**Author’s response to reviews**

**Title:** Family effects on the rurality of GP's work location: A longitudinal panel study

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**Author’s response to reviews:**

Reviewer #1:

Comment 1:

I think the article provides a valuable contribution to the understanding of GP motives to work in rural areas in Australia. Also the insight in motives to refrain from work in rural areas are described. The differences in motives for male and female GPs are interesting. Although this article focusses on Australia, it might be interesting for policy makers in the USA and Canada as well. The attraction and retention of GPs to work in rural and remote areas is a major health care problem in these countries. This article provides handles for policy makers in attracting GPs to work in rural areas.

Response

Thank you for this confirmation of the value of our paper and for affirming the wide relevance of this research beyond Australia – no action required.

Comment 2

Important to know that once GPs decided not to work in rural areas, they will not consider to work in rural areas in later stages of their life.

Response

The focus of this study is the mobility of GPs, both between rural and metropolitan and within rural areas, and how this relates to family factors like schooling and spouse career stages. Our results are based on an aggregation of all GPs over the course of the study – some may have transitioned during the observation period from having children in primary school to secondary
school, while others may not have. The analyses compares the odds of GPs working rurally (in smaller or larger communities), or not, as family factors change with the odds of working rurally for GPs in the previous life stage.

We did make a comment about the “return to rural locations” in the Discussion which suggested that there wasn’t a significant return to rural locations once all children completed secondary school. We have adjusted this wording to “corresponding increase in choice of rural work” to avoid introducing a new concept and confusing the reader as to the main focus of the study.

Action – A new reference for rural GP mobility rates has been added and the wording of the sentence in the Discussion on p11, 251-57 has been amended to provide a more accurate interpretation of the data.

Reviewer #2:

Comment 3

Overall this is a robust study, with good data, and well written down. While the topic is not very innovative, and the results may be as expected, recruitment and retention of GPs in rural areas remains an urgent issue without a definitive solution so far.

Response

Thank you for your acknowledgement of the robustness of this study, with its use of high quality data. As reviewer 1 also indicates, it is a very important topic of widespread relevance to many countries who struggle with attraction and retention of doctors in rural and remote areas. We acknowledge that schooling, partner/spouse employment needs are readily noted in the recruitment and retention literature, but its evidence stems from only cross-sectional or small qualitative studies.

We strongly argue that the methods used to quantify the size of this issue and sub-populations of GPs most at risk is highly innovative. In fact, to our knowledge, this analytical approach has never before been taken, using national-scale data and longitudinal analyses which capture the dynamics between key family-related factors and observed work location. Our innovative methods identify three key issues: (1) gender differences; (2) schooling-level differences; (3) rurality differences. Given the ongoing lack of a definitive solution, as highlighted by reviewer 2, our study represents significant advances in the existing evidence base. Our more finely-grained approach helps to specify the where and who to inform policy directions, rather than this just being another study saying “it’s a problem”.

Action – We added edited the key strengths of the study immediately prior to the Conclusion (lines 346-350).
Comment 4

Because the knowledge is not very innovative, I think it would benefit the paper tremendously if it would focus more on the implication-side of its findings. What can (local) policy do to improve retention rates of those GPs who are found to leave because of the non-professional factors that were studied in the paper? What can the educational field do? Or the GP professional bodies? In the discussion, some suggestions are made, but these can be considered weak. For example, on pg 12 (lines 260-262) mentioning is made of financial compensation. It is well-known that financial incentives 99% of the time do not work. This was confirmed by the large study "Recruitment and retention of the health workforce in Europe" (which also included cases from Australia). See Kroezen et al. (2015) "Recruitment and retention of health professionals across Europe: A literature review and multiple case study research", Health Policy, 119: 1517-1528. It is clearly stated that based on a review of R&R interventions (with one topic focusing on Attracting and retaining GPs to strengthen primary care in underserved areas): "financial incentives alone, often put in place to attract health workers to underserved areas, are unlikely to achieve their goals and are more effective if combined with other types of measures". So I would urge the authors to dive a bit deeper into R&R interventions, with proven effectiveness that may fit well with the outcomes of this paper.

Response

As per Comment 3, we believe the methods are innovative and the knowledge is new, particularly differences by gender, school level and rurality. Investigating differences in rural workforce outcomes by these factors is an important innovation that informs policymakers about how to better target retention strategies, including factoring in discussions about family factors as part of retention planning for different groups of GPs.

We have extended our 'Discussion' and edited this section to more clearly highlight the implications of the results, including a range of current programs that support families of rural GPs (see lines 298-303). Many of these do not specifically target different groups of GPs in any particular location, nor does there exist evidence of their effectiveness so we have minimised speculating about their value for improving GP spouse employment or their children’s education. In addition, we agree with reviewer 2 that financial incentives are only likely to be effective if combined with other measures, or ‘bundled’. As such, we modified this paragraph (see lines 286-291) so that it more clearly indicates that financial incentives could be part of a broader retention package (references: Buykz, Kroezen, Barnighausen). More broadly, we have expanded our discussion of the role of regional development and evidence of Australia’s commitment to this (see lines 316-322).

Action – The Discussion section has been expanded and edited to strengthen the implications emanating from this paper. A clearer message is given regarding the role of financial incentives.
Comment 5

The authors find some interesting differences between male GPs and female GPs. But again, explanations provided are weak. One important factor that is missing, in my view, is the fact that most female GPs work part-time. This may be an important explanation why there is no association with work location for female GPs when their children reach secondary school, while there is an association for male GPs with work location when their children are in secondary school. Because a part-time job can be easier combined with children going to secondary school than with younger children. However, for full-time jobs (male GPs) the combination is always problematic, of course. This explanation may also give clues for successful R&R interventions (e.g. opening up more possibilities for shared practices and part-time work, especially with the feminization of the GP workforce).

Response

We agree that these gender differences are interesting, but are limited in explaining the different patterns by male GPs and female GPs, quantified by our research. We are aware that although the quantitative analysis identifies ‘who’ and ‘where’ effects, better understanding ‘why’ particular GPs move is likely to require further qualitative research, beyond the scope of this study. We checked the published literature and found there was no evidence to inform why the differences exist.

Reviewer 2 speculates that working part-time might be a factor explaining differences in location choices between male and female GPs. We agree that this may warrant further qualitative investigation, but goes beyond the aim of this study.

Action – As part of the discussion, we noted a range of existing interventions, though these remain to be evidence-informed. We also added a statement about qualitative research being needed to investigate the ‘why’ behind gender differences that were noted in our study.

Comment 6

In the background section, on pg 5 (lines 89-99) no numbers are mentioned and no references on 1) the number of schools and 2) the quality of rural schools and universities compared to metropolitan areas. I’m sure a country as Australia has these available, and it would be interesting to mention them to see whether we are dealing more with a perceived problem or a real problem.

Response
Measuring quality of schools is a very contentious area. Apart from objective measures of quality, perceptions of quality of education are even harder to pin down. They depend on what aspects of education are valued most, which is highly individually-variable. (See https://theconversation.com/test-scores-arent-good-quality-indicators-for-schools-or-students-43475)

We are therefore reluctant to delve too deeply into quantifying rural school quality. However, in addition to our existing comments on the proportion of high school completers and university educated rural residents, we have provided more background about educational achievement between rural and metropolitan students and issues of high teacher turnover. The evidence suggests the gap is real.

Action – The Background section has been expanded with further information (and references) about the relative education ‘quality’ between metropolitan and rural areas.