Author's response to reviews

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

Authors:

Mary Margaret Huizinga (mary.margaret.huizinga@vanderbilt.edu)
Tom A Elasy (tom.elasy@vanderbilt.edu)
Kenneth A Wallston (ken.wallston@vanderbilt.edu)
Kerri Cavanaugh (kerri.cavanaugh@vanderbilt.edu)
Dianne Davis (dianne.davis@vanderbilt.edu)
Rebecca P Gregory (becky.gregory@vanderbilt.edu)
Lynn S Fuchs (lynn.fuchs@vanderbilt.edu)
Robert Malone (robb.malone@med.unc.edu)
Andrea Cherrington (cherrington@uab.edu)
Darren A DeWalt (dewaltd@med.unc.edu)
John Buse (jbuse@med.unc.edu)
Michael Pignone (pignone@med.unc.edu)
Russell L Rothman (russell.rothman@vanderbilt.edu)

Version: 3 Date: 20 February 2008

Author's response to reviews: see over
February 19, 2008

Editor in Chief  
BMC Health Services Research

To the Editor:

We appreciate the reviews from Drs. Rudd and Bosworth and have addressed the comments below. Attached please find the revised manuscript “Development and Validation of the Diabetes Numeracy Test (DNT),” which we are submitting as an original research article. We hope that you will again consider it for publication in *BMC Health Services Research*. The scales described in this paper are available through a weblink referenced in the paper ([http://vanderbiltdrtc.org/preventionandcontrol/tools.php](http://vanderbiltdrtc.org/preventionandcontrol/tools.php)).

This purpose of this manuscript is to describe the development and psychometric testing of the DNT and the shortened DNT15 and the methods we used to establish their reliability and construct validity. We believe that by publishing this scale and, thus, making it available to other investigators, its importance and utility may be further determined.

We apologize for any confusion in previous versions about the primary goal of this manuscript. This is an article designed to describe the development, reliability and construct validity of the DNT. Clinical outcomes were not part of the *a priori* construct validity model (see Figure 1) and therefore were not explored in this paper. The analyses presented in this manuscript were not meant to establish the DNT’s clinical predictability. We have made substantial changes in the manuscript to highlight that this manuscript only describes the development, reliability and construct validity of the original and shortened versions of this new tool.

The soundness of the science used to develop and psychometrically assess the DNT does not appear to be questioned by the reviewers. Rather, the reviewers principally question the utility of this scale in clinical practice. This paper is meant to introduce this new scale into the body of scientific knowledge so that further assessment of its clinical utility and significance may be explored. The DNT is a new and unique scale that measures diabetes related numeracy. The clinical significance of the scale cannot be determined at this time.

Thank you for your consideration of this revised manuscript. This study represents original work that has not been published elsewhere. An abstract related to this work was presented at the Society for General Internal Medicine in 2006. The current authors do not have any significant financial disclosures or conflict of interest. Please refer all correspondence to the address below.

Sincerely,

Mary Margaret Huizinga, MD MPH  
Vanderbilt University Medical Center  
Medical Center East, Suite 6000  
Nashville, TN 37232  
Phone: 615-936-7308  
Fax: 615-936-1269  
Email: mary.margaret.huizinga@vanderbilt.edu
Specific responses to the Editor’s comments:

1. More specifically, you must further clarify why you are not including data in this current manuscript that could be used to address points raised by the reviewers

This is an article designed to describe the development, reliability and construct validity of the DNT. Clinical outcomes were not part of the *a priori* construct validity model (see Figure 1) and therefore were not explored in this paper. The analyses presented in this manuscript were not meant to establish the DNT’s clinical predictability. We have made substantial changes in the manuscript to highlight that this manuscript only describes the development, reliability and construct validity of the original and shortened versions of this new tool.

In a separate analysis we have explored the association between the DNT and A1C. We found for every decrease of 10% in the DNT score, the hemoglobin A1C value increased by 0.09% (*p* = 0.01) after adjusting for age, sex, race, income, diabetes type, years of diabetes diagnosis, and clinic site. This exploration of the DNT and its associations with clinical outcomes is outside the scope of this manuscript and has been described in a second manuscript currently under revision at the *Annals of Internal Medicine*. If/when that second paper is accepted for publication, we can refer to it in the current manuscript. These changes include changing “validity” to “construct validity” to show that we are demonstrating a specific type of psychometric property from our *a priori* construct validity model and reducing the discussion of clinical applications. (see page 7, and 10-13)

2. …demonstrate how the test would be useful in a clinical and/or educational setting

We apologize for any confusion in previous versions about the primary goal of this manuscript. This is an article designed to describe the development, reliability and construct validity of the DNT. This paper is meant to introduce this new scale into the body of scientific knowledge so that further assessment of its clinical utility and significance may be explored. The DNT is a new and unique scale that measures diabetes related numeracy. We think that the DNT will be very useful as a research tool – to better understand the importance of diabetes related numeracy in patient self-management, self-efficacy, and clinical outcomes. While our research group includes many practicing clinicians and diabetes educators who feel that the DNT may have clinical utility, the role of the DNT for clinical or educational purposes requires further study. While our group is poised to pursue this line of research, we first need to introduce a reliable and valid scale into the literature that we may cite as we further test the clinical usefulness. We cannot make claims about the clinical usefulness before such rigorous study is applied. We believe that by publishing this scale and, thus, making it available to other investigators, its importance and utility may be further determined. We have de-emphasized potential clinical applications of the scale and reformatted the paper to focus on the psychometric properties of the DNT and DNT-15. (See pages 11-13).
Specific responses to Reviewer #1:

1. The authors state that the relationship between the DNT and health-related outcomes are currently being assessed in separate analyses [sic]. It is not clear why these results would not be included in the current paper to address issues of predictive validity.

See response # 1 to the editor above.

2. Clarify that the reliability values and correlations listed in the abstract pertain to two samples as a result of splitting the samples.

The sentence in the abstract was reworded as follows: “In split-sample analysis, correlations of the DNT-15 with the full DNT in both sub-samples was high (rho = 0.96 and 0.97 respectfully)” (see page 2)

3. Principal component analysis is not factor analyses. Factor analysis and PCA are two different, but similar analyses.

We agree that the terms may be ambiguous and that those in the field may disagree upon its usage. We have replaced the term factor analysis in the results section with principal component analysis. (see page 10)

4. Some discussion of estimated time for the shorten version should be considered.

We estimate that the time to take the shortened version of the DNT (DNT-15) is about 10-15 minutes. We are currently evaluating this as part of a larger ongoing randomized trial. We have added this estimated time to the manuscript (See Page 11)
Specific response to Reviewer #2

1. I am not comfortable with the note that questions will be answered in a second manuscript currently under review. I believe that a manuscript should contain all the needed information.

Please see the answer to the first comment of the Editor. We believe that this manuscript contains all of the information to assess the DNT’s reliability and construct validity as based on our *a priori* model.

2. I remain uncomfortable with the recommendation that this one half hour test is useful [sic] in clinical practice or for diagnostic [sic] education purposes.

We apologize for any confusion in previous versions about the primary goal of this manuscript. This is an article designed to describe the development, reliability and construct validity of the DNT. We have made changes in the manuscript to highlight that this manuscript only describes the development, reliability and construct validity of the original and shortened versions of this new tool. We have deleted the section about the clinical applications of this tool and placed more emphasis on the research capacity of the DNT and DNT15. (see pages 11-13)

Our aim in this paper was to show that the DNT is reliable and has reasonable construct validity based upon an *a priori* construct validity model. As clinicians, we believe that the scale provides useful clinical knowledge, but the full utility of the scale cannot be known until it is in the public domain of knowledge for others to consider and use. The scale may be particularly useful as a research tool to explore disease specific numeracy skills in diabetes. As clinicians and diabetes educators, we also believe the shortened DNT provides useful information that will aid in the management of diabetes, but this remains to be seen.

3. However, I do not agree that this diagnostic tool for health educators will prove useful. The 30 minutes needed for the assessment may well be applied to an in-depth education opportunity --time that is scarce in clinical settings.

Overall, I find the insights to be very valuable. I clearly have a philosophic difference with the authors about the value of testing at this point and the use of a diabetes specific numeracy assessment [sic] tool.

We do not propose to use a half-hour scale in clinical practice. The shortened version of the scale, the DNT-15, will likely be the more clinically useful scale. We estimate that this scale will only take about 10-15 minutes to administer, and the utility of this scale is currently being evaluated in a randomized trial. The current manuscript is primarily meant to introduce this new scale into the body of scientific knowledge so that further assessment of its clinical utility and significance may be explored. The DNT is a new and unique scale that measures diabetes related numeracy. The clinical significance of the scale cannot be determined at this time.