

## PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Is the Awarding Gap at UK medical schools influenced by ethnicity and medical school attended? A retrospective cohort study.
<b>AUTHORS</b>	Brown, Celia; Goss, Charlotte; Sam, Amir

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Kumar, Kavitha A. Management and Science University
<b>REVIEW RETURNED</b>	27-Jun-2023

<b>GENERAL COMMENTS</b>	An interesting article on a relevant topic in the view of the large scale global mobility of students for higher education. A observation, I would like to bring-forth is that multiple sociodemographic factors have been considered in this research work. However, only the factors having a significant impact on awarding gap has been mentioned in the title. Suggested to consider mentioning "sociodemographic factors" in the title. 2. The authors observe that the teaching and assessment methods place White students at an 'unfair advantage'. It would be helpful to the readers if this point is elaborated in discussion.
-------------------------	---

<b>REVIEWER</b>	Offiah, Gozie Royal College of Surgeons in Ireland
<b>REVIEW RETURNED</b>	30-Jun-2023

<b>GENERAL COMMENTS</b>	Thank you for the opportunity to review this paper. Congratulations to the authors on putting together a really seminal paper on the differences across ethnic minorities in UK universities. I would appreciate more elaboration in the introductory paragraph of the scale of the problem with awarding gap and the impact of same and thus why this study is really key. At the end of the introduction, while the reader notes that the aim of the study was to compare ethnicity subgroups, the research question/study objectives are not explicitly stated and it is recommended to do so after the introduction. The methods are excellently presented allowing replication of the study. The statistically analysis are well presented using the chi squared and unpaired tests, however this needs to be reviewed by data analysts. References need some formatting to ensure consistency.
-------------------------	--

<b>REVIEWER</b>	Tan, Yuan-De Baylor College of Medicine
<b>REVIEW RETURNED</b>	16-Jul-2023

<p><b>GENERAL COMMENTS</b></p>	<p>Comments on “Is the Awarding Gap at UK medical schools influenced by ethnicity and medical school Attended? A retrospective cohort study” by Brown et al.</p> <p>Authors studied influence of ethnicities and medical schools on the Awarding Gap in United kingdom(UK) using large-scale data derived from the UK Medical Education Database. To study difference in awarding between ethnicities, author introduced independent variables: UCAT score, gender, socioeconomic status, year of commencement of medical school, type of medical degree courses, index of multiple deprivation (IMD), and quintiles Q1 ~ Q5 and classified nine ethnicities Bangladeshi, Black, Chinese, Indian, Pakistani, Mixed, other Asian background and other ethnic background into Black and other minority ethnic (BAME) and white. After excluding students with no UCAT score, no ethnicity state, no UKFPO score, no IMD quintile, etc, authors finally obtained 16,020 students participating in this study. The results of this study show significant difference in UKFPO scores between students from different ethnicities subgroups. The AG varies considerably across medical schools and the largest gap was showed between BAME and white students. The conclusion made from the results is the UK medical education system places White students at an unfair advantage. There are clear differences in medical school outcomes between ethnicity subgroups and the size of AG also varies by medical school attended. However, I have many concerns that should be addressed before publishing this manuscript:</p> <p>What is Awarding gap(AG)? Whys is AG important in ethnicity education in UK?</p> <p>What is “umbrella categorization”? There is no definition or explanation of “umbrella categorization” in the manuscript.</p> <p>What is university clinic aptitude test (UCAT) and UCAT score? No definition or explanation of UCAT was found.</p> <p>What is UK Foundation Programme application (UKFPO) score?</p> <p>What is index of multiple deprivation(IMD)?</p> <p>What is standardized z-score?</p> <p>How to define quintiles Q1, Q2, Q3, Q4, and Q5?</p> <p>Line 98: Gender is not binary. Why?</p> <p>Line 138: we conducted a secondary analysis. What is secondary analysis?</p> <p>Why did authors classify ethnic students into Black and other minority ethnic (BAME) subgroup and white group?</p> <p>Line 199: We re-standardized these scores? How to standardize them? Z-score or log transformation?</p> <p>In table 1, chi-square test (<math>\chi^2</math>) is used to test independence between ethnic subgroups and IMD (quintile Q1-Q5)(or year of entry, course types), but did not test difference in IMD , year of entry, course types between BAME and white.</p>
--------------------------------	---

**Reviewer 1's Comments:**

**Comment 1: “An interesting article on a relevant topic in the view of the large scale global mobility of students for higher education. A observation, I would like to bring-forth is that multiple sociodemographic factors have been considered in this research work. However, only the factors having a significant impact on awarding gap has been mentioned in the title. Suggested to consider mentioning "sociodemographic factors" in the title."**

We would like to thank Reviewer 1 for the suggestion to highlight sociodemographic factors in the title of the manuscript. While we have adjusted for some sociodemographic factors (Index of Multiple Deprivation quintile and gender) in our modelling, this was part of a multivariate analysis alongside other variables. In Table 2 (lines 404-417) we demonstrate that all variables included in the analysis have a significant impact on the AG (as measured by UKFPO score). If we were to highlight the sociodemographic factors in the title, we would be implying they are somehow more significant than the other factors that were included in the modelling, but this was not the case as all were statistically significant. Our primary message is that individual ethnicity subgroups are variably affected by the AG and that medical school attended also has a significant impact, thus we thought it best to maintain focus on those specific outcomes alone and keep the original manuscript title focused solely on ethnicity.

**Comment 2: “The authors observe that the teaching and assessment methods place white students at an 'unfair advantage'. It would be helpful to the readers if this point is elaborated in discussion. "**

We would like to thank Reviewer 1 for asking us to elaborate on this, as it prompted us to reconsider how we would like to present this hypothesis to the Reader. Rather than stating that current teaching and assessment systems advantage white students, we feel the message should, in fact, be that the teaching and assessment systems appear to *disadvantage* BAME students. The manuscript has been revised to reflect this change and we feel this is a more impactful way of communicating this message (please see lines 532-535).

Unfair systems of teaching and assessment is one of a range of potential hypotheses for the AG. At present, it is difficult to know what the underlying reason for the AG may be, and it is likely multifactorial. We have not explicitly looked at different teaching and assessment styles in our analysis and, in the revised manuscript, we have now highlighted that further work is required in this area (please see lines 532-535). We know that medical schools have different methods of teaching and assessment, so the fact our study has established that the AG varies between medical schools provides an exciting opportunity for further study in this area.

**Reviewer 2's Comments:**

**General comment: “Thank you for the opportunity to review this paper. Congratulations to the authors on putting together a really seminal paper on the differences across ethnic minorities in UK universities.”**

We are incredibly thankful to Reviewer 2 for giving such encouraging feedback on our paper.

**Comment 1: “I would appreciate more elaboration in the introductory paragraph of the scale of the problem with awarding gap and the impact of same and thus why this study is really key.”**

We thank Reviewer 2 for highlighting the need for us to elaborate on the scale of the AG and the rationale behind our study. We have now added additional text to the first paragraph (lines 89-107) to address this, including quoting the results of a large meta-analysis by Woolf and colleagues which measured the effect size of the gap across 36 datasets including both undergraduate and postgraduate assessments (lines 102-105). We recognise this is an extremely valuable addition to the manuscript.

**Comment 2: “At the end of the introduction, while the reader notes that the aim of the study was to compare ethnicity subgroups, the research question/study objectives are not explicitly stated and it is recommended to do so after the introduction.”**

We are very appreciative to Reviewer 2 for this suggestion. We have now included text at the end of the introduction which states the objectives of our study: the primary objective being to examine how the AG affects different ethnicity subgroups as measured by UKFPO score, and the second being to investigate whether it varies by medical school attended (please see lines 160-166).

**Comment 3: “The methods are excellently presented allowing replication of the study.”**

We would like to thank Reviewer 2 for such a positive comment and are very pleased to receive this feedback.

**Comment 4: “The statistically analysis are well presented using the chi squared and unpaired tests, however this needs to be reviewed by data analyst.”**

We are very grateful for such positive feedback regarding the presentation of our analysis. Professor Celia Brown (co-first author of this manuscript), is an experienced statistician and psychometrician, and was primarily responsible for devising the methods and executing the data analysis. Furthermore, Reviewer 3 of the manuscript is a Bioinformatics Analyst, so our results have been independently reviewed and their feedback has been addressed in the revised manuscript (please see Reviewer 3's comments below). We hope that the expertise of our co-author and Reviewer 3 are sufficient to assure the quality of our analysis.

**Comment 5: “References need some formatting to ensure consistency.”**

We are very grateful to Reviewer 2 for bringing this to our attention and we apologise for this oversight. The entire reference list has been reformatted to ensure consistency and re-ordered after revisions of the manuscript. DOIs have also been added where appropriate (please see lines 661-840 for all amendments).

### **Reviewer 3's Comments:**

**Comment 1: “What is Awarding gap (AG)? Why is AG important in ethnicity education in UK?”**

Thank you to the Reviewer for raising these questions and we apologise if this was not clear in our original manuscript. In response to this comment and those of the Associate Editor and Reviewer 2

(above), we have revised the manuscript to include a more detailed definition of the Awarding Gap and have elaborated on its usage in medical education. We have now added additional text (lines 89-107) to address this, and we recognise that it is a very valuable addition to the manuscript.

**Comment 2: “What is “umbrella categorization”? There is no definition or explanation of “umbrella categorization” in the manuscript.”**

We apologise if this was not sufficiently explained. We used the term ‘umbrella categorisation’ in the same manner that one would use the English phrase ‘umbrella term’ i.e., a unifying categorization of a range of related things under one heading, rather than addressing those things individually. We felt that ‘umbrella categorisation’ is a good descriptor for the tendency to group and analyse all ethnic minority subgroups together as a single ‘BAME’ group and as ‘umbrella term’ is a common English phrase (not a technical term), we did not provide a definition. However, to avoid any potential misunderstanding, we have edited our sentence to make our use of the term clearer (lines 113-114).

**Comment 3: “What is university clinic aptitude test (UCAT) and UCAT score? No definition or explanation of UCAT was found.”**

We apologise for the lack of clarity with regards to the University Clinical Aptitude Test (UCAT). The University Clinical Aptitude Test (UCAT) is an admissions aptitude test used by most UK medical schools as part of their selection process. We have amended the manuscript so that a definition follows the first mention of the UCAT and agree that this adds clarity (please see lines 121-122).

**Comment 4: “What is UK Foundation Programme application (UKFPO) score?”**

We would like to thank the Reviewer to raising this issue and apologise if the original explanation of the UK Foundation Programme and the UK Foundation Programme application score (UKFPO) was not sufficiently clear. We have now added text to our original explanation of the UKFPO score to clarify what the UK Foundation Programme is and how the UKFPO score was used in the assessment and recruitment of new medical graduates (please see lines 147-155). We have also added an additional reference (reference 33) which explains the UK Foundation Programme application score in detail.

**Comment 5: “What is index of multiple deprivation (IMD)? ”**

The Index of Multiple Deprivation is a scale used to describe levels of socioeconomic deprivation in the UK, and it was defined on lines 183-186 of the original manuscript. On the basis of your question, we have expanded our explanation of the IMD and include examples of the indicators used to generate it (please see lines 216-222 in the revised manuscript). At the end of the sentence on line 186 in the original manuscript we had also cited the UKMED data dictionary which includes a more detailed definition of the IMD, should the reader wish to explore this (reference 35 in the revised manuscript, please see line 222).

**Comment 6: “What is standardized z-score? ”**

We would like to thank the Reviewer for highlighting this and apologise if this was not clear in the original manuscript. A Z-score is used to standardise scores on the same scale (such as examination marks, as in this case), and the Z-score measures how many standard deviations a specific data point is from the mean, so it can be either positive (greater than the mean) or negative (below than the mean). It is calculated by dividing a specific score's deviation from the mean by the standard deviation of the data set. We have added a definition of Z-score to the revised manuscript (please see line 231-233).

**Comment 7: "How to Define quintiles Q1, Q2, Q3, Q4 and Q5? "**

The IMD quintiles were defined in lines 183-186 of the original manuscript in the paragraph explaining the Index of Multiple Deprivation, but we have now expanded this definition (lines 216-222 in the revised manuscript). Again, reference 35 is cited at the end of this paragraph and readers can find further detail there should they wish to do so (line 222).

**Comment 8: "Line 98: Gender is not binary. Why? "**

Here we were referring to gender identity (rather than the nature of the variable) and it being more complex than being 'male' or 'female'. In the manuscript we have clarified this and that 'the UKMED database currently only includes options for male, female and missing/not stated. We were therefore limited to these variable values in our analyses' (please see lines 203-205).

**Comment 9: "Line 138: we conducted a secondary analysis. What is secondary analysis? "**

We would like to thank Reviewer 2 for raising this query and we apologise if use of the term 'secondary analysis' in the first line of the methods was confusing (the original sentence read 'we conducted a secondary analysis of data extracted from the UKMED database'). The term 'secondary analysis' was used in the context of conducting research using data that someone else (UKMED) had collected and was not intended to suggest additional analyses were conducted. This term has now been removed from line 170 to avoid confusion.

**Comment 10: "Why did authors classify ethnic students into Black and other minority ethnic (BAME) subgroup and white group? "**

We took this approach to classifying our students as this is the most frequent approach used when studying the AG, and where previously reported significant differences have been observed. The purpose of our study was not only to see if we could replicate these previous findings, but to better analyse the observed AG by being the first study to further break down the analysis into nine individual ethnicity subgroups. Please see lines 113-124 of the revised manuscript where this specific point is discussed.

**Comment 11: "Line 199: We re-standardized these scores? How to standardize them? Z-score or log transformation? "**

We thank the Reviewer for asking this question and apologise if this was not clear in the original manuscript. We re-standardised the scores by generating new Z-scores within our study cohort, as the Z-scores in the original data extract were calculated for all students, thus included students we eventually excluded from our study. These scores were, therefore, not correctly standardised for our specific study population, so we re-standardised them within our cohort. To clarify this, we have added that we re-standardised them 'to generate new Z-scores' (please see line 237), and we hope this helps to clarify the matter for the reader.

**Comment 12: "In table 1, chi-square test ( ) is used to test independence between ethnic subgroups and IMD (quintile Q1-Q5)(or year of entry, course types), but did not test difference in IMD , year of entry, course types between BAME and white. "**

Table 1 (lines 349-359) displays descriptive statistics for the study cohort and shows the result of the chi squared tests we performed to analyse the differences between BAME and white students across the following characteristics: proportion of students, gender, IMD quintile, Year of Entry and Course Type. It does not display comparisons between any of those characteristics. In the revised marked manuscript we have highlighted in yellow the corresponding sections of Table 1 for ease of reference (please see Table 1 on line 350).



We wish to thank the Editors and Reviewers again for this feedback, which has helped us to enhance our manuscript significantly. We believe this paper carries a very important message and, as *BMJ Open* has a precedent of publishing research on this important issue, we feel it would be of great interest to your readership. As such, we consider *BMJ Open* to be the ideal platform to disseminate our novel findings, which can help to guide future efforts to close the Awarding Gap in UK undergraduate medical education.

## VERSION 2 – REVIEW

REVIEWER	Kumar, Kavitha A. Management and Science University
REVIEW RETURNED	11-Oct-2023

GENERAL COMMENTS	The authors have done a commendable job in the revision of the manuscript. The findings of this study are relevant to medical educators across the globe.
------------------	---

REVIEWER	Tan, Yuan-De Baylor College of Medicine
REVIEW RETURNED	24-Sep-2023

GENERAL COMMENTS	z-score is standard score, standard normalized statistic. so standard z-score is not necessary unless authors redefine the standard z-score. I suggest authors use z-score.
------------------	---

## VERSION 2 – AUTHOR RESPONSE

**Reviewer 1's Comment:** "The authors have done a commendable job in the revision of the manuscript. The findings of this study are relevant to medical educators across the globe."

We would like to sincerely thank Reviewer 1 for giving us such positive feedback on our paper.

**Reviewer 3's Comment:** "z-score is standard score, standard normalized statistic. so standard z-score is not necessary unless authors redefine the standard z-score. I suggest authors use z-score."

We are very grateful to Reviewer 3 for this suggestion and agree that using the term 'z-score' is preferable. As such, we have removed the term 'standardised' from the Abstract (please see line 23 in both the main document and marked copy) and where it had previously appeared in the main body of the manuscript (please see lines 228, 234 and 287 in the marked copy of the revised manuscript and 219, 225 and 275 in the main document).

### **Comments from the Editorial Office:**

**Comment 1: “We recommend your article does not exceed 4000 words. With this, please reduce the word count of your article. However, if it is not possible, please provide an explanation in your cover letter.”**

We apologise for our previous submission being over the recommended 4,000 words. We have now reduced the word count from 4,640 to 4,255 (please see the tracked changes throughout the marked copy of the revised manuscript and line 5 for the revised word count). We recognise this is still above the recommended count, but important additions were made in response to the peer review feedback and we feel that removing any more text would affect the quality of the manuscript. We would therefore be incredibly grateful for BMJ Open’s offered flexibility around this.

**Comment 2. Please provide figure legend/caption. Please include figure legends at the end of your main manuscript. The figure legend or figure caption is a title or brief explanation about your figure.**

We would like to thank the Editorial team for highlighting this and apologise that figure legends were not included in the main manuscript previously. All figure titles and legends have now been included at the end of the manuscript (please see lines 869-902 in the marked copy of the manuscript and lines 873-906 in the main document).

**Comment 3. We have noticed that you have uploaded the file “Original Study Protocol - Brown, Goss, Sam.pdf” under 'supplementary file'. However, we cannot see any citation for this file within the main text. If this file needs to be published as a supplementary file, please cite it as 'supplementary file' in the main text. Otherwise, kindly change its file designation to ‘Supplementary file for editors only’.**

We are grateful to the Editorial team for bringing this to our attention and apologise for the oversight. We will upload the Original Study Protocol document with the designation ‘Supplementary file for editors only’.

We wish to thank the Editors and Reviewers again for all feedback received as it has enhanced our manuscript considerably. We believe this paper carries a very important message and, as *BMJ Open* has a precedent of publishing research on this issue, we feel it would be of great interest to your readership. As such, we consider *BMJ Open* to be the ideal platform to disseminate our novel findings, which can help to guide future efforts to close the Awarding Gap in UK undergraduate medical education.