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The accuracy of the Learning Disability Screening Questionnaire (LDSQ) in classifying severity of impairment: A brief report

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Abstract

Background: Outcomes for people with an intellectual disability (ID) may differ depending on the severity of the condition. This study evaluated whether a screening tool could give an early indication of severity, in order to help inform future support needs.

Methods: ROC analysis was used to examine how well the Learning Disability Screening Questionnaire (LDSQ) could classify individuals (n=238) in terms of severity of intellectual impairment.

Results: Mean LDSQ scores increased across diagnostic categories from 'severe impairment' to 'no ID' as expected. The optimal cut-points estimated based on the ROC surface and Youden Index provided correct classification probabilities for the severe, significant and non-ID groups of 0.55, 0.50 and 0.86, and 0.80, 0.32 and 0.84 respectively.

Conclusions: While the LDSQ can accurately discriminate between those with and without intellectual disability, results indicated that it may not accurately classify individuals in terms of severity of intellectual impairment.

Keywords: learning disability screening questionnaire; severity; intellectual disability

1. Introduction

People with an intellectual disability (ID) can differ greatly in terms of their severity of ID. Knowing the level of severity of ID is important because of its associations with a number of other life outcomes. These include increased likelihood of epilepsy (Chapman et al., 2010), mental health problems (Cooper, Smiley, Morrison, Williamson, & Allan, 2007) and behaviours that challenge (Koritsas & Iacono, 2012); reduced opportunity for constructive social engagement and interaction (See Mansell, 2010) and reduced control over decisions (Smyth & Bell, 2006). The longer term outcomes for people with ID also vary with severity, with those with a mild ID having a greater likelihood overall of being financially independent, living and working independently, being married and parenting children, compared to those with a moderate or severe ID (Stein, Blum, & Barbaresi 2011).

Severity of ID can be defined in terms of impairment in both intellectual and adaptive functioning. The former is based on full scale IQ (FSIQ) and is categorised as significant (FSIQ between 55 and 69) or severe (FSIQ of less than 55) impairment (British Psychological Society [BPS], 2000). The latter is based on levels of support, with intermittent or limited support indicating a significant impairment and extensive or pervasive support needs indicating a severe impairment (BPS, 2000). The accurate determination of overall severity of ID requires assessment of both intellectual and adaptive functioning, which can constitute a lengthy process (e.g. Ryan, Lopez, & Werth, 1998). Screening tools such as the *Learning Disability Screening Questionnaire (LDSQ)* have been developed to give a quick and accurate indication of whether a person is likely to have an ID or not, rather than indicating severity. The aim of the present study was, therefore, to explore whether the *LDSQ* was able to accurately classify individuals, not only in terms of ID or non-ID, but also in terms of significant or severe impairment.

2. Methods

2.1 Ethical approval

The study used pre-existing data used in previous validation studies of the *LDSQ*, for which approval from the relevant Caldicott Guardians had been obtained.

2.2 Participants

We utilised the sample (n=238) used in the two validation studies of the *LDSQ* (see 2.3) which comprised of participants who had been assessed by community ID or forensic ID services. Diagnosis of ID was made by independent clinicians based on the three criteria of ID (BPS, 2000). Insufficient standardised data from any one measure of adaptive functioning were available to allow overall severity of ID to be determined. As such, classification of 'severity' was based on FSIQ alone and participants were classified as either non-ID or as having a significant or severe intellectual impairment. Information on the sample is provided in Table 1.

2.3 Measures

The *LDSQ* is a seven item questionnaire that has been validated with clinical and forensic populations, and been found to have good psychometric properties, with sensitivity and specificity from 82-91% and 87% respectively, depending on the sample. A full description of the development and validation of the *LDSQ* can be found in McKenzie and Paxton (2006) and McKenzie, Michie, Murray, and Hales (2012).

2.4 Assessing classification accuracy

We used ROC methods which have been extended to accommodate situations in which there are more than two possible outcomes (e.g. see Nakas & Yiannoutsos, 2004). Two measures of classification ability were used: the volume under the surface (VUS) of the ROC surface and the Youden Index.

VUS in this study can be thought of as the probability that the measurements from three participants, one each taken from the non-ID, significant and severe impairment groups will be classified in the correct order by the *LDSQ*. When there are three diagnostic categories VUS can take values between 1/6 and 1, with 1 representing perfect classification. Optimal cut-points for the LDSQ for classifying individuals into diagnostic categories can also be estimated based on the ROC surface.

The Youden Index estimates the optimal cut-points for three diagnostic categories by selecting the pair of cut-points that maximises

$$\frac{1}{2} (x + y + z - 1)$$

where x,y and z are the respective probabilities of correct classification for each of the diagnostic categories. The Youden statistic can range between 0 and 1, with 1 representing a test with perfect diagnostic accuracy. In the present study, we estimated VUS, and optimal cut-points based on the ROC surface and on the Youden Index using the R package *DiagTest3Grp* package (Luo & Xiong, 2012).

3. Results

3.1 Descriptive statistics

Descriptive statistics by diagnostic category are provided in Table 1. Results indicate that mean *LDSQ* scores increase across diagnostic categories from ‘severe impairment’ to ‘no ID’ as expected.

INSERT TABLE 1 ABOUT HERE

3.2 Roc analysis

Due to substantial deviation from normality on *LDSQ* scores within the ‘severe impairment’ group, non-parametric estimation methods for the ROC analyses were used. The VUS was estimated as 0.58 (95% CI= 0.49-0.66) and the Youden Index was estimated as 0.49 (95% CI=0.43-0.56). The optimal cut-points based on the ROC surface were 0% and 50%, giving correct classification

probabilities for the severe and significant impairment and no ID groups as 0.55, 0.50 and 0.86 respectively. Optimal cut-points based on the Youden Index were 24.7% and 46.4%, giving correct classification probabilities of 0.80, 0.32 and 0.84 for the severe and significant impairment and no ID groups.

4. Conclusions

The study aimed to assess whether cut off scores could be derived from the *LDSQ* which could be used clinically as a quick and accurate method of indicating level of severity of intellectual impairment. The results suggest that *LDSQ* scores do not provide an accurate means of classifying individuals into diagnostic categories based on severity of intellectual impairment beyond the dichotomous 'ID' versus 'non-ID' classification. Previous research found significant positive correlations of the *LDSQ* score with FSIQ in both clinical (McKenzie & Paxton, 2006) and forensic (McKenzie et al., 2012) populations of 0.75 and 0.71 respectively. This suggests that, while the correlation between *LDSQ* score and FSIQ can serve as a heuristic for severity of intellectual impairment, the *LDSQ* should not be used as a formal means of classifying severity of ID. This result must be viewed in the context that even well-validated, standardised full intellectual assessments are unable to accurately measure the lowest levels of IQ (Whitaker, 2010), with the *Wechsler Adult Intelligence Scale-Fourth edition (WAIS IV UK)*: Wechsler, 2010) only measuring FSIQs of 40 and above. The present study was only able to assess severity in relation to intellectual functioning. Future research comparing *LDSQ* scores with classification of overall severity of ID based on both adaptive and intellectual functioning may overcome some of the limitations of relying on FSIQ alone.

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