Author's response to reviews

Title: Dealing with Missing Data in a Multi-question Depression Scale: A Comparison of Imputation Methods

Authors:

Fiona M Shrive (fmshrive@ucalgary.ca)
Heather Stuart (hh11@post.queensu.ca)
Hude Quan (hquan@ucalgary.ca)
William A Ghali (wghali@ucalgary.ca)

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Iratxe Puebla, Assistant Editor
BMC Health Services Research
Middlesex House
34-42 Cleveland Street
London, UK
W1T 4LB

RE: Revision of Manuscript # 1485274558295408

Dear Dr. Puebla:

Thank you for giving us the opportunity to revise the above manuscript. We have modified the manuscript in response to the reviewers' comments. We provide an itemized summary of the changes made to the paper (below). Reviewer comments are shown in bold, followed by our responses. Additions to the manuscript itself are bolded. The thoughtful comments by the reviewers have clearly improved the manuscript.

We look forward to your decision regarding our manuscript.

Please send any correspondence to Dr. William Ghali, wghali@ucalgary.ca

Yours sincerely,

Dr. Fiona M. Shrive
Dr. Heather Stuart
Dr. Hude Quan
Dr. William Ghali

Reviewer's report
Reviewer: Paula Diehr
1. The paper is now much clearer and easy to understand. The abstract is still unclear. "simulated by randomly" and "non-random missing simulation" are not the correct terms and will confuse readers. I think the terms they need are "missing completely at random" and "missing at random". These need to be written exactly this way, even though the terms are stylistically ugly.

We have now carefully gone through the text to ensure that the terminology is consistent and correct throughout the manuscript.

2. On page 6, I don't think the first method called MAR is actually MAR because it does not depend on any patient characteristics. It is just another MCAR simulation. The probability of being missing is just twice as high for question 6 as for the others. MAR means missingness depends on an observed patient characteristic. "non-random simulation" on page 7 should be "missing not at random". These terms must be used precisely.
We have changed the description of the "Q6" scenario to more clearly articulate it is an unbalanced MCAR
scenario (page 6, paragraph 2). Thus, our missing data scenarios are:
1) MCAR with the probability of missingness set at 10%
2) MCAR with the probability of missingness set at 20%
3) MCAR with the probability of missingness set at 30%
4) Unbalanced MCAR with the probability of missingness for question 6 set at 20% and 10% for all other
questions
5) MAR with the probability of missingness linked to age and sex
6) NMAR with the probability of missingness linked to the response of the question itself.

Reviewer: Kosuke Imai
1. I encourage the authors to think harder about theoretical issues that motivate this simulation exercise. I
am not suggesting that you have to write JASA paper with many proofs. Rather, I would like to know what
general implications one should take from the authors' particular simulation exercises. Under what
conditions, should we expect the authors' conclusions to hold or not to hold? Without this guidance, readers
must wonder whether the authors' simulation results are even relevant to the data they are analyzing.
Again, I do not expect any rigorous formal proofs. However, at minimum some theoretically-informed
arguments are necessary in order to apply these specific simulation results they obtained to other studies.

Thank you for rearticulating your point. This clarifies what you would like to see included the manuscript.
We have included a paragraph in the discussion (page 16, paragraph 2) discussing when MI would be
expected to perform best and how our results fit with the theoretical arguments relating to MI.

2. I think that the creator of multiple imputation will be disappointed if the main advantage of MI is not
examined at all! The main reason Don has been advocating multiple imputation over single imputation is to
take into account for the imputation uncertainty. Examining the validity of the uncertainty estimates can be
easily done by calculating the coverage probability.

We agree that this is an interesting issue to explore and have thus conducted additional analyses. We have
now included an additional table (table 5, page 27) that demonstrates the reviewer's point regarding the
advantage of MI in demonstrating the uncertainty that is associated with any imputation procedure. For
table 5, we assessed the number of times that the "true" value was captured by the range of estimated
values produced by the MI procedure with 5 imputations. We assessed this for three different missing data
scenarios (MCAR-p=0.10, MAR-age and sex and MNAR). For comparison, we also assessed the proportion
of the time that the imputed value produced by single regression imputation agreed with the true value. We
have included a paragraph presenting the results on page 13, paragraph 1, and in the discussion (page 16,
paragraph 2) briefly mention the strength of MI methods for depicting the uncertainty associated with
imputed values.