

CORRESPONDENCE

THE DEVELOPMENT OF A SYMPTOM QUESTIONNAIRE FOR ASSESSING VIRTUAL REALITY VIEWING USING A HEAD-MOUNTED DISPLAY

Ames et al. should be commended for their paper as it is important to carefully measure patient-centered outcomes.¹ However, their choice of scale deserves further comment. Citing Miller (1956), Ames et al. adopted a 7-category rating scale. More recent research shows that offering more response categories leads to underutilization or interchangeable usage of response categories.²⁻⁵ While it may be reasonable to start with more categories just in case they are all used; this should be tested. Response category usage is of particular concern for the Virtual Reality Symptom Questionnaire (VRSQ) for while 7 numerical categories were chosen, only 4 verbal descriptors were anchored to these categories. If the investigators can only verbalize 4 levels of symptoms, can the subjects be expected to verbalize 7 levels? The implication is that categories 1 and 2 are interchangeable, representing "slight" symptoms; similarly categories 3 and 4, and 5 and 6 may be interchangeable representing moderate, and severe symptoms respectively. If there is interchangeability, the scale should be collapsed to attempt to make intervals between categories of equal length. Therefore response scale structure should be examined, and this can easily be done using Rasch analysis.

Rasch analysis examines the pattern of questionnaire responses using an iterative probabilistic model to determine the calibration of the person and question (and response scale) along the same linear scale. This provides truly linear measurement by appropriate weighting of response scale categories. Without Rasch analysis, simple arbitrary assignment of ordinal values to categories assumes uniform changes between categories. For example, in a visual disability instrument such as the Activities of Daily Vision Scale,⁶ a response of "a little difficulty" (score of 4) is used to rep-

resent twice the level of ability as "extreme difficulty" (score of 2) which is similarly two times as good as "unable to perform the activity due to vision" (score of 1). This appears illogical and Rasch analysis has been used to determine category calibrations for linearity and these are essentially different for different items.³ Categories whose response severities overlap or are too close together can be combined. It is quite common that 7 categories are too many,^{2,5} but even four categories can be too many in a visual disability questionnaire.³ Once the appropriate number of categories have been determined, and calibrated for linear measurement, Rasch analysis can also be used to look at item fit to the overall questionnaire, which is very helpful for item reduction. These advantages have led to its widespread use in optometry with several questionnaires developed and scaled using Rasch analysis: e.g., for refractive correction outcomes,⁴ for low vision care,⁷ and for various visual impairments.^{8,9} Indeed when de Boer et al. reviewed the psychometric properties of existing vision-related quality of life questionnaires, Rasch scaling for questionnaire scoring was one of the criteria for rating a questionnaire's quality.¹⁰ Therefore it would be helpful for Ames et al. to test the scale structure of the VRSQ using Rasch analysis, and possibly re-visit the process of item reduction on a larger dataset.

ACKNOWLEDGMENTS

The author has no proprietary interest in, or any commercial relationships with anything mentioned in this manuscript.

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Author's Response:

We would like to thank Dr. Pesudovs for his interest in our recent publication on the development of a symptom questionnaire for virtual reality viewing.¹

There is a range of issues associated with the use of descriptors on questionnaire rating scales. For example, if just the end categories are labelled (i.e. end-anchoring) responses can be drawn towards the ends, whereas if every other category is labelled then the labelled categories are more likely to be endorsed.² However, providing descriptors is also thought to make the task less abstract.³ This was the reason for their inclusion in the VRSQ. Regardless of the number of descriptors used on a questionnaire scale there exists the problem that in the assignment of ordinal values to categories, the interval between categories cannot be assumed to be equal. Thus the application of non-parametric statistics is necessary for the analysis of questionnaire data. Although Rasch analysis can be useful in attempting to linearise an ordinal scale it was not appropriate to apply to the data presented in our manuscript on the VRSQ as

the subject numbers were not sufficiently large. A minimum of 200 subjects is considered necessary by Streiner and Norman,² although Pesudovs et al.⁴ and Gothwal et al.⁵ have applied it to the data from 43 and 78 subjects respectively. Nonetheless, we agree with Dr Pesudovs in that it would be informative to apply Rasch analysis to the VRSQ when tested on a larger subject group to further validate it as a useful tool.

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