students (26.7%, 67/251) and 10 were medical school postgraduates (40%, 10/25). The median duration of studying in the UK for international students prior to applying medicine was 2 years (IQR 2-4).

Factors influencing students to study medicine in the UK

Out of six given reasons that influenced their decision to study medicine in the UK, clinical and academic opportunities were the most essential factors (96%) among all the international students (Figure 1a). This was consistently seen in all three subgroups, pre-medical, medical and post-graduates (Figures 1b-d).

Among all respondents, this was followed by the quality of life (70%), role model advice (60%), financial prospects (51%), political landscape (42%) (Figure 1a). The least important factor was for family reasons (39%) (Figure 1a), which was seen consistently across all three groups: 43% in the pre-medical group, 40% in the medical group and 24% in the post-graduate group. (Figures 1b-d).

59% of students in the pre-medical student group ranked the political landscape in both the student's home country and the UK as more important factors to be considered when compared to the medical student and postgraduate group. This was statistically higher (p=0.002) compared to the medical student group (38%) and

borderline significant (p=0.0503) compared to the post-graduate group (36%) (Figure 1c-d).

Albeit overall quality of life was the second most influential factor to motivate students to study medicine in the UK, this was demonstrated to be significantly lower in the post-graduate group, compared to the pre-medical (*p=0.01*) and medical group (*p= 0.02*) (Figures 1c-d).

Role model advice was also amongst the more important factors prompting pre-medical school students to study in the UK, with 70% of this cohort who agreed to this, compared to 59% in the medical student group (p=0.0697) and 40% in the post-graduate group (p=0.0114) (Figures 1c-d).

42.3% (149/352) gave additional factors that influenced their decision to train in the UK. Some of the respondents stated the motivation to move abroad that stems from the culture of practising medicine in the UK, while others came to experience living abroad. From the medical students' and postgraduates' perspectives, they cited that the UK medical degree is internationally recognised with clear training pathways, without the requirement of a previous degree. Many came for the high quality of education offered, with better career prospects following graduation. Eleven respondents cited that they did not get into the medical school in their home country (Table 2).

Table 2: Factors attracting international students towards UK medical school

Facilities, Opportunities and quality of the medical curriculum	*"Yes, Indian med schools don't have facilities equivalent to UK medical schools "* *"The quality of education and the historical cities in the UK itself* *"The course here is much more clinically oriented than in Europe. It is also less heavy on the student, giving the students an opportunity to have a life outside of their medical school."* *"Research opportunities (such as PhD intercalation)* *"Quality of education and job opportunities "* *"Prominent research landscape across the board, and a variety of UK-based educational materials"* *"Different curriculum +supportive tutor and student relationship+research opportunities"* *"better teaching facilities, course structures"* *Good quality of medical education and medical work in the UK!"* *"Academic scholarship opportunity "* *"Because of its well equipped medical schools and trained medical professionals that lecture In most of these medical schools."*
Prestige and recognised internationally	*"International community, high level of education "* *"Reputable degree with top class education "* *"I can immediately study medicine and it's only for 5/6 years. Prestige"* *"Better reputation and more recognised than the medical schools in Singapore. "* *"An MBBS degree from the UK is more internationally recognised. "* *"The degree is accepted in many other countries so it would be easy to travel."* *"Viewed as a prestigious place to study medicine "* *"validity of the degree in other countries, support to students, structure of post grad training"* *"The UK medical degree is very well valued around the world, including in India and the UAE (My country of residence) "* *"Studying in English seemed the most helpful internationally. "*
Post-graduate Prosperous	*"The degree is valued internationally and can increase bargaining power amongst graduates to ask for higher salaries in overseas countries."* *"Higher job opportunities in the future "* *"More career opportunities after completing a UK degree"* *"Better future career options. "*
Oversea experience and Study culture	*"Yes, to gain more exposure by studying abroad"* *"love to stay in the uk for a couple more years"* *"To experience something new/different"* *"I love the country, always did."* *"exciting experience* *"I enjoy the learning culture in UK much more than in my home country"* *"perhaps the diversity within the school environment "* *"Life experience" ; "Better life" ; "Work life balance"*
Convenience and language	*"Partnered medical school with university back home "* *"Studied in British system* *All education was tailored to eventually study university in the UK* *English speaking medical curriculum "* *"Studying A-Levels in sixth form, it's sort of an "expectation" that using that you would go to the UK for further education"* *"It was just easier for me to apply to a UK medical school rather than an Indian medical school, as Indian medical schools are more competitive."* *"not at fluent in mother tongue"*

	"More fluent in english than in home country language *"More familiar with the system; language"* *"Language"* *"I've studied here a long time and my native language is nowhere near good enough at University level.* *"I would like to study medicine in English."* *"I speak English better than I do french/Flemish/German so couldn't study in Belgium "* *"I am used to UK's NHS and education system, which helps with my studies "* *"easier to apply from UCAS since I did my A-Levels in the UK so easier to apply within the system rather than apply to a university in my home country, India.* *"Easier pathway for international students to study medicine in comparison to other countries"* *"Direct start without premed"* *"Already studying in the UK "* *"Studied in a British school prior to this so led to pursuing further education here "*
Time saving	*"Undergraduate course vs postgraduate back home. Would end up saving 3 years."* *"Time saving in terms of graduating"* *"The pathway to becoming a doctor is the most straightforward. Getting accepted into a medical program straight out of high school automatically puts me on the path to becoming a doctor and ensures that I gain relevant clinical experience throughout my undergraduate years."* *"The duration of the course is shorter compared to other countries."* *"Takes less time to do it in the UK. "* *"Shorter training years compared to other countries"* *"Shorter length for qualification compared to other countries"* *"In Canada, you need an undergraduate degree in order to apply to medical school."* *"In Canada, the process to become a doctor is significantly longer, and slightly harder (since more qualifying exams need to be written)."* *"Medical school in North America employs the 4 + 4 model of undergraduate + graduate medicine (MD). Studying in the UK was a way to guarantee becoming a doctor in a shorter period of time."*
Politics	*"Our country has too many doctors. I wish to work in the UK and experience world-class education."* *"Politics in HK"* *"The major issue in Malaysia for medical graduates is the biased and unfair system of awarding contracts to houseman officers. We do not know how they determine who is awarded the positions as the process is not transparent. There are many other issues such as the ratio of number of doctors produced to the number of patients in Malaysia is also one of the highest in the world as we simply just have too many medical schools especially from the private sector and not enough positions to compensate for them. Thus many medical graduates in Malaysia face the prospect of going jobless after completing their clinical training."*

Perception about UK tuition fees and training cost for a medical degree

32.9% of international pre-medical students in the UK thought the average international student would have paid £200 000 - £300 000 upon completion of a medical degree in the UK, as shown in the Table 3. This perceived amount is significantly higher compared to the medical student (p=.00001) and post-graduate (p=0.0067) groups, where 41.4% of medical students and 44% of postgraduates assumed that £100 000 - £200 000 was the total cost (Table 3).

Table 3 Perceived/ known tuition fees paid by international students upon completion of a medical degree by pre-medical student, medical student and medical school graduates. Median perceived/ known tuition fees is highlighted in bold.

On average, total tuition fees upon completion of UK medical degree paid by international student	Pre-medical %(response)	Medical students %(response)	Medical School Graduates %(response)
Less than £50,000	5.3% (4)	0.8%(2)	-
£50,000 - £100,000	5.3% (4)	2.7%(7)	12%(3)
£100,000 - £200,000	13.2%(10)	**41.4%(104)**	**44%(11)**
£200,000 - £300,000	**32.9%(25)**	38.2%(96)	20%(5)
£300,000 - £400,000	6.6%(5)	7.6%(19)	12%(3)
£400,000 - £500,000	15.8%(12)	3.58%(9)	-
£500,000 - £600,000	7.9%(6)	2.4%(6)	-
More than £600,000	13.2%(10)	3.2%(8)	12%(3)

As for the total cost of training, 19.7% of international pre-medical students thought it cost £300 000 - £400 000 to train a medical student to be a doctor; 14.5% thought it cost more than £600 000 to train a doctor. 30.7% (77/251) international medical students thought it cost £50 000 - £100 000. In the international medical school graduates' group, 32% (8/25) thought it cost £50 000 - £100 000. This perceived amount by the pre-medical student group is significantly higher compared to the medical student group (p=0.0044) and post-graduate group (p= 0.0106). (Table 4)

Table 4 Perceived estimated total cost of medical training required to produce a doctor by pre-medical students, medical students and medical school graduates. Median estimated cost is highlighted in bold.

Total cost to train a medical student to become a doctor in the UK (Average)	Number of responses (Pre-medical international students)	Number of responses (International medical students)	Number of responses (International medical school graduates)
Less than £50,000	2.6%(2)	17.1%(43)	20%(5)
£50,000 - £100,000	7.9%(6)	**30.7%(77)**	**32%(8)**
£100,000 - £200,000	15.8%(12)	20.3%(51)	32%(8)
£200,000 - £300,000	18.4%(14)	13.5%(34)	12%(3)
£300,000 - £400,000	**19.7%(15)**	9.2%(23)	4%(1)
£400,000 - £500,000	10.5%(8)	4.8%(12)	-
£500,000 - £600,000	10.5%(8)	1.6%(4)	-
More than £600,000	14.5%(11)	2.8%(7)	-

In both medical student and pre-medical student groups, they thought the tuition fees paid by international students upon completion of a medical degree were statistically different to the total cost of medical training for a student to become a doctor (p=0.0007) and (p<0.0001) respectively. To the contrary, in the post-graduate group, there is no statistically significant difference (p=0.1965) in the perception of total tuition fees paid and the total cost of medical training.

Act Levy

84% (296/352) of international students were not aware of ACT LEVY. Overall, 85% of international students stated that Act levy would likely influence their decision to study medicine in the UK (44% very likely, 24.1% likely, 16.2% somewhat likely). In the subgroup, pre-medical student group was significantly less (p<0.05) influenced by ACT levy compared to the (p<0.001) medical and (p= 0.0026) post-graduate group. 74% of the pre-medical student group rated Act Levy would affect their decision to study medicine in the UK (23.7% very likely, 23.7% likely, 25% somewhat likely) with neutral and unlikely being 13% and 14% of the cohort respectively.

International students' concerns

The thematic analysis of the free text responses, which were answered by 26.1% (92/352) of respondents, looked into the students' general concerns. The majority of the pre-medical student group had no concerns (49.9%), 16.5% felt that the cost of the degree was the major concern, followed by 11.0% who fear unconscious bias and racism (Table 5).

Table 5 shows the results of the thematic analysis conducted from the responses in the free text box asking whether there were any additional concerns amongst international students coming to the UK to study medicine.

Themes	Individuals %
Impact of COVID-19 on the curriculum	2.2%
Lack Of University Support/guidance	5.5%
Culture shock/fitting in	6.6%
Post-graduate working conditions and job prospects	7.7%
Unconscious bias/Racism	11.0%
Cost Of Degree	16.5%
Other	9.9%
No Concerns	49.9%

Postgraduate and existing medical students (276/352) were asked if they have adapted well to the UK and were well supported through the medical school, university students' societies and other methods of support, according to four specific domains (Figure 2). Most students felt they had adapted well academically (75%) and socially (76%). 60% felt they had adapted well culturally while 25% disagreed. Only 28% of the international medical students felt well supported financially, 15% were neutral and 57% disagreed.

Working in NHS upon graduation

28.4% (100/352) of the respondents were unsure about working in the NHS upon graduation with 58% (204/352) and 8% (28/352) saying that they would like to work

and did not want to work in the NHS respectively. Of the respondents, 5.6% (20/352) are currently working in the UK, thereby accounting for 80% (20/25) of the post-graduate cohort.

When enquiring about considerations of leaving the NHS, 27.8% (98/352) were unsure, 29.3% (103/352) would like to work for two years until the completion of Foundation Year 2, 28.7% (101/352) would like to work for up to 10 years or until the completion of speciality training. A further 9.4% (33/352) would like to work as a consultant indefinitely, meanwhile 4.8% (17/352) would like to leave immediately upon medical school graduation. Their wishes regarding work in the NHS did not significantly differ among the subgroups (p=0.3).

The overall value of the UK medical degree

Overall, 96% of international students felt that more financial support should be given with 93% saying they would be more likely to apply for a UK medical degree if financial support was provided. 83% expressed that they would be more likely work in the UK if more financial support was given, with 84% responding that they would enter a contract to work for the NHS for at least five years, if there was more financial support for them to study medicine. (Figure 3)

In general, 54% of students felt the UK degree was value for money. There was a statistically significantly different opinion ($p<0.05$) among the subgroups; In the pre-medical school group, 71% felt that the UK degree is good value for money (17% were unsure, 12% disagreed with the statement), which was significantly ($p<0.0001$) higher than the 52% strongly agreeing and 20% of medical school students agreeing (15%

were neutral, 23% disagreed) and post-graduate (24% remained neutral, 56% disagreed) groups respectively. The post-graduate student's perception of the value for money of the UK medical degree was also significantly different (p=0.0054) when compared to the other groups.

DISCUSSION

This study evaluates previous, current, and prospective international students' perceptions regarding UK medical education. Clinical and academic opportunities were the most significant factors that attracted respondents to pursue medicine in the UK. However, among the three groups, there are significant differences in perspectives regarding the financial value of a medical degree in the UK, establishing that pre-medical students' ideas, surrounding a UK medical degree are the most optimistic, closely followed by the existing medical students and postgraduates. Our study's results highlight two important aspects for consideration regarding the future of medical education in the international arena: the cost of a medical degree and quality of medical training.

Cost of UK medical degree

Potential reasons for pre-medical students perceiving the cost of a UK medical degree higher than actual paid cost of the degree compared with the perception of medical students and medical graduates may be explained by the influence of the "perceived prestige and glamour" by friends, family, and social media.[12] As evidenced by our

findings, medical students and graduates perceive the UK medical degree placed at a higher value than its true cost. This may be cause for the gradual negative skew towards the disagreement that a UK medical degree is good value for money.

In 2017, the Department of Health quoted an average funding cost of £230,000 per medical student, of which 67% (£151,000) is a grant to the placement provider and medical school, while 33% (£64,300) constitutes repayable loans and bursary to students for living costs and tuition.[5,9] This verified cost of £230,000 per student is closer to the estimates suggested by the pre-medical student group than that of the medical student and graduate groups. Despite this, there is no clear breakdown of how these costs are utilised. For example, the costs of insurance and indemnity, placement-based teaching sessions, and other clinical resources. Given the plans to further increase international medical tuition fees via the ACT Levy, it is even more pertinent that this breakdown should be transparent.

It should be noted that the future salary offered to graduates may not offset the total cost of the degree for international students.[2,13] Given the current trend and the assumption that international medical graduates utilize 10% of their basic salary to repay student debts, it could take up to 28 years to complete repayment of the total debt accumulated during their degree.[2,13] The implementation of ACT Levy further contributes to the financial burden on international medical students; it is therefore important that applicants are well-aware of these long-term financial implications before making an application.

More work could be done to increase the transparency of the cost of medical training, especially for international medical students. This applies to the current cost of training and the added cost from the ACT Levy [14]. Universities are keen to enrol international students for financial reasons;; maintaining an element of transparency is key to ensuring that the consumer rights of these students are preserved [15]. For the international student, having the knowledge of the breakdown of these additional costs is key factor in the decision-making process when applying to read medicine in the UK.

Quality of undergraduate training

The quality of medical education and international prestige are attractive factors for international students.[16] Medical education in the UK is renowned for advanced technological facilities, research and intercalation opportunities.[16-18] Furthermore, the General Medical Council (GMC) acts as quality assurance, when stipulated professional outcomes need to be achieved.[16,17] This instils confidence in international students as it reduces the variation in the abilities of graduates from different UK medical schools.

However, there is now a rapid increase in the number of GMC-approved medical schools in the UK and overseas, [5,6,9-10] with up to 13 new medical schools currently being developed. Furthermore, as intercalated degrees no longer count for points in the UK foundation program application,[19] this policy might lower students' motivation to intercalate and hence, reduce the focus on research and development in the

undergraduate curriculum.[19] Current and new medical schools will need to ensure their curriculum is continually well-equipped with research opportunities in order to maintain high quality teaching. International students' expectations of the UK medical degree should be maintained despite these changes in policies. [5,6,9-10]

Additionally, COVID-19 has contributed to the increase in the virtual delivery of the medical curriculum. [20,21] Distance learning inevitably reduces the use of university facilities, student-to-student interaction and social experience. In our study, 15% of students felt that they did not receive adequate support academically during the pandemic, while 18-25% of international students reported that they did not feel supported socially or culturally during medical school.

Future work

With the removal of the residential labour market stress test, International medical graduates (IMGs) from overseas can compete freely with graduates from the UK. It is likely that IMGs pay less fees in their home countries than international students in the UK. Due to the change in this policy, there is no longer a favourable edge for the UK medical graduate, as competition is equal among all medical graduates. [20] Obtaining a medical degree prior to migrating to the UK to obtain postgraduate training could be perceived as a more economical way to progress in the medical career.

The high medical tuition fees will still be a major obstacle for students who are unable to secure funding from their home country, with only 28% of students feeling financially

supported in this study. In our study, 84% of international students are willing to enter a contract to work for the NHS for at least 5 years if financial support is provided. This would be a favourable strategy to contribute to national taxation and retain the medical workforce in the long term. The advocacy for medical apprenticeships and widening access to medicine is being discussed at all training levels; this raises the question as to whether there is a need for widening access for international medical students, [5,6] especially if the government would like to attract the best candidates from the international community to work in the UK.

ACKNOWLEDGEMENTS: The authors would like to thank Cardiff University Healthcare International Perspectives Society (CHIPS), OSCEazy, In2MedSchool, The Hong Kong Medical University of United Kingdom (HKMUSK) for their collaboration on this study.

VISION Collaborators

Sai Pill, Paarth Kishan Gupta, Renee Punia, Katie Cheung, Diva Jhaveri, Aaron Gnanabalan, Italia-Rosa Leech, Faith Lee, Elizabeth Wong, Kar Phoong, Memory Moyo, Isha Thakar, Viraj Shah, Rohan Gupta, Tushar Rakhecha, Movin Peramuna Gamage, Nishaanth Dalavye, Allen Mathew , Parvathy Sureshkumarnair, Sripradha Srinivasan, Becky Leveridge.

Contributors

HS (conception, design, methodology, writing, reviewing and editing and supervising). CL and SG (conception, methodology, data curation, formal analysis, writing and reviewing). TP (methodology, project administration, writing, reviewing and editing), AG (methodology, project administration, data collection, writing, reviewing and editing, SML (methodology, project administration, data collection, data analysis, writing), RB and SM (creating data collection form, data collection, data analysis, writing), FEF (methodology, writing , organising webinar, project administration), SO (methodology, project administration, reviewing and editing) ,TW (conception, design, reviewing and editing), VY (writing, reviewing and editing) All authors contributed to this article and approved the submitted version.

COMPETING INTERESTS: The authors declare none.

FUNDING: This study received no specific grant from any agency, commercial or non-profit sectors.

Data sharing statement: No additional data available. Raw data available at reasonable request.

Ethical Approval

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study had been reviewed and approved by the ethical research committee at the School of Medicine at Cardiff University, SMREC reference number 21/22.

REFERENCES

1. UCAS. UCAS Undergraduate Data Release Archive, 2022. Available at: <https://www.ucas.com/corporate/data-and-analysis/ucas-undergraduate-releases/ucas-undergraduate-analysis-reports/ucas-undergraduate-end-cycle-reports> [Accessed 15 Feb 2022].

2. Royal College of Physician London. The bubble set to burst: Is the UK's medical recruitment unsustainable after BREXIT?. *RCP Annual Conference.* 2021; 5:23. Available at: https://70b706f2.flowpaper.com/NovemberCommentary/#page=23 [Accessed 3 Oct 2021].

3. Enoch T, Ooi R, Ooi S. Impact of the implementation of the additional cost of teaching (ACT) levy on prospective international medical students applying to Northern Ireland and Scotland. *Postgrad Med J*. 2021 Apr 20:postgradmedj-2021-140194. doi: 10.1136/postgradmedj-2021-140194.

4. Aberdeen U. Tuition fees the school of medicine, medical sciences and nutrition the University of Aberdeen, 2021. Available: https://www.abdn.ac.uk/smmsn/undergraduate/medicine/tuition-fees.php [Accessed 3 Oct 2021].

5. GOV.UK Department of Health and Social Care. Expanding undergraduate medical education, 2021. Available from: https://www.gov.uk/government/consultations/expanding-undergraduate-medical-education[Accessed 3 Oct 2021].

6. The BMJ. Expanding undergraduate medical education in the UK - but at whose cost?, 2021. Available at: https://www.bmj.com/content/356/bmj.j1370/rr-0 [Accessed 3 Oct 2021]

7. Queen's University Belfast. International Tuition Fees, 2022. Available at: <https://www.qub.ac.uk/International/International-students/International-tuition-fees/> [Accessed 15 Feb 2022].

8. HEPI. The UK's tax revenues from international students post-graduation, 2022. Available at: <https://www.hepi.ac.uk/2019/03/21/the-uks-tax-revenues-from-international-students-post-graduation/> [Accessed 15 Feb 2022].

9. Royal College of Physicians. Double or quits: a blueprint for expanding medical school places, 2021 Jan.

10. Office for Students. Health education funding, medical and dental target intakes, 2021. Available at: https://www.officeforstudents.org.uk/advice-and-guidance/funding-for-providers/health-education-funding/medical-and-dental-target-intakes/ [Accessed 3 Oct 2021]

11. UK Council for International Student Affairs. International student advice and guidance — England: fee status, 2021. [accessed 3 Oct 2021] Available at: https://www.ukcisa.org.uk/information--advice/fees-and-money/england-fee-status [Accessed 3 Oct 2021]

12. McHarg, J., Mattick, K., Knight, L. Why people apply to medical school: implications for widening participation activities. *Medical Educ.* 2007; 41(8): 815-821.

13. Ooi, S., Ooi, R., Godoi, A. et al. Motivations of medical students and doctors leaving the NHS explored in a residency training application webinar series. *Postgrad Med J.* 2021 Oct 21:postgradmedj-2021-140795. doi: 10.1136/postgradmedj-2021-140795.

14. GOV.UK Competition & Markets Authority. Higher education: guide to consumer rights for students, 2015. Available at: https://www.gov.uk/government/publications/higher-education-guide-to-consumer-rights-for-students [Accessed 29th Mar 2022]

15. Levent F. The economic impacts of international student mobility in the globalization process. Journal of Human Sciences. 2016;13(3).

16. General Medical Council. Standards of UK medical education, 2021. Available from: https://www.gmc-uk.org/education/becoming-a-doctor-in-the-uk/standards-of-uk-medical-education [Accessed 3 Oct 2021]

17. Quraishi S, Wade W, Black D. Development of a GMC aligned curriculum for internal medicine including a qualitative study of the acceptability of 'capabilities in practice' as a curriculum model. *Future Healthc J.* 2019; 6(3):196-203. doi: 10.7861/fhj.2018-0016

18. Bustin S. Science in the UK − whereto now?. Biomolecular Detection and Quantification. 2016;9:A1-A4. doi: 10.1016/j.bdq.2016.08.001

19. Tonkin T. Additional achievements ruled out of foundation programme applications. *BMA,* 2021. Available at: https://www.bma.org.uk/news-and-opinion/additional-achievements-ruled-out-of-foundation-programme-applications [Accessed 4 Oct 2021]

20. Harries A., Lee C., Jones L., et al. Effects of the COVID-19 pandemic on medical students: a multicentre quantitative study. BMC Medl Educ. 2021;21(1). doi: 10.1186/s12909-020-02462-1

21. Papapanou M., Routsi E., Tsamakis K., et al. Medical education challenges and innovations during COVID-19 pandemic. Postgrad Med J. 2021 Mar 29:postgradmedj-2021-140032. doi: 10.1136/postgradmedj-2021-140032.

VISION Collaborators

Sai Pill, Paarth Kishan Gupta, Renee Punia, Katie Cheung, Diva Jhaveri, Aaron Gnanabalan, Italia-Rosa Leech, Faith Lee, Elizabeth Wong, Kar Phoong, Memory Moyo, Isha Thakar, Viraj Shah, Rohan Gupta, Tushar Rakhecha, Movin Peramuna Gamage, Nishaanth Dalavye, Allen Mathew , Parvathy Sureshkumarnair, Sripradha Srinivasan, Becky Leveridge.

Legends

Figure 1 shows the proportion of responses of factors influencing students to study medicine in the UK, a) Overall responses, b) Pre-medical responses, c) Medical Responses d) Post-graduate responses

Figure 2 shows four domains in which postgraduate and existing medical students (276/352) were asked if they had adapted well to the UK and were well supported through the medical school, university students' societies and other methods of support

Figure 3 shows 5 domains which pre-medical, medical and postgraduate students were asked to consider in relation to value of a UK medical degree.

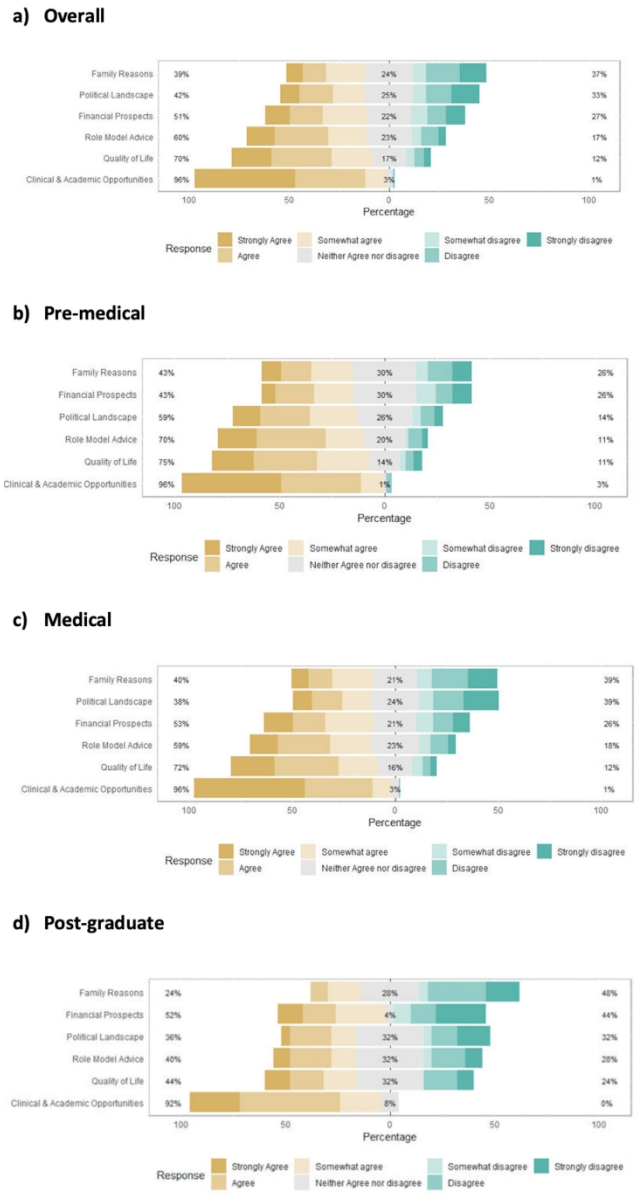


Figure 2

198x366mm (300 x 300 DPI)

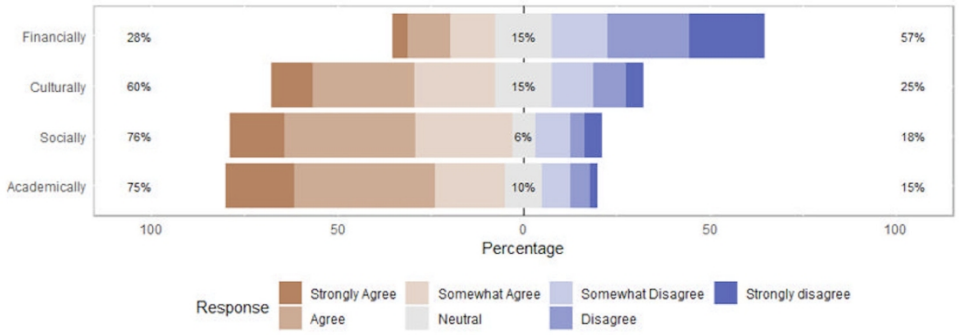


Figure 3

148x56mm (300 x 300 DPI)

Figure 1

175x255mm (300 x 300 DPI)

Supplementary Table 1 – the detailed breakdown of the nationality of the respondents to the survey

Nationality	Number of Respondent
American	9
Australian	5
Bahraini	3
Bangladeshi	1
Belgian	1
Brazilian	1
British	12
Bruneian	1
Burmese	3
Canadian	23
Chinese	16
Cypriot	3
Dutch	2
Egyptian	3
Fijian	1
Finnish	2
French	4
Gambian	1
German	2
Ghanaian	1
Greek	2
Hong Kong	36
Indian	62
Iranian	2
Iraqi	1
Irish	4

Italian	3
Japanese	4
Jordanian	2
Kenyan	1
Libyan	3
Luxembourger	1
Malaysian	76
Maldivian	1
Maltese	1
Mauritian	2
Namibian	1
New Zealander	1
Nigerian	2
Polish	2
Portuguese	1
Romanian	2
Russian	1
Sierra Leonean	1
Singaporean	21
South Korean	4
Spanish	1
Sri Lankan	2
Swedish	3
Swiss	2
Taiwanese	2
Tanzanian	1
Thai	6
Trinidadian or Tobagonian	1

Turkish	1
Zimbabwean	2

Study protocol

Study title: The Value of a UK Medical Degree for International Students: A cross sectional study: (VISION)

1.**Background:** International students have brought in financial and economic benefit for the local community in the United Kingdom (UK). A medical degree for international students is one of the most expensive undergraduate degrees in the UK, the average cost for a five-year medical course is £185,297 and £236,737 for a six-year degree (for 2020/2021 entry). A recent commentary in the Royal College of Physicians noted that this could financially burden the international students who decide to work for the NHS upon graduation, which could deter them from choosing to study medicine in the UK.

After completion of the Brexit transition in January 2021, the definition of international students will eventually be applied to a wider population and this policy could impact the medical recruitments for international students. Additionally, COVID-19 and Brexit have already impacted the decision of international students to study in the UK. This study aims to evaluate the perception of international students in obtaining a medical degree in the UK with the hopes of maintaining the popularity of a UK medical degree in comparison to other countries.

Why is this important: The "Act Levy" is an additional cost of training for international students that has been implemented in Scotland and is currently under consultation to be further introduced in England and Wales. This will result in a £10,000 - £20,000 increase in medical tuition fees for international medical students (1). It is unclear how this policy could influence the decision of international students to study medicine in the UK.

2. Aims

This cross-sectional study aims to evaluate the perspective of graduates, existing and prospective UK medical students regarding the value of a UK medical degree for international students.

2.1Methods and study design: This is a cross-sectional observational study, using a secure online questionnaire, has been created via the REDCap database, supported by Medical Education from the School of Medicine at Cardiff University. This questionnaire will be circulated to different medical schools and secondary schools across the UK and internationally

2.2 Outcome measures

- Primary outcome: Students' perceptions and concerns in a cross-sectional student survey
- Secondary outcome: The difference in perception among the prospective students, existing students and graduates of UK medical schools.

3. Study Population

3.1 Inclusion and exclusion criteria:

All international students are eligible to be included in this study.

3.1.1 An international student is defined in this study using the definition of the UK Council for International Student Affairs (UKCISA) as:

- Non-British students (full-time or part-time in education); OR
- students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status

The sampling population could be further divided into three categories by our questionnaire: pre-medical school student, medical school student, and medical school graduate.

3.1.2 Pre-medical school student is defined as applicants currently:

- NOT studying a medical degree and planning to submit their application to medicine within two years. This includes Graduate entrance study and high-school students.

3.1.3 Medical school student is defined as:

- a student currently studying medicine or on a pre-clinical/foundation part of a medical degree where a medical degree is guaranteed upon successful completion of their degree.

3.1.4 Medical school graduate

- is defined as medical graduates who have completed a medical degree within the two-year preceding the study

4. Proposed timeline

Study duration:

- from 1st April 2021 - 31st July 2021 - data collection
- 31st July 2021 - all the data is locked in the database.
- 31st July - 31st August 2021 - data analysis
- Mid July 2021 - Conference Presentation (preliminary results presentation)
- 31st Aug - 31st Sep 2021 Write up and display the results to relevant organisations/journals.

5. Ethical approval: In the reviewing stage by research committees in the School of Medicine at Cardiff University

BMJ Open

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION); A CROSS-SECTIONAL STUDY

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-065062.R1
Article Type:	Original research
Date Submitted by the Author:	13-Apr-2023
Complete List of Authors:	Li, CHUNHEI; St George's University Hospitals NHS Foundation Trust, Vascular Surgery ; Cardiff University, School of Medicine ganesananthan, sashiananthan; Chelsea and Westminster Healthcare NHS Trust Pinchemain, Trevor ; Cardiff University School of Medicine Godoi, Amanda ; Cardiff University School of Medicine Lim, Shan Ming ; Cardiff University School of Medicine Baskaran, Ravanth ; Cardiff University School of Medicine Mukhopadhyay, Srinjay ; Cardiff University School of Medicine Foo , Eu Fang ; Cardiff University School of Medicine Ooi, Setthasorn Zhi Yang; Cardiff University School of Medicine, Woo, Timothy ; King's College Hospital Yeo, Vanessa ; Royal Glamorgan Hospital collaborators, VISION; Cardiff University School of Medicine Sweetland, Helen; Cardiff University School of Medicine
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Health policy, Health economics, Medical education and training, Medical management
Keywords:	MEDICAL EDUCATION & TRAINING, EDUCATION & TRAINING (see Medical Education & Training), International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION); A CROSS-SECTIONAL STUDY

Chun Hei Li[1,*], Sashiananthan Ganesananthan [2,*], Trevor Pinchemain[3], Amanda Godoi[3], Shan Ming Lim[3], Ravanth Baskaran[3], Srinjay Mukhopadhyay[3], Foo Eu Fang[3], Setthasorn Ooi[3], Timothy Woo[4], Vanessa Yeo[5], VISION collaborators, Helen Sweetland[3]

1. St George's University Hospitals NHS Foundation Trust
2. Chelsea and Westminster Hospital NHS Foundation Trust
3. Cardiff University School of Medicine, Cardiff, United Kingdom
4. Kings Colleges University Hospital, London, United Kingdom
5. Royal Glamorgan Hospital, Pontyclun, United Kingdom

*These authors contributed equally and should be considered as joint-first authors

Corresponding author:

CHUNHEI LI submitting on behalf of

Professor Helen Sweetland MD FRCSEd (Emeritus)

Cardiff University School of Medicine

Neuadd Merionydd Building

Heath Park

Cardiff

CF14 4XN

sweetland@cardiff.ac.uk

Keywords: medical education, international students, postgraduate training

ABSTRACT

Objectives

It is estimated that NHS staff consist of over 200 different nationalities, with a reported 30.7% of doctors holding a nationality other than British. Despite this, international medical students represent 7.5% of all medical students studying in the United Kingdom (UK) and pay on average, four-to-six times more in tuition fees when compared to the £9,250 per annum (£UK 2021) paid by home students.

Methods

This is a cross-sectional observational study enquiring about international pre-medical, medical, and medical school graduates' perception of the value of the UK medical degree and factors influencing their decision to study in the UK.

Setting

This questionnaire was circulated to 24 medical schools and 64 secondary schools both internationally and across the UK.

Results

A total of 352 responses from 56 nationalities were recorded. 96% of international students identified clinical and academic opportunities as the most important factors to study medicine in the UK, closely followed by quality of life (88%). The least important factor was family reasons, with 39% of individuals identifying this factor. Only 4.82% of graduates in our study considered leaving the UK after training. Overall, 54% of students felt the UK degree was value for money. This belief was significantly higher

in pre-medical students compared to existing students and graduates (71% versus 52% and 20%, p<0.001 for all comparisons).

Conclusion

The quality of medical education and international prestige are attractive factors for international students to study medicine in the UK. However, further work is needed to ascertain reasons for the differing perceptions of the value by international students at different stages in their clinical training.

Article Summary

Strength and Limitation

- First study that systematically evaluate the perceptions of pre-medical, medical and post-graduate international doctors on the value of a UK medical degree.
- Selection bias as study survey targeted 24 medical schools and 64 secondary schools that were known to the study team.
- Small sample size in postgraduate students further biases the subgroup comparison.

INTRODUCTION

The undergraduate medical degree is a highly popular and competitive degree in the United Kingdom (UK) with over 23,710 applicants (inclusive of British citizens, residents with settled status or overseas students) competing for less than 8,000 places in 2021.[1]

International students traditionally account for a small percentage of medical students, as the annual intake is capped at 7.5% for the full cohort. [2-6] In the UK, international students pay higher tuition fees compared to 'home' students (British citizens or residents with settled status) studying the same degree. Home students' fees are currently capped at £9,250 per annum [2-4] whilst international fees are four to six-fold higher, with the latter having the additional burden of their fees being subject to annual inflation as per the Retail Price Index [2,4]. Furthermore, the 'Additional Cost of Training' (ACT) levy was introduced in Scottish medical schools in 2016,[4] and to Northern Irish medical schools in 2021.[7] ACT Levy is the additional medical training costs introduced for overseas students studying in the UK to finance clinical skills training on clinical placements delivered by the NHS. Its implementation is now under consultation to be introduced in England and Wales. This may result in a further substantial increase in medical tuition fees of up to an additional £10,000 annually for international medical students [2-7]. A single cohort of all disciplines of international students was found to contribute £3.2 billion to the UK economy over a 10-year period through taxation and National Insurance payments.[8]

Following the BREXIT transition in January 2021, the definition of international students' fee status applies to a wider population, including students from European Union (EU) countries; this policy may potentially impact the recruitment of international

medical students in the future.[4,9-10] Ultimately, this may create a selection bias towards students who have the financial means to pursue a UK medical degree, excluding those who may be capable of undertaking the academic rigour of a UK medical degree but are unable to afford the tuition fees.[2,3]

These circumstances place the UK medical degree in a unique position in the global medical education landscape for aspiring international students. Despite being a costly investment, with the current UK medical degree ranking as the most expensive undergraduate degree in the UK ,[1,4,7] it remains highly popular among international students with courses annually oversubscribed.[1] There is currently no data to demonstrate the motivation of international students to come to the UK to pursue medicine while considering, not only the monetary value but the value gained from the quality of life, societal and educational opportunities afforded by these institutions in the UK.

Identifying the motivation of this important subset (or potential subset) of the NHS medical workforce could allow policy makers to consider the current junior doctor retention crisis within the NHS in a nation with the second lowest doctor to population ratio in the EU [11]. One study found that one in ten junior doctors are considering leaving the NHS [12] while 16% of those who completed foundation training do not enter further training within three years [13] . These factors have significant implications on workforce planning and ultimately patient safety.

This study aimed to evaluate the perception of the financial cost and value of the UK medical degree for international students and their motivations for pursuing such a degree. The study analysed how these perceptions and motivations differ between

pre-medical students, medical students, and medical school graduates and analysed their perception of the 'value' of obtaining a UK medical degree.

METHODS

Study design

This online, multi-centred, cross-sectional study focused on the perceptions of a UK medical degree among pre-medical students, current medical students and recent medical graduates. A qualitative and quantitative based questionnaire was disseminated through collaborating university medical schools and established student networks across the UK and internationally, from 1st April 2021 to 31st July 2021. The questionnaire was circulated to 24 medical schools and 64 secondary schools (from 6 countries - United Kingdom, Malaysia, Singapore, Mozambique, Brazil, Vietnam). The survey was accessible as a secure online questionnaire on Microsoft Teams. The 40-item, self-administered questionnaire was developed by medical students from the Cardiff Healthcare International Perspective Society (CHIPS), which is a student-led society at Cardiff University. A review of the existing literature was performed to identify the gaps in knowledge and to look at similar questionnaires and qualitative studies on the perception of prospective, current and recently graduated international students of a UK medical degree. This allowed an understanding of domains and items relevant to determining the aim of the project. The questionnaire included a seven-point Likert scale, checkboxes, multiple-choice, and free-text questions to improve the granularity of the data. A pilot survey was distributed to a group of randomly selected 13 undergraduate international students (6 different nationalities represented), who were not involved in study conception or design, to

seek feedback, improve clarity and ensure objectivity. A copy of the final questionnaire can be found in the Supplementary Appendix.

Data processing

Throughout the period of data collection, the information received was kept in a password-protected Excel file. Prior to data analysis, all data was de-identified and stored securely. All relevant information remained non-identifiable throughout this study.

Study population

An international student eligible to be included in this study was defined using the definition from the UK Council for International Student Affairs (UKCISA) as 'non-British students (full-time or part-time in education); or students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status'.[14]

The sampled population was divided into three subgroups: pre-medical students, medical students, and medical school graduates. A pre-medical school student was defined as a student not currently studying a medical degree and who was planning to submit their application to medicine within two years of survey completion. This included high-school students, students currently taking a gap year and students who were planning to apply for graduate-entry medicine.

A medical student was defined as any student currently studying medicine or a pre-clinical component, where a medical degree is the outcome. A medical school graduate was defined as any individual who had completed a UK medical degree within two years of survey completion. This was to reduce the effect of recall bias and it is likely that some may have been affected by the ACT Levy. Participants were excluded if they did not provide consent to use of the data in publication and if they were a home student.

Outcome and statistical analysis

The study aimed to classify students' perceptions and concerns regarding a UK medical degree and determine the difference between these perceptions among prospective, existing and post-graduates of UK medical schools. Outcomes measured were predefined and categorised into four domains: 1) factors influencing international students to study medicine in the UK, 2) perception of the UK tuition fees (how much they believed or knew the total tuition fees paid by international students) and training cost for a medical degree (how much they felt or believed it cost to train a medical student to become a doctor in the UK) and Act Levy, 3) concerns about current support for international medical students in the UK, and 4) working in the NHS upon graduation.

A thematic analysis was performed by two independent reviewers (SM, RB) who systematically analysed the free-text responses and categorised them into different themes. Any discrepancies in the results were discussed among the two reviewers. If a consensus could not be reached, this was resolved by a third reviewer (SML).

Quantitative data was analysed independently by two authors (CL, SG). A Likert scale was used to quantify and rank the order of importance of the factors. The seven-points on the Likert scale ranging from 'strongly agree, agree, somewhat agree, neutral, somewhat disagree, disagree, strongly disagree' were linked to a numerical value of 1 to 7 respectively. The Kruskal-Wallis rank sum test was used for inferential analysis to compare non-parametric data among the three groups: medical student, pre-medical, post-graduate. Dunn test with Bonferroni adjustment was used as post-hoc adjustment. A Spearman Rank Correlation Coefficient Test was used to determine the association between the value of a UK medical degree and participants' perception of total tuition fees paid and the cost to train a medical student to a doctor. A p-value of less than 0.05 was set to be statistically significant in this study. All statistical analyses were performed in R programme version 3.6 (Boston, MA).

Patient and public involvement

No patients were involved in this study.

Ethical considerations

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study was reviewed and approved by the

ethical research committee at the School of Medicine at Cardiff University, (SMREC reference number 21/22).

RESULTS

The study is reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting cross-sectional studies.

Baseline characteristics

A total of 468 responses were recorded. There were 116 responses which were excluded (85 home students; 31 did not consent). 352 responses were submitted by international students with 251 medical school students (median age 21, IQR: 20 to 23 years old), 76 pre-medical school students (median age 18, IQR: 17 to 19 years old) and 25 medical school graduates (median age 25, IQR: 24 to 26 years old). Of the 352 responses, 221 were female (62.8%), 122 were male (34.7%), 6 preferred not to say (1.7%), 1 was a transgender male (0.3%) and 2 mentioned that their gender was not listed (0.6%). Among those who provided a response (non-compulsory field), 104 reported having studied in the UK prior to applying for the medical degree, with a median time of 2 years (IQR 2-4).

Out of 276 international students who reported their current or previous medical schools, 43 (15.6%) were from Scotland, 4 (1.5%) form NI, 36 (13%) were from Wales and 193 (69.9%) were from England.

A total of 56 nationalities were represented in this study, with respondents from Asian countries accounting for 68.2% of total participants, followed by the continents of Europe - 10% and North America - 9.4% (Table 1). The detailed breakdown in nationalities can be found in the (Supplementary Table 1).

Table 1 - the Nationality of the respondents to the survey

Nationality	Number of Respondents
Asia	239
North America	33
South America	1
Europe	35
Middle East	11
Oceania and Australia	7
United Kingdom (British Passport)	12
Africa	11
Russia	1

29.5% (104/352) of international students studied in the UK prior to applying to medical school; of which 27 were pre-medical students (35.5%, 27/76), 67 were current international medical students (26.7%, 67/251) and 10 were medical postgraduates (40%, 10/25). The median duration of studying in the UK for international students prior to applying for medicine was 2 years (IQR 2-4).

Factors influencing students to study medicine in the UK

Out of six given reasons that influenced the decision to study medicine in the UK, clinical and academic opportunities were the most important factors (96%) among all the international students (Figure 1a). This was consistently seen in all three subgroups (Figures 1b-d).

Among all respondents, this was followed by the quality of life (70%), role model advice (60%), financial prospects (51%), political landscape (42%) (Figure 1a). The least important factor was for family reasons (39%) (Figure 1a), which was seen consistently across all three groups: 43% in the pre-medical group, 40% in the medical group and 24% in the post-graduate group. (Figures 1b-d).

59% of students in the pre-medical student group ranked the political landscape in both the student's home country and the UK as more important factors to be considered when compared to the medical student and postgraduate group. This was statistically higher (p=0.0002) compared to the medical student group (38%) and borderline significant (p=0.0503) compared to the post-graduate group (36%) (Figure 1c-d).

Overall quality of life was the second most influential factor to motivate students to study medicine in the UK, this was demonstrated to be significantly lower in the post-graduate group, compared to the pre-medical (*p=0.01*) and medical group (*p= 0.02*) (Figures 1c-d).

Role model advice was also amongst the more important factors prompting pre-medical school students to study in the UK, with 70% of this cohort agreeing to this, compared to 59% in the medical student group (p=0.0697) and 40% in the post-graduate group (p=0.0114) (Figures 1c-d).

42.3% (149/352) gave additional factors (assessed qualitatively below in Table 2) that influenced their decision to train in the UK. Some of the respondents stated the motivation to move abroad stems from the culture of practising medicine in the UK, while others came to experience living abroad. From the medical students' and postgraduates' perspectives, they cited that the UK medical degree is internationally recognised with clear training pathways, without the requirement of a previous degree. Many came for the high quality of education offered, with better career prospects following graduation. Eleven respondents cited that they did not get into the medical school in their home country (Table 2).

Table 2: Factors attracting international students towards a UK medical school

Facilities, Opportunities and quality of the medical curriculum	*"Yes, Indian med schools don't have facilities equivalent to UK medical schools "* *"The quality of education and the historical cities in the UK itself* *"The course here is much more clinically oriented than in Europe. It is also less heavy on the student, giving the students an opportunity to have a life outside of their medical school."* *"Research opportunities (such as PhD intercalation)* *"Quality of education and job opportunities "* *"Prominent research landscape across the board, and a variety of UK-based educational materials"* *"Different curriculum +supportive tutor and student relationship+research opportunities"* *"better teaching facilities, course structures"* *Good quality of medical education and medical work in the UK!"* *"Academic scholarship opportunity "*

	"Because of its well equipped medical schools and trained medical professionals that lecture In most of these medical schools."
Prestige and recognised internationally	*"International community, high level of education "* *"Reputable degree with top class education "* *"I can immediately study medicine and it's only for 5/6 years. Prestige"* *"Better reputation and more recognised than the medical schools in Singapore. "* *"An MBBS degree from the UK is more internationally recognised. "* *"The degree is accepted in many other countries so it would be easy to travel."* *"Viewed as a prestigious place to study medicine "* *"validity of the degree in other countries, support to students, structure of post grad training"* *"The UK medical degree is very well valued around the world, including in India and the UAE (My country of residence) "* *"Studying in English seemed the most helpful internationally. "*
Post-graduate prospects	*"The degree is valued internationally and can increase bargaining power amongst graduates to ask for higher salaries in overseas countries."* *"Higher job opportunities in the future "* *"More career opportunities after completing a UK degree"* *"Better future career options. "*
Overseas experience and study culture	*"Yes, to gain more exposure by studying abroad"* *"love to stay in the uk for a couple more years"* *"To experience something new/different"* *"I love the country, always did."* *"exciting experience* *"I enjoy the learning culture in UK much more than in my home country"* *"perhaps the diversity within the school environment "* *"Life experience" ; "Better life" ; "Work life balance"*
Convenience and language	*"Partnered medical school with university back home "* *"Studied in British system* *All education was tailored to eventually study university in the UK* *English speaking medical curriculum "* *"Studying A-Levels in sixth form, it's sort of an "expectation" that using that you would go to the UK for further education"* *"It was just easier for me to apply to a UK medical school rather than an Indian medical school, as Indian medical schools are more competitive."* *"not as fluent in mother tongue"* *"More fluent in english than in home country language* *"More familiar with the system; language"* *"Language"* *"I've studied here a long time and my native language is nowhere near good enough at University level.* *"I would like to study medicine in English."* *"I speak English better than I do french/Flemish/German so couldn't study in Belgium "* *"I am used to UK's NHS and education system, which helps with my studies "* *"easier to apply from UCAS since I did my A-Levels in the UK so easier to apply within the system rather than apply to a university in my home country, India.* *"Easier pathway for international students to study medicine in comparison to other countries"* *"Direct start without premed"* *"Already studying in the UK "* *"Studied in a British school prior to this so led to pursuing further education here "*

Time saving	*"Undergraduate course vs postgraduate back home. Would end up saving 3 years."* *"Time saving in terms of graduating"* *"The pathway to becoming a doctor is the most straightforward. Getting accepted into a medical program straight out of high school automatically puts me on the path to becoming a doctor and ensures that I gain relevant clinical experience throughout my undergraduate years."* *"The duration of the course is shorter compared to other countries."* *"Takes less time to do it in the UK. "* *"Shorter training years compared to other countries"* *"Shorter length for qualification compared to other countries"* *"In Canada, you need an undergraduate degree in order to apply to medical school."* *"In Canada, the process to become a doctor is significantly longer, and slightly harder (since more qualifying exams need to be written)."* *"Medical school in North America employs the 4 + 4 model of undergraduate + graduate medicine (MD). Studying in the UK was a way to guarantee becoming a doctor in a shorter period of time."*
Politics	*"Our country has too many doctors. I wish to work in the UK and experience world-class education."* *"Politics in HK"* *"The major issue in Malaysia for medical graduates is the biased and unfair system of awarding contracts to houseman officers. We do not know how they determine who is awarded the positions as the process is not transparent. There are many other issues such as the ratio of number of doctors produced to the number of patients in Malaysia is also one of the highest in the world as we simply just have too many medical schools especially from the private sector and not enough positions to compensate for them. Thus many medical graduates in Malaysia face the prospect of going jobless after completing their clinical training."*

Perception about UK tuition fees and training costs for a medical degree

32.9% of international pre-medical students thought the average international student would have paid £200 000 - £300 000 (£UK 2021) upon completion of a medical degree in the UK, as shown in the Table 3. This perceived amount is significantly higher compared to the medical student (p=.00001) and post-graduate (p=0.0067) groups (Table 3).

Table 3 Perceived/ known tuition fees paid by international students upon completion of a medical degree by pre-medical student, medical student and medical school graduates. Median perceived/ known tuition fees are highlighted in bold (£UK 2021).

On average, total tuition fees upon completion of UK medical degree paid by international student	Pre-medical %(response)	Medical students %(response)	Medical School Graduates %(response)
Less than £50,000	5.3% (4)	0.8%(2)	-
£50,000 - £100,000	5.3% (4)	2.7%(7)	12%(3)
£100,000 - £200,000	13.2%(10)	41.4%(104)	**44%(11)**
£200,000 - £300,000	**32.9%(25)**	**38.2%(96)**	20%(5)
£300,000 - £400,000	6.6%(5)	7.6%(19)	12%(3)
£400,000 - £500,000	15.8%(12)	3.58%(9)	-
£500,000 - £600,000	7.9%(6)	2.4%(6)	-
More than £600,000	13.2%(10)	3.2%(8)	12%(3)

As for the total cost of training, 19.7% of international pre-medical students thought it cost £300 000 - £400 000 to train a medical student to be a doctor; 14.5% thought it cost more than £600 000 to train a doctor. 30.7% (77/251) international medical students thought it cost £50 000 - £100 000. In the international medical school graduates' group, 32% (8/25) thought it cost £50 000 - £100 000. This perceived amount by the pre-medical student group is significantly higher compared to the medical student group ($p<0.0001$) and post-graduate group ($p<0.0001$). (Table 4) (Supplementary Table 2)

Table 4 Perceived estimated total cost of medical training required to produce a doctor by pre-medical students, medical students and medical school graduates. Median estimated cost is highlighted in bold (£UK 2021).

Total cost to train a medical student to become a doctor in the UK (Average)	Number of responses (Pre-medical international students)	Number of responses (International medical students)	Number of responses (International medical school graduates)
Less than £50,000	2.6%(2)	17.1%(43)	20%(5)
£50,000 - £100,000	7.9%(6)	30.7%(77)	**32%(8)**
£100,000 - £200,000	15.8%(12)	**20.3%(51)**	32%(8)
£200,000 - £300,000	18.4%(14)	13.5%(34)	12%(3)
£300,000 - £400,000	**19.7%(15)**	9.2%(23)	4%(1)
£400,000 - £500,000	10.5%(8)	4.8%(12)	-
£500,000 - £600,000	10.5%(8)	1.6%(4)	-
More than £600,000	14.5%(11)	2.8%(7)	-

Both the medical student and pre-medical students thought the tuition fees paid by international students upon completion of a medical degree were statistically different to the total cost of medical training for a student to become a doctor ($p=0.0007$) and ($p<0.0001$) respectively. In the post-graduate group, there is no statistically significant difference ($p=0.1965$) in the perception of total tuition fees paid and the total cost of medical training.

There was a significant association between the students' perception of the value of a UK medical degree and their perception of the cost to train a medical student to a doctor where those that tended to disagree that the UK medical degree was value for money suggested lower cost to train a medical student to a doctor ($p = 0.00013$, Supplementary Figure 1). There was no association between their perception of value of a UK medical degree and their perception of total tuition fees paid ($p = 0.1613$, Supplementary Figure 2)

ACT Levy

84% (296/352) of international students were not aware of ACT Levy. Overall, 85% of international students stated that Act levy would probably influence their decision to study medicine in the UK (44% very likely, 24.1% likely, 16.2% somewhat likely). The pre-medical student group was significantly influenced by ACT levy compared to the ($p<0.001$) medical and ($p= 0.0026$) post-graduate group. 74% of the pre-medical student group rated Act Levy would affect their decision to study medicine in the UK (23.7% very likely, 23.7% likely, 25% somewhat likely) with neutral and unlikely being 13% and 14% of the cohort respectively.

International students' concerns

Free text responses, were provided by 26.1% (92/352) of respondents, and qualitative analysis demonstrated the students' general concerns. The majority of the pre-medical student group had no concerns (49.9%), 16.5% felt that the cost of the degree was the major concern, followed by 11.0% who feared unconscious bias and racism (Table

5). Other concerns include challenging application process for medical school admissions, learning style and potential terrorism.

Table 5 shows the results of the thematic analysis conducted from the responses in the free text box asking whether there were any additional concerns amongst international students coming to the UK to study medicine.

Themes	Individuals %
Impact of COVID-19 on the curriculum	2.2%
Lack Of University Support/guidance	5.5%
Culture shock/fitting in	6.6%
Post-graduate working conditions and job prospects	7.7%
Racism	11.0%
Cost Of Degree	16.5%
Other	9.9%
No Concerns highlighted	49.9%

Postgraduate and existing medical students (276/352) were asked if they had adapted well to the UK and been well supported by their medical school, university students' societies and other methods of support, according to four specific domains (Figure 2). Most students felt they had adapted well academically (75%) and socially (76%). 60% felt they had adapted well culturally while 25% disagreed. Only 28% of the international medical students felt well supported financially, 15% were neutral and 57% disagreed.

Working in NHS upon graduation

28.4% (100/352) of the respondents were unsure about working in the NHS upon graduation with 58% (204/352) saying they would like to work in NHS and 8% (28/352) saying they did not want to work in the NHS respectively. Of the total respondents, 5.6% (20/352) are currently working in the UK, thereby accounting for 80% (20/25) of the post-graduate cohort.

All respondents were asked whether they would consider working in the NHS; 27.8% (98/352) were unsure, 29.3% (103/352) would like to work for two years until the completion of Foundation Year 2, 28.7% (101/352) would like to work for up to 10 years or until the completion of speciality training. A further 9.4% (33/352) would like to work as a consultant indefinitely, meanwhile 4.8% (17/352) would like to leave immediately upon medical school graduation. Their wishes regarding work in the NHS did not significantly differ among the subgroups (p=0.3).

The overall value of the UK medical degree

Overall, 96% of international students felt that more financial support should be given to them with 93% saying they would be more likely to apply for a UK medical degree if financial support was provided. 83% expressed that they would be more likely to work in the UK if more financial support was given, with 84% responding that they would consider entering into a contract to work for the NHS for at least five years, if there was more financial support for them to study medicine (Figure 3).

In general, 54% of students felt the UK degree was value for money. There was a statistically significantly different opinion ($p<0.05$) among the subgroups; In the pre-medical school group, 71% felt that the UK degree is good value for money (17% were

unsure, 12% disagreed with the statement), which was significantly ($p<0.0001$) higher than the 52% strongly agreeing and 20% of medical school students agreeing (15% were neutral, 23% disagreed) and post-graduate (24% remained neutral, 56% disagreed) groups respectively. The post-graduate student's perception of the value for money of the UK medical degree was also significantly different ($p=0.0054$) when compared to the other groups.

DISCUSSION

This study evaluates the perceptions of previous, current, and prospective international students regarding UK medical education.

The results showed that clinical and academic opportunities were the most significant factors that attracted respondents to pursue medicine in the UK. However, among the three groups, there are significant differences in perspectives regarding the financial value of a medical degree in the UK, establishing that pre-medical students' are the most optimistic, closely followed by the existing medical students and then postgraduates. The study's results highlight two important aspects for consideration regarding the future of medical education in the international arena: the cost of a medical degree and quality of medical training.

Cost of UK medical degree

Potential reasons for pre-medical students perceiving the cost of a UK medical degree higher than actual paid cost of the degree compared with the perception of medical

students and medical graduates may be explained by the influence of the "perceived prestige and glamour" by friends, family, and social media.[15] As evidenced by our findings, medical students and graduates think that the tuition fees paid for a UK medical degree are higher than the actual cost to train a medical student to become a doctor. This gradual skewing of perception from pre-medical to post-graduate could be due to the progressive disagreement that a UK medical degree is good value for money (Supplementary Figures 3-4).

In 2017, the Department of Health quoted an average funding cost of £230,000 per medical student, of which 67% (£151,000) is a grant to the placement provider and medical school, while 33% (£64,300) constitutes repayable loans and bursary to students for living costs and tuition.[5,9] This cost of £230,000 per student is closer to the estimates suggested by the pre-medical student group than that of the medical student and graduate groups. Despite this, there is no clear breakdown of how these costs are utilised. For example, the costs of insurance and indemnity, placement-based teaching sessions, and other clinical resources. Given the plans to further increase international medical tuition fees via the ACT Levy, it is important that this breakdown should be transparent.

It should be noted that the future salary offered to graduates may not offset the total cost of the degree for international students.[2,16] Given the current trend and the assumption that international medical graduates utilize 10% of their basic salary to repay student debts, it could take up to 28 years to complete repayment of the total debt accumulated during their degree.[2,16] The implementation of ACT Levy will further contributes to the financial burden on international medical students; it is

therefore important that applicants are well-aware of these long-term financial implications before applying to medical schools.

More work could be done to increase the transparency of the cost of medical training, especially for international medical students. This applies to the current cost of training and the added cost from the ACT Levy [17]. Universities are keen to enrol international students for financial reasons; maintaining an element of transparency is key to ensuring that the consumer rights of these students are preserved [18]. For the international student, having the knowledge of the breakdown of these additional costs is a key factor in the decision-making process when applying to study medicine in the UK.

Quality of undergraduate training

The quality of medical education and international prestige are attractive factors for international students.[19] Medical education in the UK is renowned for advanced technological facilities, research and intercalation opportunities.[19-21] Furthermore, the General Medical Council (GMC) oversees undergraduate and postgraduate training experience and provides quality assurance, when stipulated professional outcomes need to be achieved.[19,20] This instils confidence in international students as it reduces the variation in the abilities of graduates from different UK medical schools.

However, there has recently been a rapid increase in the number of GMC-approved medical schools in the UK and overseas, [5,6,9-10] with up to 13 new medical schools

currently being developed. Furthermore, as intercalated degrees no longer count for points in the UK foundation program application,[22] this policy might lower students' motivation to intercalate and reduce the focus on research in the undergraduate curriculum.[22] Current and new medical schools will need to ensure their curriculum provide research opportunities as part of their high quality teaching. International students' expectations of the UK medical degree have to be maintained despite these changes in policies. [5,6,9-10]

The COVID-19 pandemic increased the virtual delivery of the medical curriculum. [23,24] Distance learning inevitably reduces the use of university facilities, student-to-student interaction and social experience. In our study, 15% of students felt that they did not receive adequate support academically during the pandemic, while 18-25% of international students reported that they did not feel supported socially or culturally during medical school. The study was unable to determine the actual contribution of the pandemic on this perception as only 2.2% described the COVID-19 impact on the curriculum (Table 5) as an additional factor causing concern for international students studying medicine in the UK. However, lack of cultural diversity and knowledge, potential discrimination and homesickness are long standing issues for international students adapting to life away from home. [25]

Strengths and Limitations

This is the first study to systematically evaluate the perceptions of pre-medical, medical and post-graduate international doctors on the value of a UK medical degree and factors influencing their decision to study in the UK. It is important to understand these concerns following the adverse impact of the pandemic on globalisation and

dissatisfaction among UK junior doctors towards their working conditions and their pay post-graduation.

A key study limitation is the selection bias introduced through questionnaire distribution by contacts and networks known to the study team. However, 24 medical schools and 64 secondary schools (nationally and internationally – 6 countries in total) were approached. Individuals did not enter their secondary school name/location due to small numbers of respondents so it was not possible to determine a response rate for each secondary school approached. Although not a limitation per se, the majority of respondents were female (62.8%) and from Asian nationalities (67.8%); motivations and perceptions of a UK medical degree within these demographics need to be considered when interpreting the results. With regards to post-graduate students, there is also likely recall bias towards their perceptions of the value of the degree and the influences for decisions to study in the UK and this was our smallest sample size (n=25).

The study period encompassed the COVID-19 pandemic (April – July 2021) and some students may have experienced additional stress and isolation which might have affected their motivation to pursue a medical degree during this time.

Future work

With the removal of the residential labour market stress test, International medical graduates (IMGs) from overseas can compete freely with graduates from the UK and

in 2020, the GMC reported that more IMGs registered with the GMC than UK graduates. [26] It is likely that IMGs pay less fees in their home countries than international students in the UK. Due to this change in policy, there is no longer an advantage for the UK medical graduate, as competition is equal among all medical graduates. [23] Obtaining a medical degree prior to migrating to the UK to obtain postgraduate training could be perceived as a more economical way to progress in the medical career.

The high tuition fees will be a major obstacle for students who are unable to secure funding from their home country, with only 28% of students feeling financially supported. In this study, 84% of international students stated that they are willing to enter a contract to work for the NHS for at least 5 years if financial support is provided. This would be a favourable strategy so they can contribute to national taxation and help retain the doctors who have benefited from UK training. The development of medical apprenticeships and widening access schemes to medicine are also being discussed as methods of increasing the number of doctors and healthcare professionals to address the workforce shortage. This raises the question as to whether there is a need for widening access schemes for international medical students, [5,6] especially if the government would like to attract the best candidates from the international community to work in the UK.

Currently there is a problem with retention of junior doctors in UK due to dissatisfaction about pay and work-life balance [27] [28]. There has also recently been overwhelming support of junior doctors to carry out industrial action (98% voted for industrial action with a 77% turnout) for better pay [29]. Policy makers need to consider how to address some of these problems to retain this important workforce within the NHS.

Conclusion

The quality of medical education and international prestige are still the most important factors that influence international students to study medicine in the UK. However, further work is needed to ascertain reasons for the differing perceptions of the value by international students at different stages in their clinical training.

The UK currently faces a shortage of doctors and it is therefore important to retain junior doctors who have benefited from undergraduate training in the UK. Policy makers could consider financially supporting international students who graduate and would like to continue to work for the NHS.

ACKNOWLEDGEMENTS: The authors would like to thank Cardiff University Healthcare International Perspectives Society (CHIPS), OSCEazy, In2MedSchool, The Hong Kong Medical University of United Kingdom (HKMUSK) for their collaboration on this study.

VISION Collaborators

Sai Pill, Paarth Kishan Gupta, Renee Punia, Katie Cheung, Diva Jhaveri, Aaron Gnanabalan, Italia-Rosa Leech, Faith Lee, Elizabeth Wong, Kar Phoong, Memory Moyo, Isha Thakar, Viraj Shah, Rohan Gupta, Tushar Rakhecha, Movin Peramuna Gamage, Nishaanth Dalavye, Allen Mathew , Parvathy Sureshkumarnair, Sripradha Srinivasan, Becky Leveridge.

Contributors

CL and SG (conception, methodology, data curation, formal analysis, writing and reviewing). TP (methodology, project administration, writing, reviewing and editing), AG (methodology, project administration, data collection, writing, reviewing and editing, SML (methodology, project administration, data collection, data analysis, writing), RB and SM (creating data collection form, data collection, data analysis, writing), FEF (methodology, writing , organising webinar, project administration), SO (methodology, project administration, reviewing and editing) ,TW (conception, design, reviewing and editing), VY (writing, reviewing and editing). HS (conception, design, methodology, writing, reviewing and editing and supervising). All authors contributed to this article and approved the submitted version. VISION Collaborators have contributed to data collection and distribution of the study survey.

COMPETING INTERESTS: The authors declare none.

FUNDING: This study received no specific grant from any agency, commercial or non-profit sectors.

Data sharing statement: No additional data available. Raw data available at reasonable request.

Ethical Approval

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study had been reviewed and approved by the ethical research committee at the School of Medicine at Cardiff University, SMREC reference number 21/22.

REFERENCES

1. UCAS. UCAS Undergraduate Data Release Archive, 2022. Available at: <https://www.ucas.com/corporate/data-and-analysis/ucas-undergraduate-releases/ucas-undergraduate-analysis-reports/ucas-undergraduate-end-cycle-reports> [Accessed 15 Feb 2022].
2. Royal College of Physician London. The bubble set to burst: Is the UK's medical recruitment unsustainable after BREXIT?. *RCP Annual Conference.* 2021; 5:23. Available at:

https://70b706f2.flowpaper.com/NovemberCommentary/#page=23 [Accessed 3 Oct 2021]

3. Enoch T, Ooi R, Ooi S. Impact of the implementation of the additional cost of teaching (ACT) levy on prospective international medical students applying to Northern Ireland and Scotland. *Postgrad Med J*. 2021 Apr 20:postgradmedj-2021-140194. doi: 10.1136/postgradmedj-2021-140194.
4. Aberdeen U. Tuition fees the school of medicine, medical sciences and nutrition the University of Aberdeen, 2021. Available: https://www.abdn.ac.uk/smmsn/undergraduate/medicine/tuition-fees.php [Accessed 3 Oct 2021]
5. GOV.UK Department of Health and Social Care. Expanding undergraduate medical education, 2021. Available from: https://www.gov.uk/government/consultations/expanding-undergraduate-medical-education[Accessed 3 Oct 2021].
6. The BMJ. Expanding undergraduate medical education in the UK - but at whose cost?, 2021. Available at: https://www.bmj.com/content/356/bmj.j1370/rr-0 [Accessed 3 Oct 2021]
7. Queen's University Belfast. International Tuition Fees, 2022. Available at: <https://www.qub.ac.uk/International/International-students/International-tuition-fees/> [Accessed 15 Feb 2022].
8. HEPI. The UK's tax revenues from international students post-graduation, 2022. Available at: <https://www.hepi.ac.uk/2019/03/21/the-uks-tax-revenues-from-international-students-post-graduation/> [Accessed 15 Feb 2022].

9. Royal College of Physicians. Double or quits: a blueprint for expanding medical school places, 2021 Jan.
10. Office for Students. Health education funding, medical and dental target intakes, 2021. Available at: https://www.officeforstudents.org.uk/advice-and-guidance/funding-for-providers/health-education-funding/medical-and-dental-target-intakes/ [Accessed 3 Oct 2021]
11. Team, P.S.L. (2021) *Medical Staffing in England: A defining moment for doctors and patients (BMA, 11 July 2021)*, *Patient Safety Learning - the hub*. Available at: https://www.pslhub.org/learn/improving-patient-safety/workforce-and-resources/safe-staffing-levels/medical-staffing-in-england-a-defining-moment-for-doctors-and-patients-bma-11-july-2021-r4856/ (Accessed: April 8, 2023).
12. *Working together to improve NHS staff experiences: NHS staff survey* (no date) *Working together to improve NHS staff experiences | NHS Staff Survey*. Available at: https://www.nhsstaffsurveys.com/ (Accessed: April 8, 2023).
13. *Training pathways: Why do doctors take breaks - general medical council* (no date). Available at: https://www.gmc-uk.org/-/media/documents/dc11392-training-pathways-report_pdf-75268632.pdf (Accessed: April 8, 2023).
14. UK Council for International Student Affairs. International student advice and guidance — England: fee status, 2021. [accessed 3 Oct 2021] Available at: https://www.ukcisa.org.uk/information--advice/fees-and-money/england-fee-status [Accessed 3 Oct 2021]
15. McHarg, J., Mattick, K., Knight, L. Why people apply to medical school: implications for widening participation activities. *Medical Educ.* 2007; 41(8): 815-821.

16. Ooi, S., Ooi, R., Godoi, A. et al. Motivations of medical students and doctors leaving the NHS explored in a residency training application webinar series. *Postgrad Med J.* 2021 Oct 21:postgradmedj-2021-140795. doi: 10.1136/postgradmedj-2021-140795.
17. GOV.UK Competition & Markets Authority. Higher education: guide to consumer rights for students, 2015. Available at: https://www.gov.uk/government/publications/higher-education-guide-to-consumer-rights-for-students [Accessed 29th Mar 2022]
18. Levent F. The economic impacts of international student mobility in the globalization process. Journal of Human Sciences. 2016;13(3).
19. General Medical Council. Standards of UK medical education, 2021. Available from: https://www.gmc-uk.org/education/becoming-a-doctor-in-the-uk/standards-of-uk-medical-education [Accessed 3 Oct 2021]
20. Quraishi S, Wade W, Black D. Development of a GMC aligned curriculum for internal medicine including a qualitative study of the acceptability of 'capabilities in practice' as a curriculum model. *Future Healthc J.* 2019; 6(3):196-203. doi: 10.7861/fhj.2018-0016
21. Bustin S. Science in the UK − whereto now?. Biomolecular Detection and Quantification. 2016;9:A1-A4. doi: 10.1016/j.bdq.2016.08.001
22. Tonkin T. Additional achievements ruled out of foundation programme applications. *BMA,* 2021. Available at: https://www.bma.org.uk/news-and-opinion/additional-achievements-ruled-out-of-foundation-programme-applications [Accessed 4 Oct 2021]

23. Harries A., Lee C., Jones L., et al. Effects of the COVID-19 pandemic on medical students: a multicentre quantitative study. BMC Medl Educ. 2021;21(1). doi: 10.1186/s12909-020-02462-1

24. Papapanou M., Routsi E., Tsamakis K., et al. Medical education challenges and innovations during COVID-19 pandemic. Postgrad Med J. 2021 Mar 29:postgradmedj-2021-140032. doi: 10.1136/postgradmedj-2021-140032.

25. Kristiana, I.F. *et al.* (2022) *Social support and acculturative stress of international students*, *International journal of environmental research and public health*. U.S. National Library of Medicine. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9180523/ (Accessed: April 8, 2023).

26. *The Changing Medical Workforce - GMC-uk.org* (no date). Available at: https://www.gmc-uk.org/-/media/documents/somep-2020-chapter-3_pdf-84686032.pdf?la=en&hash=D2F3AD68AF8820D40A285BDC6A391A85A780C88B (Accessed: April 8, 2023).

27. Lock, F.K. and Carrieri, D. (2022) *Factors affecting the UK junior doctor workforce retention crisis: An integrative review*, *BMJ open*. U.S. National Library of Medicine. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8960457/ (Accessed: April 8, 2023).

28. A;, W.H.C.P.A.S.S.B. (no date) *Drexit: Understanding why junior doctors leave their training programs to train overseas: An observational study of uk physicians*, *Health science reports*. U.S. National Library of Medicine. Available at: https://pubmed.ncbi.nlm.nih.gov/34646946/ (Accessed: April 8, 2023).

29. Patterson, C. (2023) *Junior doctors vote yes to industrial action*, *The British Medical Association is the trade union and professional body for doctors in the UK.* British Medical Association. Available at: https://www.bma.org.uk/news-and-opinion/junior-doctors-vote-yes-to-industrial-action (Accessed: April 8, 2023).

Legends

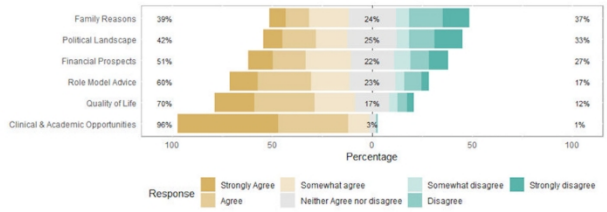
Figure 1 shows the proportion of responses of factors influencing students to study medicine in the UK, a) Overall responses, b) Pre-medical responses, c) Medical

Responses d) Post-graduate responses. Percentages in the middle of the figure denote those who neither agree nor disagree whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

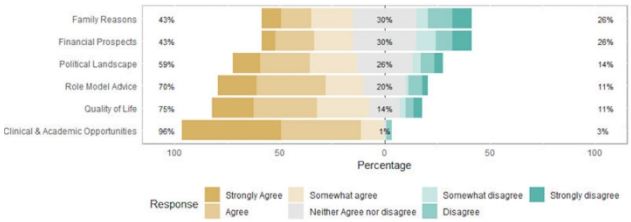
Figure 2 shows four domains in which postgraduate and existing medical students (276/352) were asked if they had adapted well to the UK and were well supported through the medical school, university students' societies and other methods of support. Percentages in the middle of the figure denote those who are neutral whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

Figure 3 shows 5 domains which pre-medical, medical and postgraduate students were asked to consider in relation to value of a UK medical degree. Percentages in the middle of the figure denote those who are neutral whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

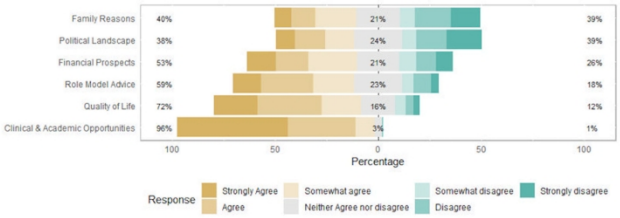
a) Overall



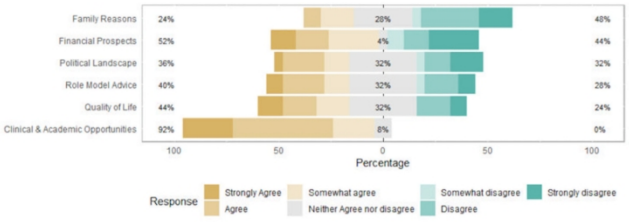
b) Pre-medical



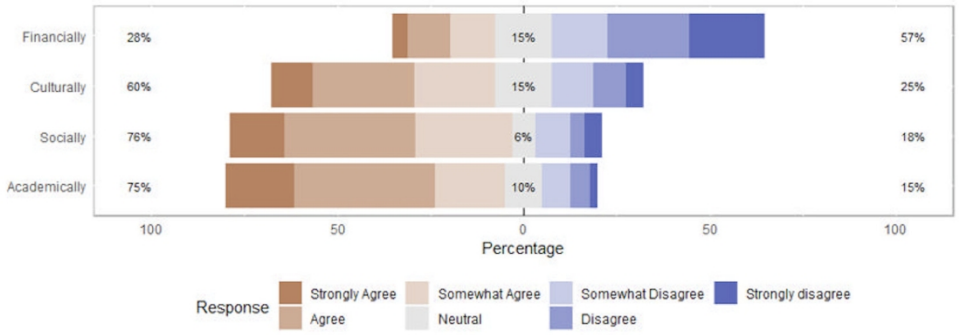
c) Medical



d) Post-graduate



198x366mm (300 x 300 DPI)



148x56mm (300 x 300 DPI)

175x255mm (300 x 300 DPI)

Supplementary Appendix

Supplementary Table 1 – the detailed breakdown of the nationality of the respondents to the survey

Nationality	Number of Respondent
American	9
Australian	5
Bahraini	3
Bangladeshi	1
Belgian	1
Brazilian	1
British	12
Bruneian	1
Burmese	3
Canadian	23
Chinese	16
Cypriot	3
Dutch	2
Egyptian	3
Fijian	1
Finnish	2
French	4
Gambian	1
German	2
Ghanaian	1
Greek	2
Hong Kong	36
Indian	62
Iranian	2

Iraqi	1
Irish	4
Italian	3
Japanese	4
Jordanian	2
Kenyan	1
Libyan	3
Luxembourger	1
Malaysian	76
Maldivian	1
Maltese	1
Mauritian	2
Namibian	1
New Zealander	1
Nigerian	2
Polish	2
Portuguese	1
Romanian	2
Russian	1
Sierra Leonean	1
Singaporean	21
South Korean	4
Spanish	1
Sri Lankan	2
Swedish	3
Swiss	2
Taiwanese	2
Tanzanian	1

Thai	6
Trinidadian or Tobagonian	1
Turkish	1
Zimbabwean	2

Supplementary Table 2a – 2m

Supplementary 2a: Perceived/ known tuition fees paid by international students upon completion of a medical degree by pre-medical student, medical student and medical school graduates.

Kruskal-Wallis rank sum test, p value<0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**<0.0001**	**0.0067**
Medical	**<0.0001**		**0.8934**
Post-graduate	**0.0067**	**0.8934**	

Supplementary 2b: Perceived estimated total cost of medical training required to produce a doctor by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value<0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**<0.0001**	**<0.0001**
Medical	**<0.0001**		**0.3400**
Post-graduate	**<0.0001**	**0.3400**	

Supplementary 2c: Perceived clinical and academic opportunities by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.5804**	**0.0435**
Medical	**0.5804**		**0.0049**
Post-graduate	**0.0435**	**0.0049**	

Supplementary 2d: Perceived financial prospects by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.32

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.3779**	**1.0000**
Medical	**0.3779**		**0.3896**
Post-graduate	**1.0000**	**0.3896**	

Supplementary 2e: Perceived family reasons by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.07

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.2185**	**0.0394**
Medical	**0.2185**		**0.1873**
Post-graduate	**0.0394**	**0.1873**	

Supplementary 2f: Perceived quality of life by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.5804**	**0.0435**
Medical	**0.5804**		**0.0049**
Post-graduate	**0.0435**	**0.0049**	

Supplementary 2g: Perceived impact of role model advice by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.02

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.0697**	**0.0114**
Medical	**0.0697**		**0.1357**
Post-graduate	**0.0114**	**0.1357**	

Supplementary 2h: Perceived political landscape in the UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value < 0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		0.0002	0.0503
Medical	0.0002		1.0000
Post-graduate	0.0503	1.000	

Supplementary 2i: Perceived ACT Levy by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value < 0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		<0.0001*	0.0026*
Medical	<0.0001*		0.9065
Post-graduate	0.0026*	0.9065	

Supplementary 2j: Perceived value for money by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value <0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		<0.001*	<0.001
Medical	<0.001*		0.0054*
Post-graduate	<0.001*	0.0054*	

Supplementary 2k: Perceived willingness to work for NHS for at least 5 years by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.96

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		1	1
Medical	1		1
Post-graduate	1	1	

Supplementary 2l: Perceived more likely to work in UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.92

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		1	1
Medical	1		1
Post-graduate	1	1	

Supplementary 2m: Perceived more likely to study medicine in UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.05

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		0.0329	1.0000
Medical	0.0329		0.3279
Post-graduate	1.0000	0.3279	

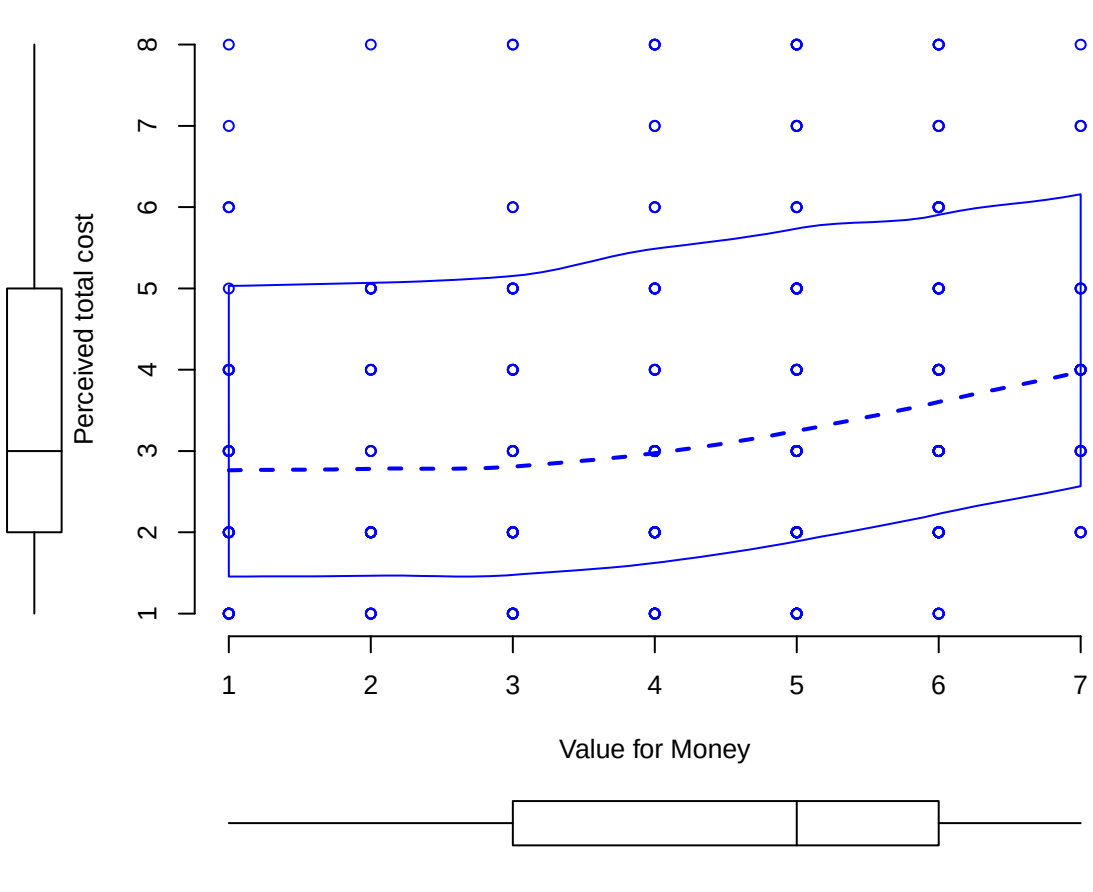
Supplementary 2n: Perceived more financial support should be given by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		0.2580	0.1189
Medical	0.2580		0.0081
Post-graduate	0.1189	0.0081*	

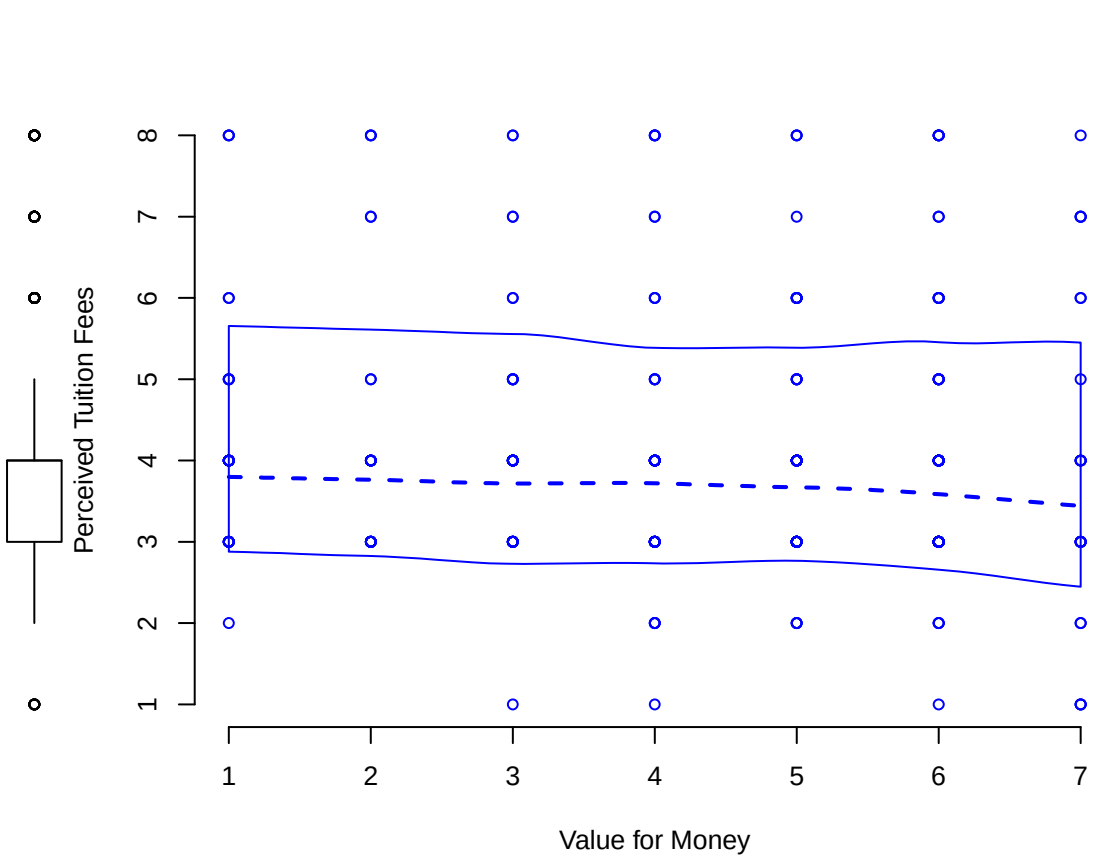
Supplementary Figure 1

Supplementary 1 is a graph comparing the perceived value for money of a UK medical degree with for perceived total cost to train a medical student to become a doctor among pre-medical students, medical students and post-graduates. The X-axis represents Groups 1-7; Group 1 : Strongly disagree, Group 2 : Disagree, Group 3 : Somewhat disagree, Group 4 : Neutral, 5 : Somewhat agree, Group 6: Agree, Group 7 : Strongly agree. Y-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000.



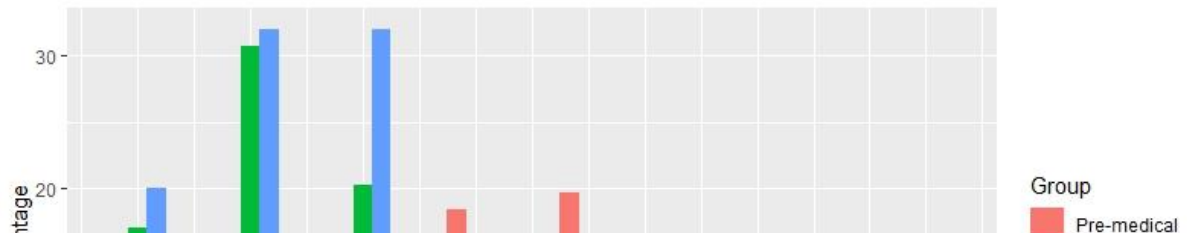
Supplementary Figure 2

Supplementary 2 is a graph comparing the perceived value for money of a UK medical degree with for perceived tuition fees paid among pre-medical students, medical students and post-graduates. The X-axis represents Groups 1-7; Group 1 : Strongly disagree, Group 2 : Disagree, Group 3 : Somewhat disagree, Group 4 : Neutral, 5 : Somewhat agree, Group 6: Agree, Group 7 : Strongly agree. Y-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000.



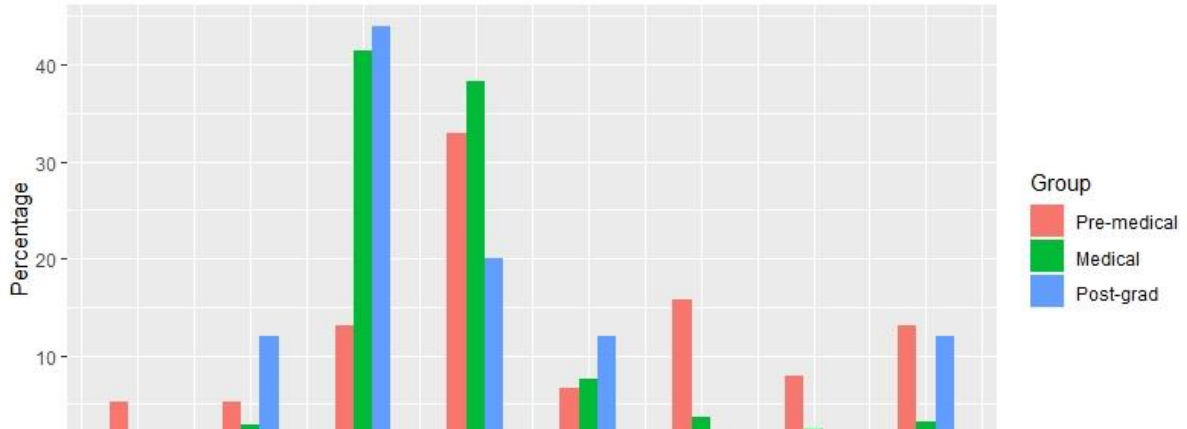
Supplementary Figure 3

Supplementary Figure 3 demonstrates a histogram for perceived cost of medical training among pre-medical students, medical students and post-graduates. X-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 - : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000; y-axis represents Percentage responses.



Supplementary Figure 4

Supplementary Figure 4 demonstrates a histogram for perceived tuition fees paid among pre-medical students, medical students and post-graduates. X-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 - : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000; y-axis represents Percentage responses.



Study protocol

Study title: The Value of a UK Medical Degree for International Students: A cross sectional study: (VISION)

1.**Background:** International students have brought in financial and economic benefit for the local community in the United Kingdom (UK). A medical degree for international students is one of the most expensive undergraduate degrees in the UK, the average cost for a five-year medical course is £185,297 and £236,737 for a six-year degree (for 2020/2021 entry). A recent commentary in the Royal College of Physicians noted that this could financially burden the international students who decide to work for the NHS upon graduation, which could deter them from choosing to study medicine in the UK.

After completion of the Brexit transition in January 2021, the definition of international students will eventually be applied to a wider population and this policy could impact the medical recruitments for international students. Additionally, COVID-19 and Brexit have already impacted the decision of international students to study in the UK. This study aims to evaluate the perception of international students in obtaining a medical degree in the UK with the hopes of maintaining the popularity of a UK medical degree in comparison to other countries.

Why is this important: The "Act Levy" is an additional cost of training for international students that has been implemented in Scotland and is currently under consultation to be further introduced in England and Wales. This will result in a £10,000 - £20,000 increase in medical tuition fees for international medical students (1). It is unclear how this policy could influence the decision of international students to study medicine in the UK.

2. Aims

This cross-sectional study aims to evaluate the perspective of graduates, existing and prospective UK medical students regarding the value of a UK medical degree for international students.

2.1Methods and study design: This is a cross-sectional observational study, using a secure online questionnaire, has been created via the REDCap database, supported by Medical Education from the School of Medicine at Cardiff University. This questionnaire will be circulated to different medical schools and secondary schools across the UK and internationally

2.2 Outcome measures

- Primary outcome: Students' perceptions and concerns in a cross-sectional student survey
- Secondary outcome: The difference in perception among the prospective students, existing students and graduates of UK medical schools.

3. Study Population

3.1 Inclusion and exclusion criteria:

All international students are eligible to be included in this study.

3.1.1 An international student is defined in this study using the definition of the UK Council for International Student Affairs (UKCISA) as:

- Non-British students (full-time or part-time in education); OR
- students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status

The sampling population could be further divided into three categories by our questionnaire: pre-medical school student, medical school student, and medical school graduate.

3.1.2 Pre-medical school student is defined as applicants currently:

- NOT studying a medical degree and planning to submit their application to medicine within two years. This includes Graduate entrance study and high-school students.

3.1.3 Medical school student is defined as:

- a student currently studying medicine or on a pre-clinical/foundation part of a medical degree where a medical degree is guaranteed upon successful completion of their degree.

3.1.4 Medical school graduate

- is defined as medical graduates who have completed a medical degree within the two-year preceding the study

4. Proposed timeline

Study duration:

- from 1st April 2021 - 31st July 2021 - data collection
- 31st July 2021 - all the data is locked in the database.
- 31st July - 31st August 2021 - data analysis
- Mid July 2021 - Conference Presentation (preliminary results presentation)
- 31st Aug - 31st Sep 2021 Write up and display the results to relevant organisations/journals.

5. Ethical approval: In the reviewing stage by research committees in the School of Medicine at Cardiff University

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

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Observational study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Yes. Informative and balanced summary is written and included in the abstract Line 44 - 71
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Yes. Written in the introduction section begins from line 84 – line 132
Objectives	3	State specific objectives, including any prespecified hypotheses Yes, on lines 135 -156, we evaluate the perception of the financial cost and value of the UK medical degree for international students (pre-medical, medical students and medical school graduates)
Methods		
Study design	4	Present key elements of study design early in the paper These are presented from lines 143 – 163.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection The setting, locations and dates are presented in lines 143-163 in study design section.
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants The eligibility criteria are defined in study population section and questionnaire circulation is described in lines 145 to 150.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Outcomes are defined in lines 191 – 207 and limitations including confounding are described in line 522 - 545
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 Our data is mainly quantitative and qualitative. Groups were pre-medical, medical and post-graduate international student.
Bias	9	Describe any efforts to address potential sources of bias Sources of biases are addressed in strengths and limitations section lines 522 - 545
Study size	10	Explain how the study size was arrived at Sample size calculations were not conducted as part of this analysis.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why This was explained in lines 209 – 221. As mentioned, three groups were chosen pre-medical, medical and post-graduates.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for

		confounding. This was explained in lines 209 – 221. Main analyses were a Kruskal-Wallis rank sum test, Dunn Test with Bonferroni adjustment and Spearman rank correlation coefficient.
		(*b*) Describe any methods used to examine subgroups and interactions Dunn Test with Bonferroni adjustment was used to examine subgroup relationships
		(*c*) Explain how missing data were addressed Missing data only exists in the optional fields, no further imputation or sensitivity analysis were made.
		(*d*) If applicable, describe analytical methods taking account of sampling strategy We have distributed our survey among our collaborators which is known to our network line 138 to line 146
		(*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 138 to line 146, Line 234 -line 243
		(b) Give reasons for non-participation at each stage Not applicable
		(c) Consider use of a flow diagram Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Line 234 -line 243
		(b) Indicate number of participants with missing data for each variable of interest Missing data only exists in the optional fields, no further imputation or sensitivity analysis were made. Line 241-243; Line 294 - 295
Outcome data	15*	Report numbers of outcome events or summary measures Line 265-441
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 Not applicable
		(*b*) Report category boundaries when continuous variables were categorized Line 265-441
		(*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 .This was explained in lines 209 – 221. Main analyses were a Kruskal-Wallis rank sum test, Dunn Test with Bonferroni adjustment and Spearman rank correlation coefficient. Correlation analysis was

		performed in the supplementary
Discussion		
Key results	18	Summarise key results with reference to study objectives Line 266- 411
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 Line 503-525
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Line 441 -488
Generalisability	21	Discuss the generalisability (external validity) of the study results Line 530 -566
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 No source of funding available / conflict of interest declared.

*Give information separately for exposed and unexposed groups.

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.

BMJ Open

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION); A CROSS-SECTIONAL STUDY

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-065062.R2
Article Type:	Original research
Date Submitted by the Author:	03-May-2023
Complete List of Authors:	Li, CHUNHEI; St George's University Hospitals NHS Foundation Trust, Vascular Surgery ; Cardiff University, School of Medicine ganesananthan, sashiananthan; Chelsea and Westminster Healthcare NHS Trust Pinchemain, Trevor ; Cardiff University School of Medicine Godoi, Amanda ; Cardiff University School of Medicine Lim, Shan Ming ; Cardiff University School of Medicine Baskaran, Ravanth ; Cardiff University School of Medicine Mukhopadhyay, Srinjay ; Cardiff University School of Medicine Foo , Eu Fang ; Cardiff University School of Medicine Ooi, Setthasorn Zhi Yang; Cardiff University School of Medicine, Woo, Timothy ; King's College Hospital NHS Foundation Trust Yeo, Vanessa ; Royal Glamorgan Hospital collaborators, VISION; Cardiff University School of Medicine Sweetland, Helen; Cardiff University School of Medicine
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Health policy, Health economics, Medical education and training, Medical management
Keywords:	MEDICAL EDUCATION & TRAINING, EDUCATION & TRAINING (see Medical Education & Training), International health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

THE VALUE OF A UK MEDICAL DEGREE FOR INTERNATIONAL STUDENTS (VISION); A CROSS-SECTIONAL STUDY

Chun Hei Li[1,*], Sashiananthan Ganesananthan [2,*], Trevor Pinchemain[3], Amanda Godoi[3], Shan Ming Lim[3], Ravanth Baskaran[3], Srinjay Mukhopadhyay[3], Eu Fang Foo [3], Setthasorn Ooi[3], Timothy Woo[4], Vanessa Yeo[5], VISION collaborators, Helen Sweetland[3]

1. St George's University Hospitals NHS Foundation Trust
2. Chelsea and Westminster Hospital NHS Foundation Trust
3. Cardiff University School of Medicine, Cardiff, United Kingdom
4. King's College Hospital NHS Foundation Trust, London, United Kingdom
5. Royal Glamorgan Hospital, Pontyclun, United Kingdom

*These authors contributed equally and should be considered as joint-first authors

Corresponding author:

CHUNHEI LI submitting on behalf of

Professor Helen Sweetland MD FRCSEd (Emeritus)

Cardiff University School of Medicine

Neuadd Merionydd Building

Heath Park

Cardiff

CF14 4XN

sweetland@cardiff.ac.uk

Keywords: medical education, international students, postgraduate training

ABSTRACT

Objectives

It is estimated that NHS staff consist of over 200 different nationalities, with a reported 30.7% of doctors holding a nationality other than British. Despite this, international medical students represent 7.5% of all medical students studying in the United Kingdom (UK) and pay on average, four-to-six times more in tuition fees when compared to the £9,250 per annum (Great British Pounds [£] in 2021) paid by home students. This study's aim and objective are to evaluate the perception of the financial cost and value of the UK medical degree for international students and their motivations for pursuing such a degree.

Methods

This is a cross-sectional observational study enquiring about international pre-medical, medical, and medical school graduates' perception of the value of the UK medical degree and factors influencing their decision to study in the UK.

A questionnaire was developed and distributed to 24 medical schools and 64 secondary schools both internationally and across the UK.

Results

A total of 352 responses from 56 nationalities were recorded. 96% of international students identified clinical and academic opportunities as the most important factors to study medicine in the UK, closely followed by quality of life (88%). The least important factor was family reasons, with 39% of individuals identifying this factor. Only 4.82% of graduates in our study considered leaving the UK after training. Overall, 54%

of students felt the UK degree was value for money. This belief was significantly higher in pre-medical students compared to existing students and graduates (71% versus 52% and 20%, p<0.001 for all comparisons).

Conclusion

The quality of medical education and international prestige are attractive factors for international students to study medicine in the UK. However, further work is needed to ascertain reasons for the differing perceptions of the value by international students at different stages in their clinical training.

Article Summary

Strength and Limitation

- First study that systematically evaluate the perceptions of pre-medical, medical and post-graduate international doctors on the value of a UK medical degree.
- Selection bias as study survey targeted 24 medical schools and 64 secondary schools that were known to the study team.
- Small sample size in postgraduate students further biases the subgroup comparison.

INTRODUCTION

The undergraduate medical degree is a highly popular and competitive degree in the United Kingdom (UK) with over 23,710 applicants (inclusive of British citizens, residents with settled status or overseas students) competing for less than 8,000 places in 2021.[1]

International students traditionally account for a small percentage of medical students, as the annual intake is capped at 7.5% for the full cohort. [2-6] In the UK, international students pay higher tuition fees compared to 'home' students (British citizens or residents with settled status) studying the same degree. Home students' fees are currently capped at £9,250 (Great British Pounds [£] in 2021) per annum [2-4] whilst international fees are four to six-fold higher, with the latter having the additional burden of their fees being subject to annual inflation as per the Retail Price Index [2,4]. Furthermore, the 'Additional Cost of Training' (ACT) levy was introduced in Scottish medical schools in 2016,[4] and to Northern Irish medical schools in 2021.[7] ACT Levy is the additional medical training costs introduced for overseas students studying in the UK to finance clinical skills training on clinical placements delivered by the NHS. Its implementation is now under consultation to be introduced in England and Wales. This may result in a further substantial increase in medical tuition fees of up to an additional £10,000 annually for international medical students [2-7]. A single cohort of all disciplines of international students was found to contribute £3.2 billion to the UK economy over a 10-year period through taxation and National Insurance payments, further highlighting the significant economic contribution from this population.[8]

Following the BREXIT transition in January 2021, the definition of international students' fee status applies to a wider population, including students from European

Union (EU) countries; this policy may potentially impact the recruitment of international medical students in the future.[4,9-10] Ultimately, this may create a selection bias towards students who have the financial means to pursue a UK medical degree, excluding those who may be capable of undertaking a UK medical degree but are unable to afford the tuition fees.[2,3]

These circumstances place the UK medical degree in a unique position in the global medical education landscape for aspiring international students. Despite being a costly investment, with the current UK medical degree ranking as the most expensive undergraduate degree in the UK,[1,4,7] it remains highly popular among international students with courses annually oversubscribed.[1] There is currently no data to demonstrate the motivation of international students to come to the UK to pursue medicine, taking into account not only the monetary value but also the value gained from the quality of life, societal and educational opportunities afforded by these institutions in the UK.

Identifying the motivation of this important subset (or potential subset) of the NHS medical workforce could allow policy makers to consider the current junior doctor retention crisis within the NHS in a nation with the second lowest doctor to population ratio in the EU [11]. One study found that one in ten junior doctors are considering leaving the NHS [12] while 16% of those who completed foundation training do not enter further training within three years [13] . These factors have significant implications on workforce planning and ultimately patient safety.

This study aimed to evaluate the perception of the financial cost and value of the UK medical degree for international students and their motivations for pursuing such a degree. The study analysed how these perceptions and motivations differ between

pre-medical students, medical students, and medical school graduates and analysed their perception of the 'value' of obtaining a UK medical degree.

METHODS

Study design

This online, multi-centred, cross-sectional study focused on the perceptions of a UK medical degree among pre-medical students, current medical students and recent medical graduates. A qualitative and quantitative based questionnaire was disseminated through collaborating university medical schools and established student networks across the UK and internationally, from 1st April 2021 to 31st July 2021. The questionnaire was circulated to 24 medical schools and 64 secondary schools (from 6 countries - United Kingdom, Malaysia, Singapore, Mozambique, Brazil, Vietnam). The survey was accessible as a secure online questionnaire on Microsoft Teams. The 40-item, self-administered questionnaire was developed by medical students from the Cardiff Healthcare International Perspective Society (CHIPS), which is a student-led society at Cardiff University. A review of the existing literature was performed to identify the gaps in knowledge and to look at similar questionnaires and qualitative studies on the perception of prospective, current and recently graduated international students of a UK medical degree. This allowed an understanding of domains and items relevant to determining the aim of the project. The questionnaire included a seven-point Likert scale, checkboxes, multiple-choice, and free-text questions to improve the granularity of the data. A pilot survey was distributed to a group of randomly selected 13 undergraduate international students (6 different nationalities represented), who were not involved in study conception or design, to

seek feedback, improve clarity and ensure objectivity. A copy of the final questionnaire can be found in the Supplementary Appendix Table 1.

Data processing

Throughout the period of data collection, the information received was kept in a password-protected Excel file. Prior to data analysis, all data was de-identified and stored securely. All relevant information remained non-identifiable throughout this study.

Study population

An international student eligible to be included in this study was defined using the definition from the UK Council for International Student Affairs (UKCISA) as 'non-British students (full-time or part-time in education); or students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status'.[14]

The sampled population was divided into three subgroups: pre-medical students, medical students, and medical school graduates. A pre-medical school student was defined as a student not currently studying a medical degree and who was planning to submit their application to medicine within two years of survey completion. This included high-school students, students currently taking a gap year and students who were planning to apply for graduate-entry medicine.

A medical student was defined as any student currently studying medicine or a pre-clinical component, where a medical degree is the outcome. A medical school graduate was defined as any individual who had completed a UK medical degree within two years of survey completion. This was to reduce the effect of recall bias and it is likely that some may have been affected by the ACT Levy. Participants were excluded if they did not provide consent to use of the data in publication and if they were a home student.

Outcome and statistical analysis

The study aimed to classify students' perceptions and concerns regarding a UK medical degree and determine the difference between these perceptions among prospective, existing and post-graduates of UK medical schools. Outcomes measured were predefined and categorised into four domains: 1) factors influencing international students to study medicine in the UK, 2) perception of the UK tuition fees (how much they believed or knew the total tuition fees paid by international students) and training cost for a medical degree (how much they felt or believed it cost to train a medical student to become a doctor in the UK) and Act Levy, 3) concerns about current support for international medical students in the UK, and 4) working in the NHS upon graduation.

A thematic analysis was performed by two independent reviewers (SM, RB) who systematically analysed the free-text responses and categorised them into different themes. Any discrepancies in the results were discussed among the two reviewers. If a consensus could not be reached, this was resolved by a third reviewer (SML).

Quantitative data was analysed independently by two authors (CL, SG). A Likert scale was used to quantify and rank the order of importance of the factors. The seven-points on the Likert scale ranging from 'strongly agree, agree, somewhat agree, neutral, somewhat disagree, disagree, strongly disagree' were linked to a numerical value of 1 to 7 respectively. The Kruskal-Wallis rank sum test was used for inferential analysis to compare non-parametric data among the three groups: medical student, pre-medical, post-graduate. Dunn test with Bonferroni adjustment was used as post-hoc adjustment. A Spearman Rank Correlation Coefficient Test was used to determine the association between the value of a UK medical degree and participants' perception of total tuition fees paid and the cost to train a medical student to a doctor. A p-value of less than 0.05 was set to be statistically significant in this study. All statistical analyses were performed in R programme version 3.6 (Boston, MA).

Patient and public involvement

No patients were involved in this study.

Ethical considerations

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study was reviewed and approved by the ethical research committee at the School of Medicine at Cardiff University, (SMREC reference number 21/22).

RESULTS

The study is reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting cross-sectional studies.

Baseline characteristics

A total of 468 responses were recorded. There were 116 responses which were excluded (85 home students; 31 did not consent). 352 responses were submitted by international students with 251 medical school students (median age 21, IQR: 20 to 23 years old), 76 pre-medical school students (median age 18, IQR: 17 to 19 years old) and 25 medical school graduates (median age 25, IQR: 24 to 26 years old). Of the 352 responses, 221 were female (62.8%), 122 were male (34.7%), 6 preferred not to say (1.7%), 1 was a transgender male (0.3%) and 2 mentioned that their gender was not listed (0.6%). Among those who provided a response (non-compulsory field), 104 reported having studied in the UK prior to applying for the medical degree, with a median time of 2 years (IQR 2-4).

Out of 276 international students who reported their current or previous medical schools, 43 (15.6%) were from Scotland, 4 (1.5%) form NI, 36 (13%) were from Wales and 193 (69.9%) were from England.

A total of 56 nationalities were represented in this study, with respondents from Asian countries accounting for 68.2% of total participants, followed by the continents of

Europe - 10% and North America - 9.4% (Table 1). The detailed breakdown in nationalities can be found in the (Supplementary Table 2).

Table 1 - the Nationality of the respondents to the survey

Nationality	Number of Respondents
Asia	239
North America	33
South America	1
Europe	35
Middle East	11
Oceania and Australia	7
United Kingdom (British Passport)	12
Africa	11
Russia	1

29.5% (104/352) of international students studied in the UK prior to applying to medical school; of which 27 were pre-medical students (35.5%, 27/76), 67 were current international medical students (26.7%, 67/251) and 10 were medical postgraduates (40%, 10/25). The median duration of studying in the UK for international students prior to applying for medicine was 2 years (IQR 2-4).

The overall value of the UK medical degree

Overall, 96% of international students felt that more financial support should be given to them with 93% saying they would be more likely to apply for a UK medical degree if financial support was provided. 83% expressed that they would be more likely to work in the UK if more financial support was given, with 84% responding that they would consider entering into a contract to work for the NHS for at least five years, if there was more financial support for them to study medicine (Figure 1).

In general, 54% of students felt the UK degree was value for money. There was a statistically significantly different opinion ($p<0.05$) among the subgroups; In the pre-medical school group, 71% felt that the UK degree is good value for money (17% were unsure, 12% disagreed with the statement), which was significantly ($p<0.0001$) higher than the 52% strongly agreeing and 20% of medical school students agreeing (15% were neutral, 23% disagreed) and post-graduate (24% remained neutral, 56% disagreed) groups respectively. The post-graduate student's perception of the value for money of the UK medical degree was also significantly different ($p=0.0054$) when compared to the other groups.

Factors influencing students to study medicine in the UK

Out of six given reasons that influenced the decision to study medicine in the UK, clinical and academic opportunities were the most important factors (96%) among all

the international students (Figure 2a). This was consistently seen in all three subgroups (Figures 2b-d).

Among all respondents, this was followed by the quality of life (70%), role model advice (60%), financial prospects (51%), political landscape (42%) (Figure 2a). The least important factor was for family reasons (39%) (Figure 1a), which was seen consistently across all three groups: 43% in the pre-medical group, 40% in the medical group and 24% in the post-graduate group. (Figures 2b-d).

59% of students in the pre-medical student group ranked the political landscape in both the student's home country and the UK as more important factors to be considered when compared to the medical student and postgraduate group. This was statistically higher (p=0.0002) compared to the medical student group (38%) and borderline significant (p=0.0503) compared to the post-graduate group (36%) (Figure 2c-d).

Overall quality of life was the second most influential factor to motivate students to study medicine in the UK, this was demonstrated to be significantly lower in the post-graduate group, compared to the pre-medical (*p=0.01*) and medical group (*p= 0.02*) (Figures 2c-d).

Role model advice was also amongst the more important factors prompting pre-medical school students to study in the UK, with 70% of this cohort agreeing to this, compared to 59% in the medical student group (p=0.0697) and 40% in the post-graduate group (p=0.0114) (Figures 2c-d).

42.3% (149/352) gave additional factors (assessed qualitatively below in Supplementary Table 2) that influenced their decision to train in the UK. Some of the respondents stated the motivation to move abroad stems from the culture of practising medicine in the UK, while others came to experience living abroad. From the medical students' and postgraduates' perspectives, they cited that the UK medical degree is internationally recognised with clear training pathways, without the requirement of a previous degree. Many came for the high quality of education offered, with better career prospects following graduation. Eleven respondents cited that they did not get into the medical school in their home country (Supplementary Table 3).

Perception about UK tuition fees and training costs for a medical degree

32.9% of international pre-medical students thought the average international student would have paid £200 000 - £300 000 upon completion of a medical degree in the UK, as shown in the Table 2a. This perceived amount is significantly higher compared to the medical student (p=.00001) and post-graduate (p=0.0067) groups (Table 2a).

Table 2a Perceived/ known tuition fees paid by international students upon completion of a medical degree by pre-medical student, medical student, and medical school graduates. Median perceived/ known tuition fees are highlighted in bold.

On average, total tuition fees upon completion of UK medical degree paid by international student	Pre-medical %(response)	Medical students %(response)	Medical School Graduates %(response)
Less than £50,000	5.3% (4)	0.8%(2)	-

£50,000 - £100,000	5.3% (4)	2.7%(7)	12%(3)
£100,000 - £200,000	13.2%(10)	41.4%(104)	**44%(11)**
£200,000 - £300,000	**32.9%(25)**	**38.2%(96)**	20%(5)
£300,000 - £400,000	6.6%(5)	7.6%(19)	12%(3)
£400,000 - £500,000	15.8%(12)	3.58%(9)	-
£500,000 - £600,000	7.9%(6)	2.4%(6)	-
More than £600,000	13.2%(10)	3.2%(8)	12%(3)

As for the total cost of training, 19.7% of international pre-medical students thought it cost £300 000 - £400 000 to train a medical student to be a doctor; 14.5% thought it cost more than £600 000 to train a doctor. 30.7% (77/251) international medical students thought it cost £50 000 - £100 000. In the international medical school graduates' group, 32% (8/25) thought it cost £50 000 - £100 000. This perceived amount by the pre-medical student group is significantly higher compared to the medical student group ($p<0.0001$) and post-graduate group ($p<0.0001$). (Table 2b) (Supplementary Table 4)

Table 2b Perceived estimated total cost of medical training required to produce a doctor by pre-medical students, medical students, and medical school graduates. Median estimated cost is highlighted in bold.

Total cost to train a medical student to become a doctor in the UK (Average)	Number of responses (Pre-medical international students)	Number of responses (International medical students)	Number of responses (International medical school graduates)

Less than £50,000	2.6%(2)	17.1%(43)	20%(5)
£50,000 - £100,000	7.9%(6)	30.7%(77)	**32%(8)**
£100,000 - £200,000	15.8%(12)	**20.3%(51)**	32%(8)
£200,000 - £300,000	18.4%(14)	13.5%(34)	12%(3)
£300,000 - £400,000	**19.7%(15)**	9.2%(23)	4%(1)
£400,000 - £500,000	10.5%(8)	4.8%(12)	-
£500,000 - £600,000	10.5%(8)	1.6%(4)	-
More than £600,000	14.5%(11)	2.8%(7)	-

Both the medical student and pre-medical students thought the tuition fees paid by international students upon completion of a medical degree were statistically different to the total cost of medical training for a student to become a doctor (p=0.0007) and (p<0.0001) respectively. In the post-graduate group, there is no statistically significant difference (p=0.1965) in the perception of total tuition fees paid and the total cost of medical training.

There was a significant association between the students' perception of the value of a UK medical degree and their perception of the cost to train a medical student to a doctor where those that tended to disagree that the UK medical degree was value for money suggested lower cost to train a medical student to a doctor (p = 0.00013, Supplementary Figure 1). There was no association between their perception of value of a UK medical degree and their perception of total tuition fees paid (p = 0.1613, Supplementary Figure 2)

ACT Levy

84% (296/352) of international students were not aware of ACT Levy. Overall, 85% of international students stated that Act levy would probably influence their decision to study medicine in the UK (44% very likely, 24.1% likely, 16.2% somewhat likely). The pre-medical student group was significantly influenced by ACT levy compared to the ($p<0.001$) medical and ($p= 0.0026$) post-graduate group. 74% of the pre-medical student group rated Act Levy would affect their decision to study medicine in the UK (23.7% very likely, 23.7% likely, 25% somewhat likely) with neutral and unlikely being 13% and 14% of the cohort respectively.

International students' concerns

Free text responses were provided by 26.1% (92/352) of respondents, and qualitative analysis demonstrated the students' general concerns. The majority of the pre-medical student group had no concerns (49.9%), 16.5% felt that the cost of the degree was the major concern, followed by 11.0% who feared unconscious bias and racism (SupplementaryTable 5). Other concerns include challenging application process for medical school admissions, learning style and potential terrorism.

Postgraduate and existing medical students (276/352) were asked if they had adapted well to the UK and been well supported by their medical school, university students' societies and other methods of support, according to four specific domains (Figure 3). Most students felt they had adapted well academically (75%) and socially (76%). 60% felt they had adapted well culturally while 25% disagreed. Only 28% of the international medical students felt well supported financially, 15% were neutral and 57% disagreed.

Working in NHS upon graduation

28.4% (100/352) of the respondents were unsure about working in the NHS upon graduation with 58% (204/352) saying they would like to work in NHS and 8% (28/352) saying they did not want to work in the NHS respectively. Of the total respondents, 5.6% (20/352) are currently working in the UK, thereby accounting for 80% (20/25) of the post-graduate cohort.

All respondents were asked whether they would consider working in the NHS; 27.8% (98/352) were unsure, 29.3% (103/352) would like to work for two years until the completion of Foundation Year 2, 28.7% (101/352) would like to work for up to 10 years or until the completion of speciality training. A further 9.4% (33/352) would like to work as a consultant indefinitely, meanwhile 4.8% (17/352) would like to leave immediately upon medical school graduation. Their wishes regarding work in the NHS did not significantly differ among the subgroups (p=0.3).

DISCUSSION

This study evaluates the perceptions of previous, current, and prospective international students regarding UK medical education.

The results showed that clinical and academic opportunities were the most significant factors that attracted respondents to pursue medicine in the UK. However, among the three groups, there are significant differences in perspectives regarding the financial value of a medical degree in the UK, establishing that pre-medical students are the most optimistic, closely followed by the existing medical students and then

postgraduates. The study's results highlight two important aspects for consideration regarding the future of medical education in the international arena: the cost of a medical degree and quality of medical training.

Cost of UK medical degree

Potential reasons for pre-medical students perceiving the cost of a UK medical degree higher than actual paid cost of the degree compared with the perception of medical students and medical graduates may be explained by the influence of the "perceived prestige and glamour" by friends, family, and social media.[15] As evidenced by our findings, medical students and graduates think that the tuition fees paid for a UK medical degree are higher than the actual cost to train a medical student to become a doctor. This gradual skewing of perception from pre-medical to post-graduate could be due to the progressive disagreement that a UK medical degree is good value for money (Supplementary Figures 3-4).

In 2017, the Department of Health quoted an average funding cost of £230,000 per medical student, of which 67% (£151,000) is a grant to the placement provider and medical school, while 33% (£64,300) constitutes repayable loans and bursary to students for living costs and tuition.[5,9] This cost of £230,000 per student is closer to the estimates suggested by the pre-medical student group than that of the medical student and graduate groups. Despite this, there is no clear breakdown of how these costs are utilised. For example, the costs of insurance and indemnity, placement-based teaching sessions, and other clinical resources. Given the plans to further increase international medical tuition fees via the ACT Levy, it is important that this breakdown should be transparent.

It should be noted that the future salary offered to graduates may not offset the total cost of the degree for international students.[2,16] Given the current trend and the assumption that international medical graduates utilize 10% of their basic salary to repay student debts, it could take up to 28 years to complete repayment of the total debt accumulated during their degree.[2,16] The implementation of ACT Levy will further contributes to the financial burden on international medical students; it is therefore important that applicants are well-aware of these long-term financial implications before applying to medical schools.

More work could be done to increase the transparency of the cost of medical training, especially for international medical students. This applies to the current cost of training and the added cost from the ACT Levy [17]. Universities are keen to enrol international students for financial reasons; maintaining an element of transparency is key to ensuring that the consumer rights of these students are preserved [18]. For the international student, having the knowledge of the breakdown of these additional costs is a key factor in the decision-making process when applying to study medicine in the UK.

Quality of undergraduate training

The quality of medical education and international prestige are attractive factors for international students.[19] Medical education in the UK is renowned for advanced technological facilities, research and intercalation opportunities.[19-21] Furthermore, the General Medical Council (GMC) oversees undergraduate and postgraduate training experience and provides quality assurance, when stipulated professional

outcomes need to be achieved.[19,20] This instils confidence in international students as it reduces the variation in the abilities of graduates from different UK medical schools.

However, there has recently been a rapid increase in the number of GMC-approved medical schools in the UK and overseas, [5,6,9-10] with up to 13 new medical schools currently being developed. Furthermore, as intercalated degrees no longer count for points in the UK foundation program application,[22] this policy might lower students' motivation to intercalate and reduce the focus on research in the undergraduate curriculum.[22] Current and new medical schools will need to ensure their curriculum provide research opportunities as part of their high quality teaching. International students' expectations of the UK medical degree have to be maintained despite these changes in policies. [5,6,9-10]

The COVID-19 pandemic increased the virtual delivery of the medical curriculum. [23,24] Distance learning inevitably reduces the use of university facilities, student-to-student interaction and social experience. In our study, 15% of students felt that they did not receive adequate support academically during the pandemic, while 18-25% of international students reported that they did not feel supported socially or culturally during medical school. The study was unable to determine the actual contribution of the pandemic on this perception as only 2.2% described the COVID-19 impact on the curriculum (Table 5) as an additional factor causing concern for international students studying medicine in the UK. However, lack of cultural diversity and knowledge, potential discrimination and homesickness are long standing issues for international students adapting to life away from home. [25]

Strengths and Limitations

This is the first study to systematically evaluate the perceptions of pre-medical, medical and post-graduate international doctors on the value of a UK medical degree and factors influencing their decision to study in the UK. It is important to understand these concerns following the adverse impact of the pandemic on globalisation and dissatisfaction among UK junior doctors towards their working conditions and their pay post-graduation.

A key study limitation is the selection bias introduced through questionnaire distribution by contacts and networks known to the study team. However, 24 medical schools and 64 secondary schools (nationally and internationally – 6 countries in total) were approached. Individuals did not enter their secondary school name/location due to small numbers of respondents so it was not possible to determine a response rate for each secondary school approached. Although not a limitation per se, the majority of respondents were female (62.8%) and from Asian nationalities (67.8%); motivations and perceptions of a UK medical degree within these demographics need to be considered when interpreting the results. With regards to post-graduate students, there is also likely recall bias towards their perceptions of the value of the degree and the influences for decisions to study in the UK and this was our smallest sample size (n=25).

The study period encompassed the COVID-19 pandemic (April – July 2021) and some students may have experienced additional stress and isolation which might have affected their motivation to pursue a medical degree during this time.

Future work

With the removal of the residential labour market stress test, International medical graduates (IMGs) from overseas can compete freely with graduates from the UK and in 2020, the GMC reported that more IMGs registered with the GMC than UK graduates. [26] It is likely that IMGs pay less fees in their home countries than international students in the UK. Due to this change in policy, there is no longer an advantage for the UK medical graduate, as competition is equal among all medical graduates. [23] Obtaining a medical degree prior to migrating to the UK to obtain postgraduate training could be perceived as a more economical way to progress in the medical career.

The high tuition fees will be a major obstacle for students who are unable to secure funding from their home country, with only 28% of students feeling financially supported. In this study, 84% of international students stated that they are willing to enter a contract to work for the NHS for at least 5 years if financial support is provided. This would be a favourable strategy so they can contribute to national taxation and help retain the doctors who have benefited from UK training. The development of medical apprenticeships and widening access schemes to medicine are also being discussed as methods of increasing the number of doctors and healthcare professionals to address the workforce shortage. This raises the question as to whether there is a need for widening access schemes for international medical students, [5,6] especially if the government would like to attract the best candidates from the international community to work in the UK.

Currently there is a problem with retention of junior doctors in UK due to dissatisfaction about pay and work-life balance [27] [28]. There has also recently been overwhelming support of junior doctors to carry out industrial action (98% voted for industrial action with a 77% turnout) for better pay [29]. Policy makers need to consider how to address some of these problems to retain this important workforce within the NHS. Our current study focused primarily on the financial cost of a UK medical degree. It is important to bear in mind other geographic are an option for international applicants, including the USA and other parts of Europe. It would therefore be of interest to compare and contrast the different regions, although this was beyond the scope of the present study.

Conclusion

The quality of medical education and international prestige are still the most important factors that influence international students to study medicine in the UK. However, further work is needed to ascertain reasons for the differing perceptions of the value by international students at different stages in their clinical training.

The UK currently faces a shortage of doctors, and it is therefore important to retain junior doctors who have benefited from undergraduate training in the UK. Policy makers could consider financially supporting international students who graduate and would like to continue to work for the NHS.

ACKNOWLEDGEMENTS: The authors would like to thank Cardiff University Healthcare International Perspectives Society (CHIPS), OSCEazy, In2MedSchool, The Hong Kong Medical University of United Kingdom (HKMUSK) for their collaboration on this study.

VISION Collaborators

Sai Pill, Paarth Kishan Gupta, Renee Punia, Katie Cheung, Diva Jhaveri, Aaron Gnanabalan, Italia-Rosa Leech, Faith Lee, Elizabeth Wong, Kar Phoong, Memory Moyo, Isha Thakar, Viraj Shah, Rohan Gupta, Tushar Rakhecha, Movin Peramuna Gamage, Nishaanth Dalavye, Allen Mathew , Parvathy Sureshkumarnair, Sripradha Srinivasan, Becky Leveridge.

Contributors

CL and SG (conception, methodology, data curation, formal analysis, writing and reviewing). TP (methodology, project administration, writing, reviewing and editing), AG (methodology, project administration, data collection, writing, reviewing and editing, SML (methodology, project administration, data collection, data analysis, writing), RB and SM (creating data collection form, data collection, data analysis, writing), FEF (methodology, writing , organising webinar, project administration), SO (methodology, project administration, reviewing and editing) ,TW (conception, design, reviewing and editing), VY (writing, reviewing and editing). HS (conception, design, methodology, writing, reviewing and editing and supervising). All authors contributed to this article and approved the submitted version. VISION Collaborators have contributed to data collection and distribution of the study survey.

COMPETING INTERESTS: The authors declare none.

FUNDING: This study received no specific grant from any agency, commercial or non-profit sectors.

Data sharing statement: No additional data available. Raw data available at reasonable request.

Ethical Approval

Participation in the survey was voluntary and confidential. Upon submitting the forms, participants confirmed their consent to participate in the study and to the handling of data according to Article 6(1)(a) of the General Data Protection Regulation (GDPR). Individuals were allowed the right to withdraw consent and request removal of their data from the Google Form platform at any time. Access to the data was only granted to the steering committee of the study. This study had been reviewed and approved by the ethical research committee at the School of Medicine at Cardiff University, SMREC reference number 21/22.

REFERENCES

1. UCAS. UCAS Undergraduate Data Release Archive, 2022. Available at: <https://www.ucas.com/corporate/data-and-analysis/ucas-undergraduate-

releases/ucas-undergraduate-analysis-reports/ucas-undergraduate-end-cycle-reports> [Accessed 15 Feb 2022].

2. Royal College of Physician London. The bubble set to burst: Is the UK's medical recruitment unsustainable after BREXIT?. *RCP Annual Conference.* 2021; 5:23. Available at: https://70b706f2.flowpaper.com/NovemberCommentary/#page=23 [Accessed 3 Oct 2021]
3. Enoch T, Ooi R, Ooi S. Impact of the implementation of the additional cost of teaching (ACT) levy on prospective international medical students applying to Northern Ireland and Scotland. *Postgrad Med J*. 2021 Apr 20:postgradmedj-2021-140194. doi: 10.1136/postgradmedj-2021-140194.
4. Aberdeen U. Tuition fees the school of medicine, medical sciences and nutrition the University of Aberdeen, 2021. Available: https://www.abdn.ac.uk/smmsn/undergraduate/medicine/tuition-fees.php [Accessed 3 Oct 2021]
5. GOV.UK Department of Health and Social Care. Expanding undergraduate medical education, 2021. Available from: https://www.gov.uk/government/consultations/expanding-undergraduate-medical-education[Accessed 3 Oct 2021].
6. The BMJ. Expanding undergraduate medical education in the UK - but at whose cost?, 2021. Available at: https://www.bmj.com/content/356/bmj.j1370/rr-0 [Accessed 3 Oct 2021]

7. Queen's University Belfast. International Tuition Fees, 2022. Available at: <https://www.qub.ac.uk/International/International-students/International-tuition-fees/> [Accessed 15 Feb 2022].
8. HEPI. The UK's tax revenues from international students post-graduation, 2022. Available at: <https://www.hepi.ac.uk/2019/03/21/the-uks-tax-revenues-from-international-students-post-graduation/> [Accessed 15 Feb 2022].
9. Royal College of Physicians. Double or quits: a blueprint for expanding medical school places, 2021 Jan.
10. Office for Students. Health education funding, medical and dental target intakes, 2021. Available at: https://www.officeforstudents.org.uk/advice-and-guidance/funding-for-providers/health-education-funding/medical-and-dental-target-intakes/ [Accessed 3 Oct 2021]
11. Team, P.S.L. (2021) *Medical Staffing in England: A defining moment for doctors and patients (BMA, 11 July 2021)*, *Patient Safety Learning - the hub*. Available at: https://www.pslhub.org/learn/improving-patient-safety/workforce-and-resources/safe-staffing-levels/medical-staffing-in-england-a-defining-moment-for-doctors-and-patients-bma-11-july-2021-r4856/ (Accessed: April 8, 2023).
12. *Working together to improve NHS staff experiences: NHS staff survey* (no date) *Working together to improve NHS staff experiences | NHS Staff Survey*. Available at: https://www.nhsstaffsurveys.com/ (Accessed: April 8, 2023).
13. *Training pathways: Why do doctors take breaks - general medical council* (no date). Available at: https://www.gmc-uk.org/-/media/documents/dc11392-training-pathways-report_pdf-75268632.pdf (Accessed: April 8, 2023).

14. UK Council for International Student Affairs. International student advice and guidance — England: fee status, 2021. [accessed 3 Oct 2021] Available at: https://www.ukcisa.org.uk/information--advice/fees-and-money/england-fee-status [Accessed 3 Oct 2021]
15. McHarg, J., Mattick, K., Knight, L. Why people apply to medical school: implications for widening participation activities. *Medical Educ.* 2007; 41(8): 815-821.
16. Ooi, S., Ooi, R., Godoi, A. et al. Motivations of medical students and doctors leaving the NHS explored in a residency training application webinar series. *Postgrad Med J.* 2021 Oct 21:postgradmedj-2021-140795. doi: 10.1136/postgradmedj-2021-140795.
17. GOV.UK Competition & Markets Authority. Higher education: guide to consumer rights for students, 2015. Available at: https://www.gov.uk/government/publications/higher-education-guide-to-consumer-rights-for-students [Accessed 29th Mar 2022]
18. Levent F. The economic impacts of international student mobility in the globalization process. Journal of Human Sciences. 2016;13(3).
19. General Medical Council. Standards of UK medical education, 2021. Available from: https://www.gmc-uk.org/education/becoming-a-doctor-in-the-uk/standards-of-uk-medical-education [Accessed 3 Oct 2021]
20. Quraishi S, Wade W, Black D. Development of a GMC aligned curriculum for internal medicine including a qualitative study of the acceptability of 'capabilities in practice' as a curriculum model. *Future Healthc J.* 2019; 6(3):196-203. doi: 10.7861/fhj.2018-0016

21. Bustin S. Science in the UK − whereto now?. Biomolecular Detection and Quantification. 2016;9:A1-A4. doi: 10.1016/j.bdq.2016.08.001

22. Tonkin T. Additional achievements ruled out of foundation programme applications. *BMA,* 2021. Available at: https://www.bma.org.uk/news-and-opinion/additional-achievements-ruled-out-of-foundation-programme-applications [Accessed 4 Oct 2021]

23. Harries A., Lee C., Jones L., et al. Effects of the COVID-19 pandemic on medical students: a multicentre quantitative study. BMC Medl Educ. 2021;21(1). doi: 10.1186/s12909-020-02462-1

24. Papapanou M., Routsi E., Tsamakis K., et al. Medical education challenges and innovations during COVID-19 pandemic. Postgrad Med J. 2021 Mar 29:postgradmedj-2021-140032. doi: 10.1136/postgradmedj-2021-140032.

25. Kristiana, I.F. *et al.* (2022) *Social support and acculturative stress of international students*, *International journal of environmental research and public health*. U.S. National Library of Medicine. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9180523/ (Accessed: April 8, 2023).

26. *The Changing Medical Workforce - GMC-uk.org* (no date). Available at: https://www.gmc-uk.org/-/media/documents/somep-2020-chapter-3_pdf-84686032.pdf?la=en&hash=D2F3AD68AF8820D40A285BDC6A391A85A780C88B (Accessed: April 8, 2023).

27. Lock, F.K. and Carrieri, D. (2022) *Factors affecting the UK junior doctor workforce retention crisis: An integrative review*, *BMJ open*. U.S. National Library of Medicine. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8960457/ (Accessed: April 8, 2023).

28. A;, W.H.C.P.A.S.S.B. (no date) *Drexit: Understanding why junior doctors leave their training programs to train overseas: An observational study of uk physicians*, *Health science reports*. U.S. National Library of Medicine. Available at: https://pubmed.ncbi.nlm.nih.gov/34646946/ (Accessed: April 8, 2023).

29. Patterson, C. (2023) *Junior doctors vote yes to industrial action*, *The British Medical Association is the trade union and professional body for doctors in the UK.* British Medical Association. Available at: https://www.bma.org.uk/news-and-opinion/junior-doctors-vote-yes-to-industrial-action (Accessed: April 8, 2023).

Legends

Figure 1shows 5 domains which pre-medical, medical and postgraduate students were asked to consider in relation to value of a UK medical degree. Percentages in the middle of the figure denote those who are neutral whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

Figure 2 shows the proportion of responses of factors influencing students to study medicine in the UK, a) Overall responses, b) Pre-medical responses, c) Medical Responses d) Post-graduate responses. Percentages in the middle of the figure denote those who neither agree nor disagree whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

Figure 3 shows four domains in which postgraduate and existing medical students (276/352) were asked if they had adapted well to the UK and were well supported through the medical school, university students' societies and other methods of

support. Percentages in the middle of the figure denote those who are neutral whilst the percentage on the left of the bar is a total of those who somewhat agree, agree and strongly agree and the percentage on the right of the bar is the total of those who somewhat disagree, disagree and strongly disagree.

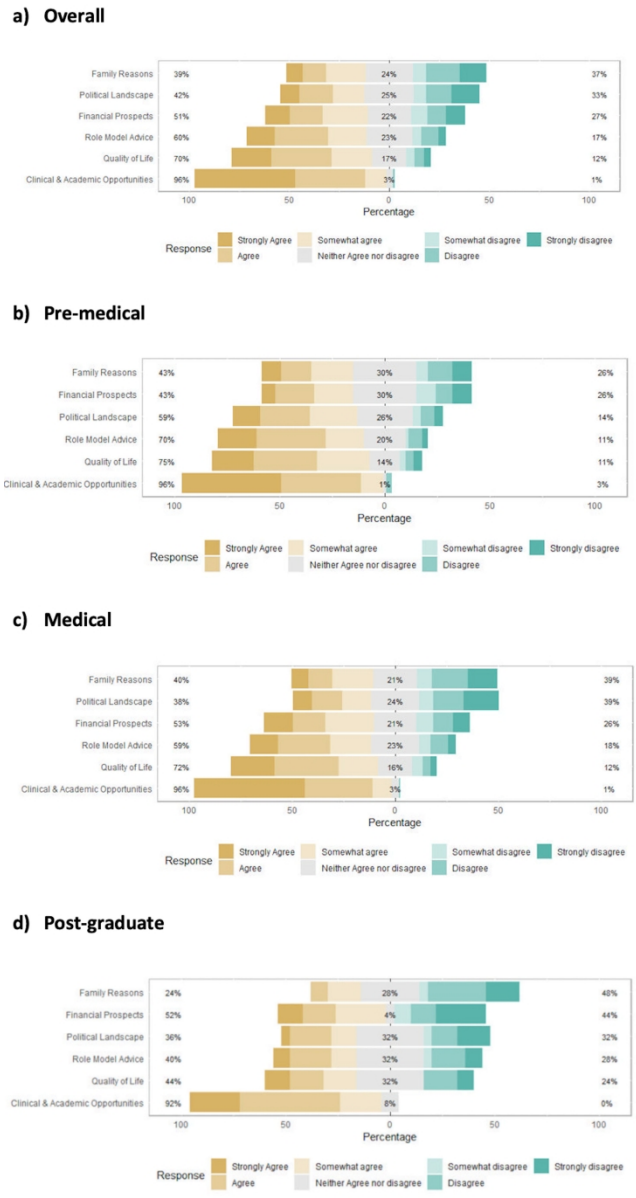


Figure 2

198x366mm (300 x 300 DPI)

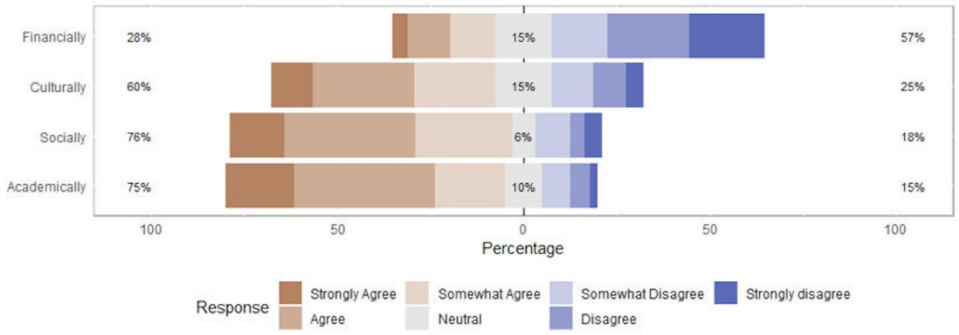


Figure 3

148x56mm (300 x 300 DPI)

Figure 1

175x255mm (300 x 300 DPI)

Supplementary Appendix
Supplementary Table 1

1.
Participation is completely voluntary. Any responses you provide are anonymous. By filling in this questionnaire your are giving your consent to participate in this study and for use of your anonymised data in future publication(s). Do you give your consent for participation?
2.
Are/were you a Home or International Student? An international student in this study is defined as : Non-British student (who are in full-time or part-time education); OR A student whose normal residency is not in the United Kingdom and without a settled status; OR A student whose tuition fees status is recognised as international/Oversea/EU by a UK university/institution.
3.
Age
4.
Gender
5.
Nationality
6.
Are you a pre-medical (applying to medical school within the next 2 years), medical or post-graduate (who MUST have completed a UK medical degree within the five-year preceding this study) doctor?
7.
Did/Do you study in the UK prior to applying/starting medical school?
8.
For how many years did you study in the UK, prior to medical school?
9.
To what extent did the following influence your decision of studying medicine in the UK
10.
Do you have any other reason(s) for coming to the UK to study medicine?
11.
What is/will be your fee status? *Home fees are defined as £0-£10.5K per academic year.
12.
On average, how much do you think an international student has paid in total tuition fees (£) upon completion of a medical degree in the UK?
13.
On average, what do you think is the total cost (£) to train a medical student to become a doctor in the UK?
14.
To what extent do you agree with this statement:
15.
To what extent has the following affected your perception of the value of a UK medical degree
16.
Were you aware of the ACT LEVY prior to this questionnaire?
17.

The ACT Levy is a fee of £10,000 per year, in addition to those normally paid by international medical students. It is intended to cover the cost of clinical education delivered in hospitals. This fee has already been implemented in Scottish medical schools and some English medical schools. There is some possibility that this will be introduced in all UK medical schools.

18.
Do you have any other comments regarding the ACT LEVY or international student fees?

19.
Do you have any other concerns about studying medicine in the UK?

20.
Do you hope to work in the NHS upon graduation?

21.
How long do you want to work in the NHS upon graduation from UK medical school

22.
Do you have any other comments ?

23.
Did you study in the UK prior to applying/starting medical school?

24.
For how many years did you study in the UK, prior to medical school?

25.
Medical School (Currently in/Graduated from in the past 5 years)

26.
To what extent did the following influence your decision of studying medicine in the UK

27.
Do you have any other reason(s) for coming to the UK to study medicine?

28.
What is/was your fee status? *Home fee defined as £0-£10.5K per academic year

29.
On average, how much do you think an international student has paid in total tuition fees (£) upon completion of a medical degree in the UK?

30.
On average, what do you think is the total cost (£) to train a medical student to become a doctor in the UK?

31.
To what extent do you agree with this statement:

32.
To what extent has the following affected your perception of the value of a UK medical degree

33.
Were you aware of the ACT LEVY prior to this questionnaire?

34.
The ACT Levy is a fee of £10,000 per year, in addition to those normally paid by international medical students. It is intended to cover the cost of clinical education delivered in hospitals. This fee has already been implemented in Scottish medical schools and some English medical schools. There is some possibility that this will be introduced in all UK medical schools.

35.

Do you have any other comments regarding the ACT LEVY or international student fees?

36.

To what extent do you agree with this statement: As an international student I have adapted well to the UK and I have been well supported through either my medical school, university student societies and other methods of support.

37.

Do you have any other concerns about studying medicine in the UK?

38.

Do you hope to work in the NHS upon graduation?

39.

How long do you want to work in the NHS upon graduation from UK medical school

40.

Do you have any other comments ?

Supplementary Appendix

Supplementary Table 2 – the detailed breakdown of the nationality of the respondents to the survey

Nationality	Number of Respondent
American	9
Australian	5
Bahraini	3
Bangladeshi	1
Belgian	1
Brazilian	1
British	12
Bruneian	1
Burmese	3
Canadian	23
Chinese	16
Cypriot	3
Dutch	2
Egyptian	3
Fijian	1
Finnish	2
French	4
Gambian	1
German	2
Ghanaian	1
Greek	2
Hong Kong	36
Indian	62
Iranian	2

Iraqi	1
Irish	4
Italian	3
Japanese	4
Jordanian	2
Kenyan	1
Libyan	3
Luxembourger	1
Malaysian	76
Maldivian	1
Maltese	1
Mauritian	2
Namibian	1
New Zealander	1
Nigerian	2
Polish	2
Portuguese	1
Romanian	2
Russian	1
Sierra Leonean	1
Singaporean	21
South Korean	4
Spanish	1
Sri Lankan	2
Swedish	3
Swiss	2
Taiwanese	2
Tanzanian	1

Thai	6
Trinidadian or Tobagonian	1
Turkish	1
Zimbabwean	2

Supplementary Table 3: Factors attracting international students towards a UK medical school.

Facilities, Opportunities and quality of the medical curriculum	*"Yes, Indian med schools don't have facilities equivalent to UK medical schools "* *"The quality of education and the historical cities in the UK itself* *"The course here is much more clinically oriented than in Europe. It is also less heavy on the student, giving the students an opportunity to have a life outside of their medical school."* *"Research opportunities (such as PhD intercalation)* *"Quality of education and job opportunities "* *"Prominent research landscape across the board, and a variety of UK-based educational materials"* *"Different curriculum +supportive tutor and student relationship+research opportunities"* *"better teaching facilities, course structures"* *Good quality of medical education and medical work in the UK!"* *"Academic scholarship opportunity "* *"Because of its well equipped medical schools and trained medical professionals that lecture In most of these medical schools."*
Prestige and recognised internationally	*"International community, high level of education "* *"Reputable degree with top class education "* *"I can immediately study medicine and it's only for 5/6 years. Prestige"* *"Better reputation and more recognised than the medical schools in Singapore. "* *"An MBBS degree from the UK is more internationally recognised. "* *"The degree is accepted in many other countries so it would be easy to travel."* *"Viewed as a prestigious place to study medicine "* *"validity of the degree in other countries, support to students, structure of post grad training"* *"The UK medical degree is very well valued around the world, including in India and the UAE (My country of residence) "* *"Studying in English seemed the most helpful internationally. "*
Post-graduate prospects	*"The degree is valued internationally and can increase bargaining power amongst graduates to ask for higher salaries in overseas countries."* *"Higher job opportunities in the future "* *"More career opportunities after completing a UK degree"* *"Better future career options. "*
Overseas experience and study culture	*"Yes, to gain more exposure by studying abroad"* *"love to stay in the uk for a couple more years"* *"To experience something new/different"* *"I love the country, always did."* *"exciting experience* *"I enjoy the learning culture in UK much more than in my home country"* *"perhaps the diversity within the school environment "*

	"Life experience" ; "Better life" ; "Work life balance"
Convenience and language	*"Partnered medical school with university back home "* *"Studied in British system* *All education was tailored to eventually study university in the UK* *English speaking medical curriculum "* *"Studying A-Levels in sixth form, it's sort of an "expectation" that using that you would go to the UK for further education"* *"It was just easier for me to apply to a UK medical school rather than an Indian medical school, as Indian medical schools are more competitive."* *"not as fluent in mother tongue"* *"More fluent in english than in home country language* *"More familiar with the system; language"* *"Language"* *"I've studied here a long time and my native language is nowhere near good enough at University level.* *"I would like to study medicine in English."* *"I speak English better than I do french/Flemish/German so couldn't study in Belgium "* *"I am used to UK's NHS and education system, which helps with my studies "* *"easier to apply from UCAS since I did my A-Levels in the UK so easier to apply within the system rather than apply to a university in my home country, India.* *"Easier pathway for international students to study medicine in comparison to other countries"* *"Direct start without premed"* *"Already studying in the UK "* *"Studied in a British school prior to this so led to pursuing further education here "*
Time saving	*"Undergraduate course vs postgraduate back home. Would end up saving 3 years."* *"Time saving in terms of graduating"* *"The pathway to becoming a doctor is the most straightforward. Getting accepted into a medical program straight out of high school automatically puts me on the path to becoming a doctor and ensures that I gain relevant clinical experience throughout my undergraduate years."* *"The duration of the course is shorter compared to other countries."* *"Takes less time to do it in the UK. "* *"Shorter training years compared to other countries"* *"Shorter length for qualification compared to other countries"* *"In Canada, you need an undergraduate degree in order to apply to medical school."* *"In Canada, the process to become a doctor is significantly longer, and slightly harder (since more qualifying exams need to be written)."* *"Medical school in North America employs the 4 + 4 model of undergraduate + graduate medicine (MD). Studying in the UK was a way to guarantee becoming a doctor in a shorter period of time."*
Politics	*"Our country has too many doctors. I wish to work in the UK and experience world-class education."* *"Politics in HK"* *"The major issue in Malaysia for medical graduates is the biased and unfair system of awarding contracts to houseman officers. We do not know how they determine who is awarded the positions as the process is not transparent. There are many other issues such as the ratio of number of doctors produced to the number of patients in Malaysia is also one of the highest in the world as we simply just have too many medical schools especially from the private sector*

	and not enough positions to compensate for them. Thus many medical graduates in Malaysia face the prospect of going jobless after completing their clinical training."

Supplementary Table 4a – 4m

Supplementary 4a: Perceived/ known tuition fees paid by international students upon completion of a medical degree by pre-medical student, medical student and medical school graduates.

Kruskal-Wallis rank sum test, p value<0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**<0.0001**	**0.0067**
Medical	**<0.0001**		**0.8934**
Post-graduate	**0.0067**	**0.8934**	

Supplementary 4b: Perceived estimated total cost of medical training required to produce a doctor by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value<0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**<0.0001**	**<0.0001**
Medical	**<0.0001**		**0.3400**
Post-graduate	**<0.0001**	**0.3400**	

Supplementary 4c: Perceived clinical and academic opportunities by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.5804**	**0.0435**
Medical	**0.5804**		**0.0049**
Post-graduate	**0.0435**	**0.0049**	

Supplementary 4d: Perceived financial prospects by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.32

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.3779**	**1.0000**
Medical	**0.3779**		**0.3896**
Post-graduate	**1.0000**	**0.3896**	

Supplementary 3e: Perceived family reasons by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.07

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.2185**	**0.0394**
Medical	**0.2185**		**0.1873**
Post-graduate	**0.0394**	**0.1873**	

Supplementary 4f: Perceived quality of life by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value: 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.5804**	**0.0435**
Medical	**0.5804**		**0.0049**
Post-graduate	**0.0435**	**0.0049**	

Supplementary 4g: Perceived impact of role model advice by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.02

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.0697**	**0.0114**
Medical	**0.0697**		**0.1357**
Post-graduate	**0.0114**	**0.1357**	

Supplementary 4h: Perceived political landscape in the UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value < 0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		0.0002	0.0503
Medical	0.0002		1.0000
Post-graduate	0.0503	1.000	

Supplementary 4i: Perceived ACT Levy by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value < 0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		<0.0001*	0.0026*
Medical	<0.0001*		0.9065
Post-graduate	0.0026*	0.9065	

Supplementary 4j: Perceived value for money by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value <0.001

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		<0.001*	<0.001
Medical	<0.001*		0.0054*
Post-graduate	<0.001*	0.0054*	

Supplementary 4k: Perceived willingness to work for NHS for at least 5 years by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.96

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		1	1
Medical	1		1
Post-graduate	1	1	

Supplementary 4l: Perceived more likely to work in UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.92

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**1**	**1**
Medical	**1**		**1**
Post-graduate	**1**	**1**	

Supplementary 4m: Perceived more likely to study medicine in UK by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.05

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.0329**	**1.0000**
Medical	**0.0329**		**0.3279**
Post-graduate	**1.0000**	**0.3279**	

Supplementary 4n: Perceived more financial support should be given by pre-medical students, medical students and medical school graduates.

Kruskal-Wallis rank sum test, p value = 0.01

Categories	Pre-Medical	Medical	Post-graduate
Pre-Medical		**0.2580**	**0.1189**
Medical	**0.2580**		**0.0081**
Post-graduate	**0.1189**	**0.0081***	

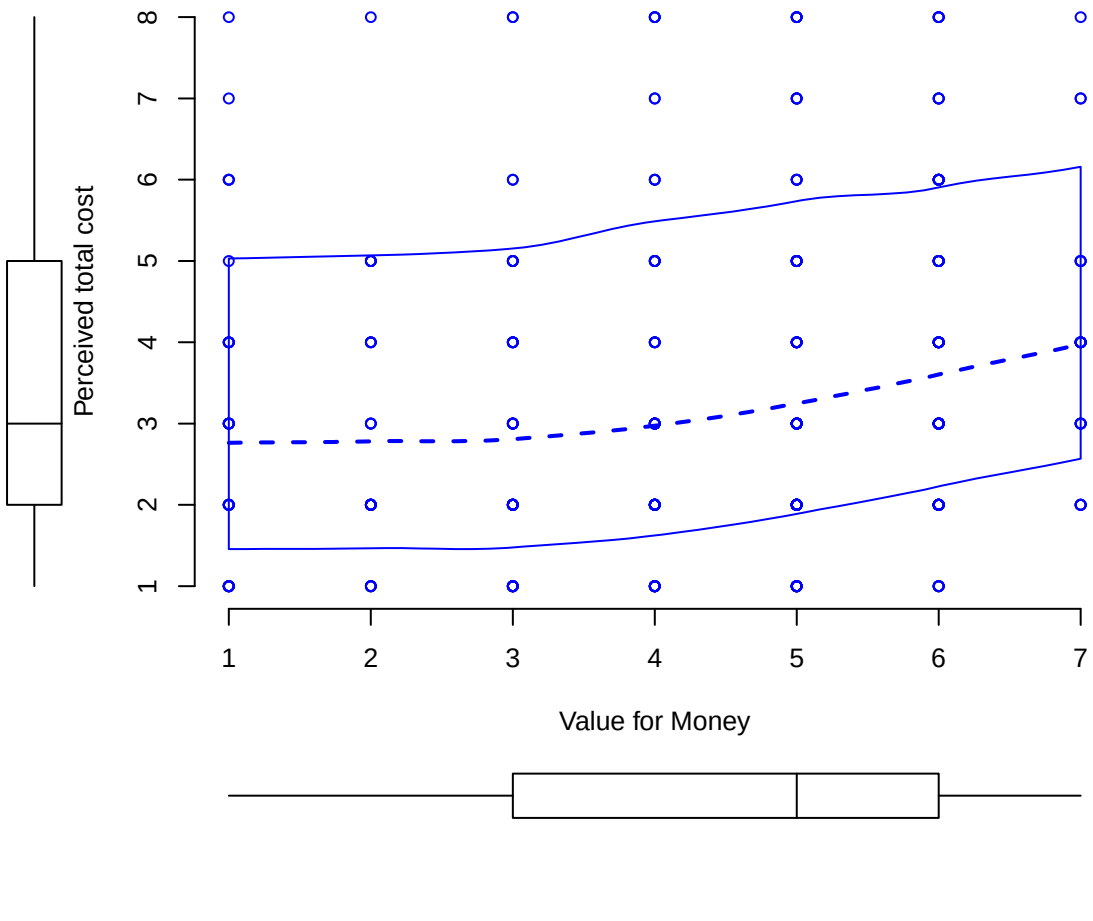
Supplementary Table 5 shows the results of the thematic analysis conducted from the responses in the free text box asking whether there were any additional concerns amongst international students coming to the UK to study medicine.

Themes	Individuals %
Impact of COVID-19 on the curriculum	2.2%
Lack Of University Support/guidance	5.5%
Culture shock/fitting in	6.6%
Post-graduate working conditions and job prospects	7.7%
Racism	11.0%

Cost Of Degree	16.5%
Other	9.9%
No Concerns highlighted	49.9%

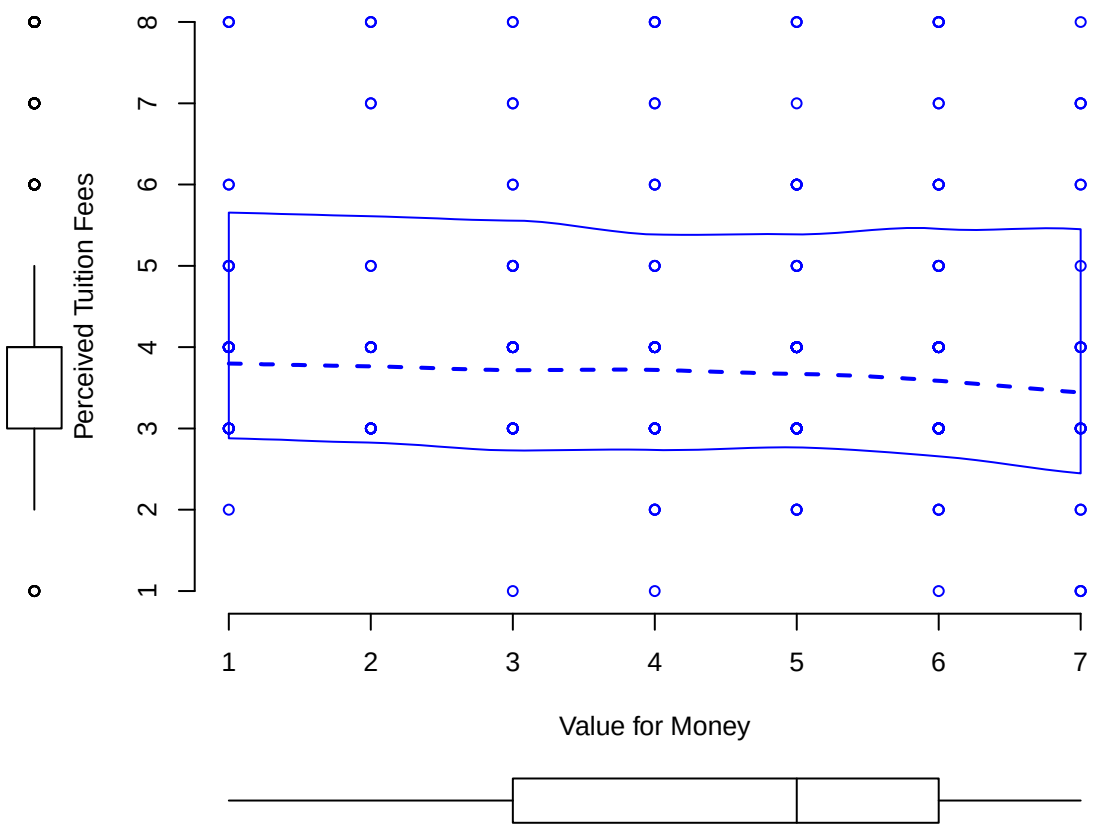
Supplementary Figure 1

Supplementary 1 is a graph comparing the perceived value for money of a UK medical degree with for perceived total cost to train a medical student to become a doctor among pre-medical students, medical students and post-graduates. The X-axis represents Groups 1-7; Group 1 : Strongly disagree, Group 2 : Disagree, Group 3 : Somewhat disagree, Group 4 : Neutral, 5 : Somewhat agree, Group 6: Agree, Group 7 : Strongly agree. Y-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000.



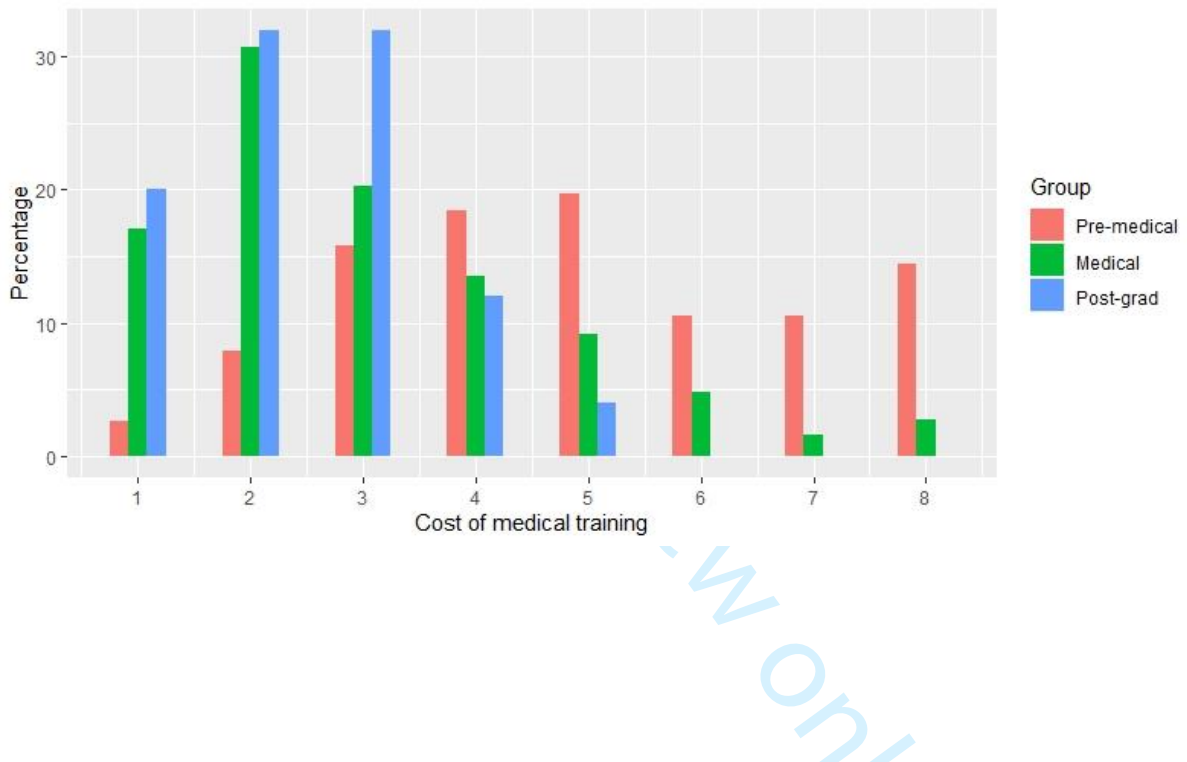
Supplementary Figure 2

Supplementary 2 is a graph comparing the perceived value for money of a UK medical degree with for perceived tuition fees paid among pre-medical students, medical students and post-graduates. The X-axis represents Groups 1-7; Group 1 : Strongly disagree, Group 2 : Disagree, Group 3 : Somewhat disagree, Group 4 : Neutral, 5 : Somewhat agree, Group 6: Agree, Group 7 : Strongly agree. Y-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000.



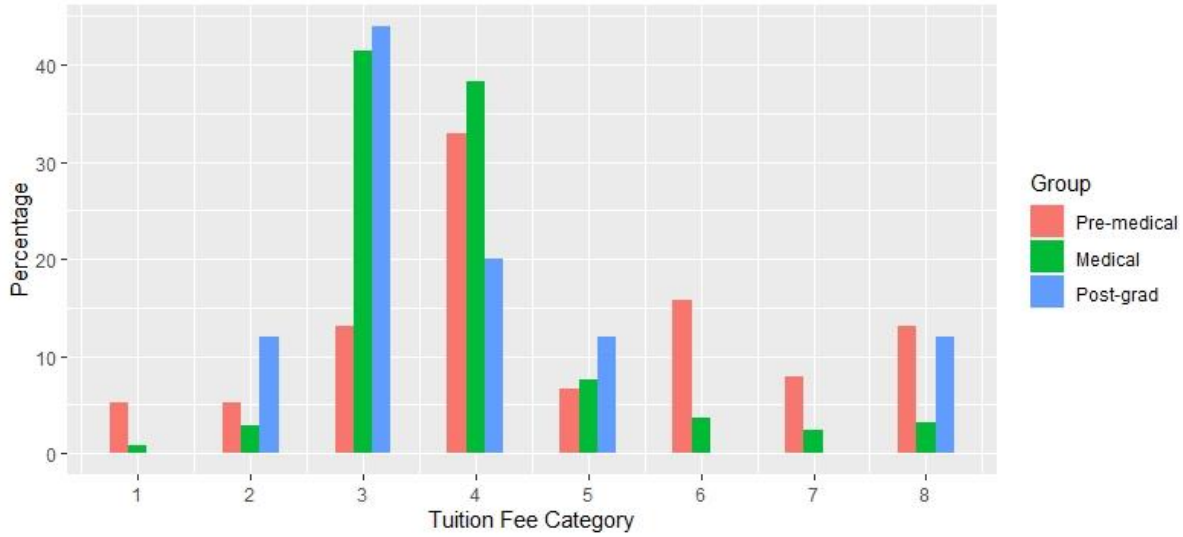
Supplementary Figure 3

Supplementary Figure 3 demonstrates a histogram for perceived cost of medical training among pre-medical students, medical students and post-graduates. X-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 - : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000; y-axis represents Percentage responses.



Supplementary Figure 4

Supplementary Figure 4 demonstrates a histogram for perceived tuition fees paid among pre-medical students, medical students and post-graduates. X-axis represents Group 1-8; Group 1 : Less than £50,000; Group 2 : £50,000 - £100,000, Group 3 : £100,000 - £200,000, Group 4 - : £200,000 - £300,000, Group 5 : £300,000 - £400,000 , Group 6: £400,000 - £500,000, Group 7 : £500,000 - £600,000, Group 8: More than £600,000; y-axis represents Percentage responses.



Study protocol

Study title: The Value of a UK Medical Degree for International Students: A cross sectional study: (VISION)

1.**Background:** International students have brought in financial and economic benefit for the local community in the United Kingdom (UK). A medical degree for international students is one of the most expensive undergraduate degrees in the UK, the average cost for a five-year medical course is £185,297 and £236,737 for a six-year degree (for 2020/2021 entry). A recent commentary in the Royal College of Physicians noted that this could financially burden the international students who decide to work for the NHS upon graduation, which could deter them from choosing to study medicine in the UK.

After completion of the Brexit transition in January 2021, the definition of international students will eventually be applied to a wider population and this policy could impact the medical recruitments for international students. Additionally, COVID-19 and Brexit have already impacted the decision of international students to study in the UK. This study aims to evaluate the perception of international students in obtaining a medical degree in the UK with the hopes of maintaining the popularity of a UK medical degree in comparison to other countries.

Why is this important: The "Act Levy" is an additional cost of training for international students that has been implemented in Scotland and is currently under consultation to be further introduced in England and Wales. This will result in a £10,000 - £20,000 increase in medical tuition fees for international medical students (1). It is unclear how this policy could influence the decision of international students to study medicine in the UK.

2. Aims

This cross-sectional study aims to evaluate the perspective of graduates, existing and prospective UK medical students regarding the value of a UK medical degree for international students.

2.1Methods and study design: This is a cross-sectional observational study, using a secure online questionnaire, has been created via the REDCap database, supported by Medical Education from the School of Medicine at Cardiff University. This questionnaire will be circulated to different medical schools and secondary schools across the UK and internationally

2.2 Outcome measures

- Primary outcome: Students' perceptions and concerns in a cross-sectional student survey
- Secondary outcome: The difference in perception among the prospective students, existing students and graduates of UK medical schools.

3. Study Population

3.1 Inclusion and exclusion criteria:

All international students are eligible to be included in this study.

3.1.1 An international student is defined in this study using the definition of the UK Council for International Student Affairs (UKCISA) as:

- Non-British students (full-time or part-time in education); OR
- students whose normal residency is not in the UK and are regarded as students with Overseas/International fee status

The sampling population could be further divided into three categories by our questionnaire: pre-medical school student, medical school student, and medical school graduate.

3.1.2 Pre-medical school student is defined as applicants currently:

- NOT studying a medical degree and planning to submit their application to medicine within two years. This includes Graduate entrance study and high-school students.

3.1.3 Medical school student is defined as:

- a student currently studying medicine or on a pre-clinical/foundation part of a medical degree where a medical degree is guaranteed upon successful completion of their degree.

3.1.4 Medical school graduate

- is defined as medical graduates who have completed a medical degree within the two-year preceding the study

4. Proposed timeline

Study duration:

- from 1st April 2021 - 31st July 2021 - data collection
- 31st July 2021 - all the data is locked in the database.
- 31st July - 31st August 2021 - data analysis
- Mid July 2021 - Conference Presentation (preliminary results presentation)
- 31st Aug - 31st Sep 2021 Write up and display the results to relevant organisations/journals.

5. Ethical approval: In the reviewing stage by research committees in the School of Medicine at Cardiff University

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

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Observational study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Yes. Informative and balanced summary is written and included in the abstract Line 44 - 71
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Yes. Written in the introduction section begins from line 84 – line 132
Objectives	3	State specific objectives, including any prespecified hypotheses Yes, on lines 135 -156, we evaluate the perception of the financial cost and value of the UK medical degree for international students (pre-medical, medical students and medical school graduates)
Methods		
Study design	4	Present key elements of study design early in the paper These are presented from lines 143 – 163.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection The setting, locations and dates are presented in lines 143-163 in study design section.
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants The eligibility criteria are defined in study population section and questionnaire circulation is described in lines 145 to 150.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Outcomes are defined in lines 191 – 207 and limitations including confounding are described in line 522 - 545
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 Our data is mainly quantitative and qualitative. Groups were pre-medical, medical and post-graduate international student.
Bias	9	Describe any efforts to address potential sources of bias Sources of biases are addressed in strengths and limitations section lines 522 - 545
Study size	10	Explain how the study size was arrived at Sample size calculations were not conducted as part of this analysis.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why This was explained in lines 209 – 221. As mentioned, three groups were chosen pre-medical, medical and post-graduates.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for

		confounding. This was explained in lines 209 – 221. Main analyses were a Kruskal-Wallis rank sum test, Dunn Test with Bonferroni adjustment and Spearman rank correlation coefficient.
		(*b*) Describe any methods used to examine subgroups and interactions Dunn Test with Bonferroni adjustment was used to examine subgroup relationships
		(*c*) Explain how missing data were addressed Missing data only exists in the optional fields, no further imputation or sensitivity analysis were made.
		(*d*) If applicable, describe analytical methods taking account of sampling strategy We have distributed our survey among our collaborators which is known to our network line 138 to line 146
		(*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 138 to line 146, Line 234 -line 243
		(b) Give reasons for non-participation at each stage Not applicable
		(c) Consider use of a flow diagram Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Line 234 -line 243
		(b) Indicate number of participants with missing data for each variable of interest Missing data only exists in the optional fields, no further imputation or sensitivity analysis were made. Line 241-243; Line 294 - 295
Outcome data	15*	Report numbers of outcome events or summary measures Line 265-441
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 Not applicable
		(*b*) Report category boundaries when continuous variables were categorized Line 265-441
		(*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 .This was explained in lines 209 – 221. Main analyses were a Kruskal-Wallis rank sum test, Dunn Test with Bonferroni adjustment and Spearman rank correlation coefficient. Correlation analysis was

		performed in the supplementary
Discussion		
Key results	18	Summarise key results with reference to study objectives Line 266- 411
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 Line 503-525
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Line 441 -488
Generalisability	21	Discuss the generalisability (external validity) of the study results Line 530 -566
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 No source of funding available / conflict of interest declared.

*Give information separately for exposed and unexposed groups.

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.