Psychometric measurement properties of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS) evaluated among Veterans with mild traumatic brain injury and behavioural health conditions

**Manuscript ID TIDS-01-2019-052**

**Editor**

**Comment:** “Revise your section on 'Implications for Rehabilitation' to bring them in line with the house style of the Journal. It helps to have an initial bullet point setting the context followed by two or three direct recommendations in this case to those using the WHODAS in practice. Each should be a single sentence.”

**Response:**

Thank you for pointing this out. We have revised the Implications for Rehabilitation section to be in line with the style of the Journal. The bullets have been reduced to a single sentence for each bullet point.

**Reviewer 1**

**Comment:** “The running head is laconic as it should be but the mTBI abbreviation can be confusing; in key words you have got both short and long expressions which is fine”

**Response:** We have revised the Running Head title from “WHODAS Psychometrics: mTBI and Behavioural Health” to “WHODAS Psychometrics: mild TBI and Behavioural Health”

**Comment:** “Implications for rehabilitation: second chapter: first sentence: can be used "as"?”

**Response:** Thank you for pointing this out. We have revised the Implications for Rehabilitation section to be in line with the style of the Journal. The bullets have been reduced to a single sentence for each bullet point.

**Comment:** “In Results, in Sample Characteristics you have listed diagnosis of behavioural health conditions in the two groups; this could be written more clearly.”

**Response:** Thank you for this opportunity to increase clarity in the manuscript. We have now re-written this sentence, in the first paragraph of the Results, to read, “Behavioural health condition diagnoses for the behavioural health conditions alone group (n=24) and the mTBI+behavioural health conditions group (n=128), included anxiety, depression, and PTSD, 48% (n=11) and 33% (n=42), respectively.”

**Comment:** “Construct Validity: first chapter, second last sentence, delete 0.75”

**Response:** The 0.75 in the Construct Validity section, first paragraph, second to last sentence has now been deleted.

**Comment:** “In Discussion, the chapter "These findings and interpretation are consistent..." you could add one more citation of a recent WHODAS-12 study in TBI in Journal of Rehabilitation Medicine 2018;50:514- If you feel you have got too many citations I would suggest that you could omit your 8th citation (manual for WHODAS) and simply use <http://www.who.int/classifications/icf/whodasii/en/> in the text”

**Response:** Thank you for these suggestions. We have now incorporated this suggested paper in the discussion.

**Comment:** “Conclusion: 4-5th line: multiple co-occurring behavioural health conditions (add s, pluralis)”

**Response:** Thank you for pointing out this error. This sentence now reads, “Individuals with mTBI and multiple co-occurring behavioural health conditions also had greatest disability.”

**Reviewer 2**

**Comment: “**First, on page 13 l. 4: Item D2.5 under the Mobility subscale, is in the original version “Walking long distance”. This mobility item has been extended in your version into Walking or wheeling… (the expression “or equivalent” pertains to the distance unit, not the way one moves about). How many participants used a wheelchair in this study? The extension of this mobility item should be described in the method section, and discussed as a possible limitation, as it might influence a direct comparison with other studies testing psychometric properties of the WHODAS.”

**Response:** Thank you for pointing out this area if confusion and allowing us to clarify. Item D2.5 on the WHODAS 2.0 36-item version, self-administered data collection form we used stated, “Walking a long distance such as a kilometer [or equivalent]?” To clarify, we have corrected this error and removed references to “wheeling” in Table 2 and Table 4.

**Comment:** “Page 4 lines 48-58: You argue that a comprehensive disability measure is a candidate standardized method for measuring disability in Veteran populations with TBI and behavioural health conditions. It should be noted that the TBI population in general and those with behavioural health conditions have mental health problems that are not covered in the WHODAS. The WHODAS has a cognitive function scale, but not a mental health scale, unlike for example the SF-36. I think that even if the scale and factors in this study shows that the WHODAS has sufficient metric and scale properties to differentiate among the groups, it should be noted that it is design to capture functioning on ICF activities and participation dimensions, but that supplemental assessments regarding the mental health issues might be relevant. You could add this into the introduction, or if preferred, into the discussion section.”

**Response:** Thank you for raising this important point. We agree that the WHODAS does not have a domain that directly measures behavioural/mental health problems. Our introduction, as originally written, specifies that WHODAS items were developed based on ICF dimensions and further points out the relevance and precedence of using the WHODAS in psychiatric populations. However, we note this important point and have added the following two sentences in the last paragraph of the Discussion, “The WHODAS captures functioning on ICF activities and participation dimensions, which do not specifically include a domain related to behavioural/mental health problems. Therefore, supplemental assessments specific to behavioural/mental health problems may be indicated.”

**Comment:** “Page 6 l. 35: You write WHODAS-36 here. Other labels are WHODAS 2.0 followed by just using WHODAS as the general term. Since this is also the 36-item version you refer to I suggest you use only WHODAS “The psychometric properties of the WHODAS have…» or “of the 36-item WHODAS”…

**Response:** We agree that using multiple terms is confusing. We have changed the term, “WHODAS-36” to “36-item WHODAS.” We have also eliminated the WHODAS 2.0 label.

**Comment:** “Page 7 l. 54-59: You write: “Veterans in the parent database could be classified as not having behavioural health conditions for the study purposes yet have other behavioural health conditions.“ It is not clear to me what this means. Could you please explain this more in the text.”

**Response:** Thank you for allowing us to clarify this important point in the manuscript. What is meant here is that behavioural health conditions for the purposes of the parent study met criteria for PTSD, depression and anxiety. We know that this is not an exhaustive list of behavioural health conditions. To be clearer in the manuscript, we have now removed this sentence. We believe that what was clear in the manuscript as written was our operational criteria for behavioural health conditions.

**Comment:** “Page 7 l. 59- page 8 l. 15. The AUD – This is also not quite clearly described. Are participants that fulfill AUD criteria scoring 4 (3) on the questionnaire categorized as having behavioural problems in this study, but not the parent study? Or are there any controls that fulfill the AUD criteria?”

**Response:** Thank you for allowing us to clarify. Participants meeting AUDIT-C criteria for probable AUD are not categorized as having bevioural health conditions for the parent study or this study. To clarify, we have now added “or this study” at the end of the following sentence in the Methods, “Individuals meeting the criteria for probable AUD were not classified as having a behavioural health condition in the parent study or this study.” There are 70 combat controls that met probable AUD criteria on the AUDIT-C. Thus, we examined DIF by AUD status and did not find that the participant’s measures of functional disability were substantially different when estimated with and without differential item functioning items, indicating that AUD status was not distorting participant measures. To address the need for broadening the classification of behavioural health conditions, we have added the following sentences to the Discussion paragraph addressing study limitations, “Our sample classification of behavioural health conditions was limited to depression, anxiety and PTSD. Future work should also include a more comprehensive and broader spectrum of individuals with behavioural health conditions.”

**Comment:** “Page 8 l. 50: As a European I do not understand the need to have race and ethnicity as separate categories. And is this dichotomy useful for the description of the population or the analyses?”

**Response:** The standard federal categories for race and ethnicity are defined by the U.S. Office of Management and Budget (OMB) and are employed for medical research. In addition, data are collected in a separate question asking whether someone is “Hispanic” or “Latino”; Hispanics or Latinos are an ethnic group based on family background or ancestral ties. Hispanics or Latinos may be of any race, and are asked the same race question as everyone else. Although the races are defined as having origins in particular parts of the world, in reality race and Hispanic origin are self-defined. Thus, we are keeping our sample characteristics separate as race and ethnicity. Allowing for our sample characterization to be consistent with reporting standards of the U.S.

**Comment:** “Page 9 l. 8: The logit values: Did you log-transform the data? If not, please explain what you refer to.”

**Response:** Rasch analysis converts raw scores to log odd units referred to as logits. This sentence with relevant citation are now included in the Methods, ‘Psychometric analyses’ section.

**Comment:** “Page 9: descriptions and performance of the statistical analysis: I trust there will be a reviewer with competence in the statistical methods applied in this study. The analysis section appears thorough and the procedures are described in detail.”

**Response:** Thank you.

**Comment:** “Page 9 l. 31-32: My only questions concern the two small clinical groups, TBI only (n=10) and behavioural health conditions only (n=24), if they are large enough to provide sufficient information to be analyzed as separate clinical groups (l. 31).”

**Response:** We agree. Therefore, our main analysis brought all of these “clinical groups” together (n=162).

**Comment:** “Page 11 l. 22-24. This is unclear, “the largest group” meaning? Please rephrase.”

**Response:** We agree that this sentence is unclear and have re-written it to address this comment and the comment of reviewer 1, above.

**Comment:** “Page 12 l. 42. Please remove 0.75”

**Response:** Removed, thank you.

**Comment:** “Page 12 l. 45-47: I think the sentence “Overall, we concluded the items of the WHODAS can be considered unidimensional for practical purposes in this patient population.” needs a reason for the “for practical purposes” expression.”

Response: Thank you for the opportunity to provide clarity. By “practical purposes” we mean for use in general clinical practice. Although the WHODAS, like most rehabilitation assessment tools, is not perfectly unidimensional, for use in general clinical practice it is certainly useful for informing clinicians about functional disability for Veterans with mTBI and co-occurring behavioural health conditions. Thus, we have changed the term “practical purposes” to “general clinical practice”.

**Comment:** “Page 13 l. 3: Have you considered whether the change of the mobility item into walking or wheeling might have contributed to the misfit of this item? This should be addressed in the discussion section.”

**Response:** Thank you for giving us the opportunity to correct this error. As described above in reference to the similar reviewer 1 comment, we have removed references to wheeling and this we did not change the mobility item to include wheeling.

**Comment:** “Page 13 l. 47-52: Please explain a bit more to the reader what you mean in. “As illustrated in Figure 1, the average performance of this sample of Veterans on the WHODAS was 56.78 (+ 6.95), which is equivalent to a total raw complex score of 59 on the WHODAS.” I cannot understand this in the text, or in figure 1 or from the figure legend.”

**Response:** Thank you for providing us an opportunity to clarify this sentence.

As illustrated in Figure 1, the average difficulty of the items was 56.78 (6.95 SD) logits (as indicated by the ‘M’ on the right hand side), which is equivalent to the total raw complex score of 59 on the WHODAS. Meanwhile, the average performance of this sample of Veterans on the WHODAS was 36.04+11.78. This tells us that our items are slightly too easy for this sample.

We have removed the phrase, “which is equivalent to a total raw complex score of 59 on the WHODAS,” to avoid distraction from the main point.

**Comment:** “Page 16 l. 31-33: See comment above regarding the “for practical purposes”. Overall, our results suggest that WHODAS items the form a dimension of disability that is sufficiently unidimensional for practical purposes.

**Response:** As above, we have changed the term “practical purposes” to “general clinical practice”.

**Comment:** “Page 17 l. 42: effect size was 1.64 in results section. Which is correct?”

**Response:** We appreciate the opportunity to correct this error in the discussion. The effect size is indeed, 1.64.

**Comment:** “Page 18 l. 17-20: Please provide a reference here Finally a general comment: The discussion does not relate to the WHODAS 2.0 development and psychometric properties in the discussion. Although it is important to discuss the study results, relating it to other literature, not only in the introduction section is relevant. You could relate some of the findings to the WHODAS 2.0 Manual (2010), your ref.#8.”

**Response:** We have revised our language and provided a reference indicating the frequency mTBI occurs with other conditions. We have also added a sentence to the discussion on page 16 line 24 related to differences in the WHODAS manual and our findings.