Reviewer's report

Title: Development and Validation of the Diabetes Numeracy Test (DNT)

Version: 1 Date: 12 September 2007

Reviewer: Rima E Rudd

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The manuscript is very well written, focused, and logically organized. The steps in the development of the instrument are clearly articulated as are the analytic processes applied to determine internal and external reliability of the constructed scale.

The manuscript addresses an important health literacy issue that has not been well addressed or well measured. As the authors point out, adults managing a chronic disease are expected to perform multiple tasks involving numbers, understand mathematical concepts, and use a variety of tools including clocks, calendars, tables, charts, and graphs. The IOM report, cited by the authors, does indeed call for a broad understanding of health literacy that includes quantitative skills/numeracy. In addition, the IOM report called for the development of health literacy measures that move beyond approximations of reading skills [as measured by word recognition tools or cloze tests to indicate comprehension].

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

1. As a result of cognitive interviews and through the test analyses, the authors were able to identify several problem areas for the sample of patient participants in the study. This analytic process is quite impressive. A multi-disciplinary team examined mathematical tasks involved in five diabetes self-management areas. These include: interpretations of food labels, determinations of when to refill medicines, use of titration instructions, interpretations of insulin measures, and calculations for the adjustment of insulin dosage. In addition, the authors highlight the importance of the demand side: the critical importance of “framing” [presentation of clear instructions], the difficulties in multi-step math calculations, and benefits of clear presentation of data in tables. It would appear that action to clarify instructions, to simplify tools such as measurement tables for dosage, and to minimize the need for patients to multiply, divide, or use fractions – would alleviate much of the burden on the patient. What clinicians would do differently for those with high and those with low numeracy skills is not clear.

Ironically, the conclusions to be drawn from these important insights/findings serve to undermine the main argument that numeracy skills ought to be measured and therefore call the proposal for numeracy testing into question. First, the authors point out at the very start, that significant numbers of US adults have basic or below basic literacy and numeracy skills. They also note that
diabetes management requires the application of many literacy and numeracy skills and that these skills are even more important as the disease progresses. Given the general mismatch between existing skills and existing demands, the logical conclusion is that universal precautions ought to prevail. The authors need to make a very strong argument for the value of testing numeracy skills in clinical practice. This reader is not persuaded.

This is not to say that the work contained herein is of no importance. Indeed, the insights gleaned from the process are of critical concern. I suggest that these insights ought to be the focus of the paper.

2. Please see note #7 below. The authors need to present more information re: the items on the scale with particular attention to % of simple and complex numeric calculations.

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Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Please consider the following and offer modifications:

1. Page 4 – Missing details in background: Details focused on the quantitative scores from the NALS and the NAALS is needed. The authors ought to present findings. They should make some meaning of the fact that prose, document, and quantitative scores do differ. They need to present the quantitative score findings.

2. Page 4 – Confusing use of terms: the authors do not differentiate between measures of quantitative skills and measures of numeracy. The NALS and the NAALS measured quantitative skills. The Adult Literacy and Lifeskills [ALLS] changed from quantitative measures to measures of numeracy. Scholars in the field differentiate between the two.

3. Page 4 – Weak source for definition of key terms: More detailed discussion of the term numeracy is needed. The citation for the definition of numeracy comes from an article in a medical journal focused on the use of food labels. Definitions of critical terms ought to be derived from more appropriate sources within the education field. The authors might want to look at the definition of terms in the Adult Literacy and Lifeskills Surveys, assessments of adult literacy skills used in industrialized nations [see Education Testing Services and/or Statistics Canada].

4. Page 5 - Silence regarding the TOFHLA: the authors make no mention of the fact that the TOFHLA attempted to measure quantitative skills. This is relevant to the study at hand.

5. Page 5 – Needed clarification of purpose: it is not clear whether the authors are focused on a ‘diabetes related literacy assessment’ or a ‘diabetes related numeracy assessment’.

6. Page 5 – Incomplete argument: why is it important to develop a scale that measures ‘diabetes related numeracy’ rather than develop a scale that measures ‘health related numeracy’? Need researchers develop numeracy scales for all chronic diseases? Asthma management, for example, requires monitoring, measuring, calculations, use of measurement tools, medicine labels and
directions…

7. Page 5 – Needed analysis: the authors make note of an initial analytic process that involved a delineation of numeracy tasks in diabetes management. At the same time, they do not seem to differentiate between relatively easy tasks and higher level, more difficult tasks. An analysis of the difficulty level of items is needed. The authors might want to look at the development of the adult literacy measures to understand how the education scholars scored various quantitative items [See Kirsch’s What was measured?]. The panel determined that the 45-item scale covered the range of numeracy skills. One cannot understand the scale without some indication of the number of easy items [simple math vs the number of complex numeric tasks.

8. Suggestion for additional Ho: The authors measured duration of diabetes [table 1] but do not appear to consider duration in any of the analyses. Might patients, over time, improve their understanding of their disease, their use of existing materials and tools, and their management skills? Would this compensate for limited skills?

9. Page 8 - Convenience sample. The authors draw their convenience sample from an academic health center and a VA health center. They might have INCREASED DIVERSITY AMONG PARTICIPANTS HAD THEY drawn a more diverse convenience sample through the use of additional community based sites.

9. Pages 9-10: WRAT-3R. The DNT is strongly correlated with the WRAT-3R. Is the WRAT-3R also correlated with education, income, word recognition [REALM], and DKT? THE ANALYSIS OUGHT TO INDICATE WHAT, IF ANY, ADDED VALUE THERE IS IN THE ADMINISTRATION OF THE DNT.

Discretionary Revisions (which the author can choose to ignore)

If the authors move forward with the emphasis on an assessment tool - please include a detailed discussion of the value of clinical testing with some insight and directions re: what actions clinicians should take with patients who score low and what actions clinicians should take with patients who score high.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:
I declare that I have no competing interests