Development and evaluation of the Critical Thinking about Health Test

Background

The Informed Health Choices (IHC) Key Concepts are principles for evaluating the trustworthiness of treatment claims and comparisons, and for making informed choices.[1] The Claim Evaluation Tools item bank contains multiple-choice questions (MCQs) that assess an individual's understanding of and ability to apply the IHC Key Concepts.[2] The item bank includes four MCQs for each IHC Key Concept. We developed the databank after finding that existing measurement tools only included a handful of the Key Concepts.[3]

In a previous study, we developed a measurement instrument that included 26 MCQs, two each for 13 Key Concepts. We used Rasch analysis to validate that instrument, which was used in a randomized trials of a primary school intervention (that included 12 of the concepts) and a podcast for parents (that included 9 of the concepts).[4-6]

Objective

To develop and evaluate an outcome measure for randomized trials of a secondary school intervention that includes nine concepts, using MCQs from the Claim Evaluation Tools item bank.

Methods

We first conducted cognitive interviews and piloted the questionnaire to get feedback from secondary school students in Kenya, Rwanda, and Uganda on the acceptability and relevance of the terminology and formats used in the questionnaire. We then recruited secondary school students and adults in the three countries to complete the questionnaire for a Rasch analysis. We estimated that recruiting approximately 500 people in each country, with an equal distribution of men and women and secondary school students and adults would be adequate.

Rasch analysis is a dynamic way of developing outcome measures to achieve construct validity.[7] It addresses important measurement issues required for validating an outcome measure, including; internal construct validity (by testing for multidimensionality), invariance of the items (item-person-interaction), and item bias (differential item function). We explored summary and individual fit to the Rasch model using the RUMM2030 software.

The questionnaire used for the Rasch analsysis included two item-sets, the first evaluated the ability to apply the IHC Key Concepts using MCQs (scored dichotomously). It included three MCQs for each of the nine Key Concepts. Each MCQ had three response options (Additional file 6). The other item-set evaluated intended behaviour and self-efficacy (Additional file 6). Data were collected primarily electronically using a service hosted by the University of Oslo (Nettskjema). For participants that did not have Internet access, we used paper questionnaires with answer sheets that could be scanned using ZipGrade.

Findings

Findings from the cognitive interviews and piloting of the questionnaire led to only minor changes, such as changing some of the names and other terminology used in the MCQs to improve familiarity. We also changed the format of the intended behaviours and self-efficacy questions.

We recruited 1671 participants who completed the questionnaires. Overall, both item-sets were found to have good fit to the Rasch model. They showed good targeting and were reliable (Cronbach's Alpha above 0.7). Individual person fit to the ability item set was very good, and most

items showed good fit to the Rasch model. However, this analysis gave good indication of potential items that should be removed because of high fit residuals, under-discrimination, or DIF.

Individual item fit for the intended behaviour and self-efficacy questions was satisfactory, but analysis of individual personal fit suggested that some people in our target audience may not respond as expected to those questions. Three items measuring intended behaviour had disordered item curves. A reanalysis of these indicated that dichotomizing the intended behaviour and self-efficacy items would resolve this issue.

There was no local dependency in either of the item-sets, and both item-sets were found to have acceptable unidimensionality.

Based on the findings of the Rasch analysis we selected two MCQs for each Key Concept for the Critical Thinking about Health (CTH) Test.

Conclusion

The two item-sets were found to be reliable with satisfactory measurement properties. We used the findings of the cognitive interviews and the Rasch analysis to refine and improve the outcome measure and ensure the validity and reliability of the CTH Test.

References

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