Reviewer’s report

Title: Severely malnourished children with a low weight-for-height have a higher mortality than those with a low mid-upper-arm-circumference: I. Empirical data demonstrates Simpson's paradox

Version: 1 Date: 05 Oct 2017

Reviewer: Alan Jackson

Reviewer's report:

This series of three papers presumably reflects a single paper that has been submitted in the past and returned to be redrafted. The papers represent a detailed analysis which seeks to rebut an ongoing debate in the literature around the most suitable approach to identifying children with severe acute malnutrition in order to provide most appropriate care. It hinges on the relative importance and use of the different WHO criteria, mid-upper arm circumference, weight for height, the presence of nutritional oedema, separately or together.

Paper 1.

There are two important points addressed in the first paper. Firstly, the relative risk of mortality associated with each criterion on its own, and when it is combined with the other criteria. The authors have analysed a body of data to which they have access, some 76,887 aged from 6 to 60 months, of whom 3,558 died. The second point is statistical and seeks to clarify the basis for different interpretations which are considered in the literature stating greater benefit of MUAC over weight for height for a range of reasons.

1. The analysis of the data show clearly that each criterion carries its own risk of mortality and any approach that selects one over another will fail to adequately identify all the children at significant risk. Further it shows that the risks are interactive, rather than simply additive. Simply combining the groups without a better understanding of the biological/pathological basis for these differences may not be appropriate.
2. Simpson's paradox is an accepted statistical principle and although it may be a common cause for analytical concern it is not widely familiar to many carrying out clinical-related research. A clear concise articulation of the basis of the problem it identifies at an early stage of the manuscript would have been helpful for the usual reader in following the detailed information and arguments that follow. A simple statement along the lines that it is a special or extreme form of confounding which identifies how groups, (or criteria) might, or might not, be combined, for analysis would be of value in.

3. Page 4, line 40; should it be "underestimated" for "overestimated"?

4. Page 7, line 130; this is a tortuous introduction to the second a priori hypothesis.

5. Page 10 identifies a range of issues around judgements on data handling, which are welcome. However, it would be of value to have some sense of the magnitude of these issues, or frequency of occurrence.

6. In the Figures, it is not clear what the ALL column in red represents. Elsewhere in the text it is used with a meaning that does not fit here.

Paper 2.

This paper offers a systematic review of the literature of all the other papers which relate the WHO criteria for SAM to outcome, but where the information is not sufficiently complete to contribute to Paper 1. In this way the authors seek to consider all the possible information that might argue against the thesis which is propounded in paper 1. The data and information are well organised and making it possible to follow the variable nature of the information presented and the changes in practice with time and geography. It is not possible to check all the data, but by and large the argument is persuasively made that none of this information differs in a way that would cause major concern for the interpretations offered in Paper 1.

1. Abstract line 20. Here and elsewhere this term is used and it is difficult to see how criteria can be additive for mortality (it is only possible to die once). If possible an alternate expression would be preferable. Presumably the risk of death is increased by having more than one risk factor. Is this additive?

2. Table 1. It is not clear what "Both sdy" and "Both Com" mean.
Paper 3.

This is a paper which takes available data to carry out a modelling simulation. This draws on the data and interpretations of Paper 1 and Paper 2. The consequence of using different criteria on the number of children who are not likely to die through not receiving the appropriate attention is assessed. Against the criteria for characterising SAM (MUAC and SAM), the two factors of importance are variations in case load and case fatality rate. The model allows an assessment of the practical implications of strong recommendations that have been made to only use MUAC as the anthropometric criterion for identifying children with SAM. If the logic of these papers is to be follow this has serious ramifications which are increasingly being discussed in the literature.

1. Abstract, lines 10,17,18,20,24. Here and elsewhere there is generous use of "relative". At times this has clear technical implications, at others it has lack of clarity or allows ambiguity. Some care here would make it easier for the reader to follow.

2. The discussion of this Paper makes important points, but it is overlong and at times tends towards the polemical. The reader would benefit if this were concise and to the point.

3. There are no references for this paper.

Taken as a whole these are important papers which contain a body of detail that at times appears repetitive eg Paper 3. The work needs to be accessible to an audience that would value the principles being enunciated without being overburdened by all the detail offered to justify the journey. This may be challenging but is important if the main message which is being made is to command the support it seeks.

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