

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Are efforts to attract graduate applicants to UK medical schools effective in increasing the participation of under-represented socioeconomic groups? A national cohort study.
<b>AUTHORS</b>	Kumwenda, Ben; Cleland, Jennifer; Greatrix, Rachel; MacKenzie, Rhoda; Prescott, Gordon

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Jon Dowell Dundee University, UK Programme Director for Scottish Graduate Entry Medicine and therefore potentially more positively orientated towards GEM. Previous colleague with many of research team, potentially more supportive of their endeavours.
<b>REVIEW RETURNED</b>	12-Aug-2017

<b>GENERAL COMMENTS</b>	<p>I enjoyed reading this paper which I found an interesting exploration of new data in a complex area. The premise for the study is appropriate although I would be in favour of maintaining the broader perspective implied in the title rather than the tighter focus on socio-economic aspects presented in the paper. Overall I believe it merits publication but there a number of ways in which I would suggest it may be strengthened.</p> <p><b>Abstract</b> The first paragraph of the abstract is perhaps a little disingenuous to authors such as Garrud (ref 29), who did indeed compare entrance to standard five year courses. Interestingly, the most striking statistic for me in the paper was the much reduced odds of a successful application from a graduate which is presented in the abstract. This finding is not discussed in the discussion. The concluding paragraph of the abstract focuses on socio-economic factors and concludes that graduate entry has not been a success in this regard. I'm not convinced, having viewed reference 11, that socio-economic diversity was the priority at the time the graduate entry schools were commissioned. I would also question the statement that it has 'not been successful' and argue that the data presented suggests there has been some marginal positive progress as a result. Hence, some revisions may be appropriate.</p> <p><b>Introduction</b> Overall the introduction is clearly written and introduces a wide range of the relevant literature.</p>
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The authors may wish to reflect on the concluding sentence, Lines 23 to 26 on page 4 suggesting that prior work was conducted too early to offer a true impact assessment. To an extent, the findings of this study appear to support the earlier work.

The introduction would be strengthened, I believe, by the inclusion of some discussion around the complexities of assessing the socio-economic status in both school lever and in particular graduate applicants. This is a complex area as the authors acknowledge that is fundamental to the understanding of the paper and claims made as a result.

#### Methods

In line 52 on page 5 it is claimed that the applicants had given permission for their data to be used for research purposes. Strickly speaking, I believe they had been notified that their data would be used for this purpose rather than giving their express permission. The following sentence regarding the 50% match of records requires further explanation and should probably be presented within the results. I would strongly suggest that a flow diagram presenting the stages at which missing data arose should be presented along with some additional analyses of the groups with and without data available to assess the impact of missingness. If indeed only 50% of the records could be matched this may fundamentally undermine the conclusions drawn from the data. (though I appreciate I may have misunderstood the statement regarding 50% I would have anticipated something around 160,000 medical school applicants within the eight year period covered (not 117) and fully understanding how the data presented derives from the total potential applicant pool is key, (accepting not all are within the UKCAT database.) Alternatively, information regarding the percentage of missing data could be included within table 1. For instance, it would appear that the data regarding the type of school attended was available for approximately 30% of graduate entry applicants in contrast with 75% of school leavers. Clearly this affects the reader's ability to have confidence in the conclusion that the 4.7% reduction in graduate entrance applying from fee paying schools reflects the situation accurately.

I would also suggest that it is important to present some basic time trend analysis to reassure us that the data collated over the eight year study period can appropriately be analysed as one. Evidence of significant trends during this period my question this assumption.

#### Results

I found results to be very clearly presented with the exception of that regarding the missingness of data throughout, as mentioned above.

#### Discussion

A key concern with the dataset available for this study is the validity of the source data, in particular as it applies to SES. This needs more detailed discussion, especially concerns regarding postcode derived IMD which is considered very suspect for the GEM cohort. Similarly, the impact of missing data must be addressed.

The conclusion, that diversity has not been improved by GEM entry does not seem entirely supported by the data which shows a 4.6% 'improvement' by 'top' occupation or 8% by IMD quintile. Although this is a marginal shift, figures 2 and 3 indicate that there are positive trends in all areas. To me the conclusion appears, it has helped to a small (and arguably trivial) extent. The need for better data in terms of completeness and quality may also be a legitimate call.

<b>REVIEWER</b>	Rizwana Lala University of Sheffield Unit Dental Public Health Sheffield S10 2TA United Kingdom
<b>REVIEW RETURNED</b>	23-Aug-2017

<b>GENERAL COMMENTS</b>	<p>I have some concerns about the assumptions made by the authors that graduate entry aims to widen participation to medicine. This is unsupported by the literature. If access to higher education is a barrier, then access to multiple degrees would be an even greater hurdle.</p> <p>There are some contradictions about the proportion of graduates and non-graduates that study medicine throughout the manuscript. I have annotated the appropriate sections on the PDF file. Please could you clarify the data.</p> <p>The authors claim about reduced access to medicine is representative of higher education.</p> <p>The data was not adequately analysed in terms of ethnicity. Although there is wide participation from Black and Ethnic Minority Communities, it is difficult to know if access to certain ethnic groups needs to be improved. There is also no comparison to see if the proportion of people from BAME groups given an offer study medicine is representative of the population.</p> <p>The authors have data on the type of school (independent or state) the applicants attended. This is a good indicator of socio-demographic background. However, this data is not analysed and there is no justification for this.</p> <p>The reviewer also provided a marked copy with additional comments. Please contact the publisher for full details.</p>
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### VERSION 1 – AUTHOR RESPONSE

Reviewer 1

R1: I enjoyed reading this paper which I found an interesting exploration of new data in a complex area. The premise for the study is appropriate although I would be in favour of maintaining the broader perspective implied in the title rather than the tighter focus on socio-economic aspects presented in the paper. Overall I believe it merits publication but there a number of ways in which I would suggest it may be strengthened.

We have kept the tight focus as class is the main issue in the UK and so have changed the title to: Are efforts to attract graduate applicants to UK medical schools effective in widening access? A national cohort study

R2: I have some concerns about the assumptions made by the authors that graduate entry aims to widen participation to medicine. This is unsupported by the literature. If access to higher education is a barrier, then access to multiple degrees would be an even greater hurdle.

The discourse that graduate entry is one way to widen participation to medicine is supported by the medical education literature (e.g., Garrud, 2011). We agree this may seem counter-intuitive but it is linked to school achievement and those from poorer schools not attaining the required grades for medicine, and then doing a degree and trying for graduate entry.

R2: There are some contradictions about the proportion of graduates and non-graduates that study medicine throughout the manuscript. I have annotated the appropriate sections on the PDF file. Please could you clarify the data.

We have now added a flow diagram to help clarify any data issues.

R2: The authors claim about reduced access to medicine is representative of higher education.

Yes, the claim is supported by the wider literature that we have referenced throughout the article.

R2: The data was not adequately analysed in terms of ethnicity. Although there is wide participation from Black and Ethnic Minority Communities, it is difficult to know if access to certain ethnic groups needs to be improved.

There is also no comparison to see if the proportion of people from BAME groups given an offer study medicine is representative of the population.

Pg20, line 15-20 of Table 3 'Multiple logistic regression for offers to medical school 2007 – 2014' shows the detailed analysis done on ethnicity variable. Also we have changed the title of the paper to make clear that our focus is not ethnicity but socio-economic class (although ethnicity is a variable in our model)

Data is not easily available to compare like for like populations, i.e. BME status of 16-45 year olds in the UK in 2006-2014. This was not our focus and we believe that the change in title and amendments to the paper make that clear to readers now.

R2: The authors have data on the type of school (independent or state) the applicants attended. This is a good indicator of socio-demographic background. However, this data is not analysed and there is no justification for this.

Type of school was described in Tables 1 and 2. However, it was only available for one third of graduates. If type of school was included in a multivariable regression analysis with other covariates, the consequent analysis was limited to only one quarter of graduates. This analysis was not pursued due to concern about bias and a lack of representativeness among graduates. Consequently, the other two measures of socio-demographic background which were more complete were used in the multivariable analyses rather than school type. We have clarified this in the results section.

#### Abstract

R1: The first paragraph of the abstract is perhaps a little disingenuous to authors such as Garrud (ref 29), who did indeed compare entrance to standard five year courses.

Interestingly, the most striking statistic for me in the paper was the much reduced odds of a successful application from a graduate which is presented in the abstract. This finding is not discussed in the discussion.

The concluding paragraph of the abstract focuses on socio-economic factors and concludes that graduate entry has not been a success in this regard. I'm not convinced, having viewed reference 11,

that socio-economic diversity was the priority at the time the graduate entry schools were commissioned.

I would also question the statement that it has 'not been successful' and argue that the data presented suggests there has been some marginal positive progress as a result. Hence, some revisions may be appropriate.

Response: We have again reviewed the literature and feel that our wording is appropriate in view of the restriction on word count.

This has been added to the discussion – the text on page 10 has been edited and it now reads '...attracting graduates has been only marginally successful, with very minor positive trends in all areas.'

The discourse that the establishment of GEMS was to increase numbers and increase the demographic diversity of medical students/doctors is well-represented in the literature (e.g., Garrud, 2011; Mathers et al., 2010).

Perhaps the direction of travel/trend is encouraging if not overwhelming. This has now been added to the discussion and abstract.

#### Introduction

R1: Overall the introduction is clearly written and introduces a wide range of the relevant literature. The authors may wish to reflect on the concluding sentence, Lines 23 to 26 on page 4 suggesting that prior work was conducted too early to offer a true impact assessment. To an extent, the findings of this study appear to support the earlier work.

The introduction would be strengthened, I believe, by the inclusion of some discussion around the complexities of assessing the socio-economic status in both school level and in particular graduate applicants. This is a complex area as the authors acknowledge that is fundamental to the understanding of the paper and claims made as a result.

Response: We meant only that it was possible that prior work may have been carried out too early and that our work would help to see whether previous findings held. This sentence has been adjusted.

We agree there are complexities surrounding these markers in graduate students, particularly for NS-SEC – where parental occupation is taken into account for school leavers, but for graduates and older applicants may be that of the applicant themselves, particularly if they have been employed after leaving school or after a first degree. This also holds for IMD status, as postcode may be that of the applicant or be parental, for mature students and graduates. It is not possible to untangle whether a mature applicant supplies their own, or parental details. We have done the best we can with the data available and made clear its shortcomings in the results and discussion.

[Pg3, Ln45] ...compared to an average of 7% of all school pupils.

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R2: 'This is across higher education. Not just medical schools.'

Response: We have added a sentence in the introduction to allude to the complexities of the issue, particularly in relation to the professions.

[Pg3, Ln49] ...raising social mobility.

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R2: Worth comparing medicine to other disciplines. This is not just a medical school problem, but a problem with higher education and social mobility more widely.

Response: As above, we have added a sentence in the introduction.

[Pg3, Ln57] ...and the diversity of students and hence doctors would be increased.

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R2: 'Life experience' does not necessarily mean more BAME people and people from lower SES. Reading for one degree is a privilege, opting for a second would be an even greater one. Intuitively, I would expect graduate entry programmes to narrow participation.

Response: We agree with R2's comment regarding 'life experience', but the references cited here come from well-established sources that have shaped the discourse of diversity in medical education.

[Pg4, Ln3] ...work in deprived and underserved areas.

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R2: Second degree, more debt etc.. Not sure this is what would be expected??

Response: As above, we agree this is superficially counter-intuitive but it is related to inequality earlier in the education pipeline.

[Pg4, Ln9] ...graduates now make nearly a quarter of the contemporary UK medical student population.

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R2: If GEMs are nearly 40% of the population, are the 10% of the programmes really large?

15-20% of traditional programmes' students are graduates, but 100% of GEM students are graduates.

[Pg4, Ln28] ...GEM programmes only account for 10% of all medical programmes...

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R2: Contradicts your statement in line 9

To clarify- GEMS are the programmes, graduates are the applicants/students. The majority of graduates are in traditional programmes. 10% of medical degree programmes are graduate-only.

#### Methods

R1: In line 52 on page 5 it is claimed that the applicants had given permission for their data to be used for research purposes. Strictly speaking, I believe they had been notified that their data would be used for this purpose rather than giving their express permission.

The following sentence regarding the 50% match of records requires further explanation and should probably be presented within the results. I would strongly suggest that a flow diagram presenting the stages at which missing data arose should be presented along with some additional analyses of the groups with and without data available to assess the impact of missingness. If indeed only 50% of the records could be matched this may fundamentally undermine the conclusions drawn from the data. (though I appreciate I may have misunderstood the statement regarding 50% I would have anticipated something around 160,000 medical school applicants within the eight year period covered (not 117) and fully understanding how the data presented derives from the total potential applicant pool is key, (accepting not all are within the UKCAT database.) Alternatively, information regarding the percentage of missing data could be included within table 1. For instance, it would appear that the

data regarding the type of school attended was available for approximately 30% of graduate entry applicants in contrast with 75% of school leavers. Clearly this affects the reader's ability to have confidence in the conclusion that the 4.7% reduction in graduate entrance applying from fee paying schools reflects the situation accurately.

I would also suggest that it is important to present some basic time trend analysis to reassure us that the data collated over the eight year study period can appropriately be analysed as one. Evidence of significant trends during this period my question this assumption.

Response: This sentence has been adjusted to take account of your helpful comment. It now reads "had been notified that their data would be used for research purposes."

This sentence regarding 50% was entered in error. This has been addressed.

A flow diagram (see supplementary file\_flow chart) has been provided to clarify the matching between UCAS and UKCAT data tables. A new statement 'The online supplementary file illustrates a flow diagram showing how the data files were merged from different source documents. '... has been added to the main article.

We have adjusted Table 1 to incorporate the proportion of missing data for each variable used in the analysis.

Please see our response above regarding 'school type' variable. This analysis was not pursued due to concern about bias and a lack of representativeness among graduates.

Also added is the Supplementary file 'time trend analysis' which illustrates the distribution of UKCAT test takers who applied to medicine only programmes across the study period. The proportion of graduate applicants has risen from 8.5% in 2006 to 26.9% in 2013 but this may be an artefact of systems changes rather than increasing numbers of graduates.

## Results

R1: I found results to be very clearly presented with the exception of that regarding the missingness of data throughout, as mentioned above.

Response: Covered above.

[Pg7, Ln8] ...23.6% of the applicants were graduates....

R2: Your own data contradicts your claims again about the proportion of graduates and non-graduates

Response: Please note the result represented here only relates 'applicants' in the sample and not the number of graduates currently in medical schools.

[Pg7, Ln10] ...median age for the non-graduate applicants was 18 years; 23 years for the graduate applicants.

R2: Interesting finding. Graduates are still fairly young

Response: Yes, many graduates would have applied for medicine very quickly after taking a first degree as this increases their admissions academic score.

[Pg7, Ln20] ...the sample was predominantly of candidates from white ethnic backgrounds....

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R2: How does that compare to the BAME population nationally? Seems like ethnic minority groups are well represented on the whole. Though there may be more need to widen access to particular ethnic groups

Response: As above, unfortunately it is not a simple task to define BME numbers for the population age 16-45 in the UK between 2006-14. We have changed the title of the paper to make our focus clearer to the readers.

[Pg8, Ln27-28] ...the additional effect of socio-economic disadvantage for graduates (compared to graduates) was small...

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R2: Does not make sense??

Response: Apologies, this was a typo, the sentence has been corrected. Many thanks for spotting this.

[Pg8, Ln32-33] ...association between socio-economic disadvantage and the likelihood of getting an offer for medical school affected graduates and non-graduates in a similar way.

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R2: Also, your data above suggests that graduates need higher UKCAT scores to get an offer, with those from a higher SES more likely to well in the UKCAT. So the barriers faced by graduates from a lower SES may be greater

Response: We thank the reviewer for noting the potential disadvantage for graduates and those with higher categories of SES (less skilled parental occupation). We were also concerned that these effects might interact and so Model 2 in Table 3 was used to consider this interaction between categories of SEC and graduate status. We did not find a significant interaction ( $p=0.22$ ), so the effect of the combination of these two potential sources of disadvantage (higher SES and being a graduate) was no worse or better than expected if the two effects were independent.

[Pg9, Ln5] ...

R2: Is there any reason you did not analyse the school attended data?

Response: Please see our response to the similar query above (pg2).

R1: A key concern with the dataset available for this study is the validity of the source data, in particular as it applies to SES. This needs more detailed discussion, especially concerns regarding postcode derived IMD which is considered very suspect for the GEM cohort. Similarly, the impact of missing data must be addressed.

Response: See discussion page 9 lines 36-48. We feel this area has been adequately discussed.

As above, note that the section mentioning 50% matching is incorrect.

[Pg9, Ln50] ...those used are the 'basic units' that indicate educational disadvantage in the UK.

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R2: I do not think you can call graduates educationally disadvantaged

Response: We did not infer that graduates are educationally disadvantaged, we were referring to the sociodemographic variables in the paragraphs above this sentence which do indicate educational disadvantage.



## Conclusion

R1: The conclusion, that diversity has not been improved by GEM entry does not seem entirely supported by the data which shows a 4.6% 'improvement' by 'top' occupation or 8% by IMD quintile. Although this is a marginal shift, figures 2 and 3 indicate that there are positive trends in all areas. To me the conclusion appears, it has helped to a small (and arguably trivial) extent. The need for better data in terms of completeness and quality may also be a legitimate call.

Response: The discussion has been expanded to reflect a marginal shift.

## VERSION 2 – REVIEW

<b>REVIEWER</b>	Rizwana Lala University of Sheffield
<b>REVIEW RETURNED</b>	01-Oct-2017

<b>GENERAL COMMENTS</b>	<p>I think this manuscript has improved significantly due to the amendments. The addition of the flow chart and time trend analysis add significant clarity.</p> <p>I still have a couple of minor concerns. The title could be adjusted further to make it clearer the study is addressing widening access for those from lower socio-economic groups. The term 'widening access' is very broad including gender and BAME. This study for sound reasons does not analyse these data adequately.</p> <p>The authors give a reasonable explanation, back by evidence, why graduate application may widen participation into medicine. However, this is not reflected in the manuscript. It would be helpful to the reader to outline this rationale.</p> <p>Overall, I have really enjoyed reading this manuscript and feel it outlines some very interesting findings.</p>
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## VERSION 2 – AUTHOR RESPONSE

### Reviewer 2

I still have a couple of minor concerns. The title could be adjusted further to make it clearer the study is addressing widening access for those from lower socio-economic groups. The term 'widening access' is very broad including gender and BAME. This study for sound reasons does not analyse these data adequately.

### Author Response

We have changed the title, and it now reads:

Are efforts to attract graduate applicants to UK medical schools effective in increasing the participation of under-represented socioeconomic groups? A national cohort study.

We have also added a sentence to the end of the abstract to indicate that the article is about graduate applicants from widening access backgrounds.

### Reviewer 2

The authors give a reasonable explanation, back by evidence, why graduate application may widen participation into medicine. However, this is not reflected in the manuscript. It would be helpful to the reader to outline this rationale.

#### Author Response

We have reviewed the document carefully and believe that this is covered (see highlighted sections of the tracked version). The actual text in the article reads:

- The assumption behind this was that, by accepting students with more life experience, the diversity of students and hence doctors would be increased<sup>12-15</sup>, and this would result in more doctors willing to work in deprived and underserved areas.<sup>16-18</sup> [pg3]
- However, to date, there is relatively little information relating to whether, or not, attracting graduates has increased the diversity of medicine in the UK. [pg4]
- In conclusion, the aim of diversifying the medical student population on socio-economic grounds by attracting graduates has been only marginally successful, with very minor positive trends in all areas. It may be that to draw a more diverse group of graduates into medicine requires different selection criteria for this group, one that places appreciable weight on the degree qualification and other graduate attributes, such as experience and passion for medicine. However, to change the selection process of graduates or indeed any group requires a shift towards affirmative action and/or a commitment to increase diversity. [pg11]