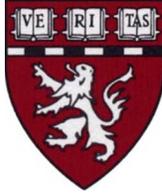


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Dr. Elizabeth Loder
Head of research, *The BMJ*

Dear Dr. Loder,

Thank you for giving us an opportunity to revise and resubmit our manuscript entitled “**Association between physician U.S News & World Report medical school ranking and subsequent patient outcomes and costs of care: An observational study (BMJ.2018.044856.R1).**” Below are the comments we received from the committee and reviewers (in *italics*), as well as a point-by-point response as to how we addressed them (in **boldface**).

We very much appreciate the added thought and critical appraisal provided by Dr. Phillips.

In our revised manuscript, we have added several additional analyses including an analysis using alternative rankings based on social mission score and NIH funding, as suggested by Dr. Phillips, and confirmed that our findings are not qualitatively affected by the choice of ranking. **Importantly, we have also revised our manuscript to clarify that the purpose of our study was not to evaluate the quality of medical school of training, but to investigate whether popular perceptions of what constitutes a ‘top’ vs ‘non-top’ medical school actual bears any relationship with hard clinical outcomes and costs of care.** We are not arguing that the accurately measured quality of a medical school bears no relationship with the quality of its graduates. Rather, the purpose of our paper is to analyze whether the popularly used US News and World Report rankings have any relationship with the quality of medical graduates. **In other words, does the US News and World report ranking of a medical school provide any predictive signal of downstream quality? It appears not to, at least in this analysis.** We now make this clear in the manuscript, both in the title and manuscript.

We hope we have adequately addressed all points raised by Dr. Phillips. If anything remains unclear or if specific modifications to the manuscript would be helpful, please do not hesitate to contact us. Thank you very much for considering our manuscript.

Sincerely yours,

Anupam B. Jena, MD, PhD

Comments by the reviewer:

I appreciate the efforts of the authors to address my concerns with this paper. It remains a valiant attempt to assess relationships between training environment and future practice patterns. The analytic methods are world class. However the medical school ranking scheme on which it hinges is so fundamentally flawed that the likelihood of a Type 1 error is high.

Thank you for your thoughtful comments. We completely agree with you that it would be incorrect to take our findings to infer that the quality of medical school training bears no relationship with the quality and costs of care provided by physicians downstream. In theory, there could be a causal effect of medical training or the types of physicians who attend specific medical schools may have different innate skill.

Importantly, the goal of our study is NOT to analyze whether medical school quality is related with downstream quality and costs of care. The goal of our study is to understand whether the heavily used *U.S. News & World Report* (USNWR) rankings bear any relationship, as a predictive signal, with the downstream quality of physicians. Patients and others view these rankings as being informative of quality, but empirical evidence is lacking to support the validity of this perception. By linking the medical school from which a physician graduated with hard measures of physician-level quality (mortality, readmissions, and costs of care), we can rigorously examine whether USNWR rankings offer any signal as to a physician's quality. We find no evidence of that, which is the main point of the analysis. You astutely write this at the end of your report – our study is about the relationship of USNWR rankings with physician quality, NOT about whether better schools (measured objectively) produce better clinicians. We revised our manuscript to clarify this point, and hope this critical issue of study framing and interpretation is now clearer.

We also agree with you that there are potential issues with the USNWR rankings, and we have now added two alternative rankings (Fitzhugh Mullan's ranking based on social mission score and ranking based on NIH funding) to our revised manuscript based on your recommendations. We still find that these rankings are not associated with downstream physician outcomes. It's important to note, however, that these findings are NOT widely known to patients, or even most researchers, and the purpose of our study was to analyze whether common PERCEPTIONS of quality (the USNWR is commonly used) do in fact bear any relationship with measures of quality that patients and society care about.

The authors fundamentally seek to test an inverse cost law (BMJ readers are no doubt familiar with the inverse care law), ie, does school ranking relate to trainees' future cost-related behaviors. They test both USNWR primary care and research rankings for association. As I previously described, the primary care ranking bears little association with empiric rankings that use actual primary care output. Please look at table 2 of the appendix of Fitzhugh Mullan's 2010 NEJM paper which ranks all medical schools by primary care output (<http://annals.org/data/Journals/AIM/20208/152-12-804-Appendix.pdf>) NONE of the top ten USNWR schools make the top 10, and only OHSU breaks the top 20. An opinion poll does not pass muster as the key criterion for a study that declares whether or not an important relationship between training and practice behavior exists, especially when much better criteria are available. For example, why not use Mullan's ranking? If they think is dated, repeat it--the data are already in their hands to do so. If they don't like that method, and the goal is really to see if there is a relationship between medical school and future outcomes, then use cluster analysis or a similar method--cluster graduates by school and analyze whether there is variance in outcomes associated with school. This would mean that they could include international graduates whom they currently exclude. Similarly, why use research rank when a more objective measure sits on the NIH website, specifically, the ability to rank institutions based on their NIH funding? If that is deemed to be too limiting, it is still worth comparing the rankings to see if the USNWR opinion poll bears any relationship?

Thank you for your insightful comments, which we respond to in detail above. As noted, based on your suggestion, we added two secondary analyses to our revised manuscript: the analysis using Fitzhugh Mullan’s ranking based on social mission score, and ranking based on NIH funding to medical schools. We found no meaningful associations between social mission ranking and patient outcomes/costs of care, which we now report. As we note above, the goal of our study was to understand whether the heavily used USNWR rankings bear any relationship, as a predictive signal, with the downstream quality of physicians.

Previous, related studies of USNWR rankings and opioid-related prescribing patterns suggest that graduates of lower-ranked schools are more likely to prescribe opioids. In our own analysis, we found is that lower-ranked schools were much more likely to produce primary care physicians who, because they provide more than half of the outpatient care in the US, are far more likely to care for patients presenting with pain. The relationship was not about quality of medical school, the relationship was between primary care production, care volume, and prevalence of pain as a presenting or comorbid symptom. The problem in this case was different from that in the current paper in that its main problem hinged on the explanatory relationship between ranking and outcome. In this case, the ranking was a viable criterion because the opinion-based ranking does affect the types of students who apply and matriculate, and the cultural influence on choosing primary care careers--both negative; this despite the fact that the authors focused on quality (ranking) rather than on primary care output. It is important though, because it signals that the authors accepted it as a quality ranking rather than on the relationship between ranking and workforce outcomes that might explain the research outcome of interest. That is still a problem in this paper, that is, that they accept the rankings as valid.

We appreciate the opportunity to clarify this point. We agree that there are issues with the methodology of USNWR rankings, and as we state above we are by no means accepting them as quality rankings. Rather, we know that these are opinion-based rankings but ones that patient and most clinicians are astutely aware of. We show that these opinion-based rankings bear no relationship with the actual quality of care provided by physicians later in their careers. Our view is that it is important to empirically understand whether the widely-used opinion-based ranking of medical schools serve any predictive signal patient outcomes and costs of care of physicians who graduated from higher ranked medical schools.

To clarify this point, in our revised manuscript, we devoted an entire paragraph in the Discussion explaining this distinction as follows (page 22, paragraph 2):

“It is important to emphasize what this study does and does not attempt to identify whether the quality of medical education has impact on downstream practice patterns of physicians. Our main interest was to analyze whether the commonly used USNWR ranking is associated with subsequent patient outcomes and costs of care for physicians who graduated from medical schools with high vs. low USNWR rankings. We chose this question because the USNWR ranking of the medical school from which a physician graduated may be used by patients and clinicians as a signal for physician quality. We found no evidence that the USNWR ranking of the medical school from which a physician graduated bears any relationship with subsequent patient outcomes, at least when considering physicians who practice within the same the hospital. We also found no relationship between two other ranking schema and subsequent patient outcomes of physicians who graduated from high vs. low ranked medical schools (based on these two ranking schemes, one based on social mission score and the other on NIH funding); however, this does not imply that the quality of medical school training bears no relationship with quality of downstream patient care, which is a distinct question. It may, but the main focus of this study was whether common perceptions of a medical school’s quality – based on widely used USNWR rankings – provide any predictive signal for subsequent patient outcomes and costs of care..”

BMJ would do a huge disservice to the field by publishing this study in its current configuration because it would communicate that there is little to no association between medical school of training (more specifically, its rank for primary care or research) and future cost-related behaviors when that is not what they have tested. I think what it really revealing is that the USNWR ranking process has no relationship to reality. Alternative, objective data are available for creating rankings to test, and they could simply look at outcome variance related to school of graduation. I strongly recommend not publishing the current manuscript.

Our goal here is produce robust, rigorous analysis of a specific question: does the popularly used USNWR ranking tell us anything about the downstream quality and costs of care of physicians who graduated from higher vs lower ranked medical schools (based on that ranking)? The answer to that question is no. We have carefully gone through the manuscript to make sure that it is clear that we are NOT asking the question that you have posed – can medical school training matter for downstream physician outcomes? To be responsive to your suggestions regarding alternative means of ranking schools, we have conducted and now report additional analyses that suggest that two other ranking schema are also not associated with physician outcomes and costs of care. However, because the USNWR rankings are well known to patients and clinicians, we retain the view of focusing on this ranking because the core question is whether USNWR rankings provide any PREDICTIVE SIGNAL as to the future cost-related behavior and patient outcomes of physicians.