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**Validating the Learning Disability Screening Questionnaire against the WAIS-IV**

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**Abstract**

The Learning Disability Screening Questionnaire, a brief screening tool for intellectual disability, was originally validated against the WAIS III which was superseded by the WAIS-IV in the UK in 2010. This study examines the performance of the LDSQ using the WAIS-IV as the diagnostic intellectual assessment. Based on the original optimal cut off score, the LDSQ sensitivity value was equivalent (91%) to that obtained in the original validation study, while the specificity value was higher at 92 %. This suggests that the LDSQ remains valid when using the WAIS-IV as the comparator intellectual assessment.

**Keywords:** Learning Disability Screening Questionnaire; WAIS-IV, sensitivity, specificity, Intellectual Disability; Psychometrics

There are a number of circumstances under which it may be helpful to have a quick and accurate indicator of whether an individual is likely to have an intellectual disability (ID). This can include the need to quickly identify people with ID in situations where they may be particularly vulnerable to exploitation, disadvantage or abuse, such as criminal justice services (Talbot, 2008), but where limited access to an appropriately qualified psychologist precludes timely full diagnostic assessment (Crawford, Allan, & Jack, 1992). Screening assessments may also be helpful where all that is required is an estimate of population characteristics, for example to stratify or match participants in clinical research (Spinks et al., 2009). Screening may also occur in services where there are limited resources and/or high demands (Crawford, Anderson, Rankin, & MacDonald, 2010), for example, to prioritise those individuals who are most in need of full diagnostic assessment.

The Learning Disability Screening Questionnaire (LDSQ: McKenzie & Paxton, 2006) was designed as a brief screening tool to identify adults who are likely to have an intellectual disability (ID). Developed in the UK (where ‘learning disability’ is the term that is commonly used to refer to people with ID), the LDSQ, is now used internationally, for example in services across Europe, in Canada, the US and Australia. The LDSQ has seven items relating to reading, writing, telling the time, current living situation, employment, previous support at school and contact with ID services. Items are scored dichotomously and used to calculate a total percentage score. Those scoring below the cut-off are considered likely to have ID.

Previous research has suggested that the LDSQ has good psychometric properties in groups of individuals at elevated risk of ID in both clinical and forensic settings (e.g. Murray & McKenzie, 2013; McKenzie, Michie, Murray, & Hales, 2012). In respect of the former setting, the scale has yielded sensitivity and specificity values of 91.2% and 87% respectively, for ID in a sample referred to community ID health services (Paxton, McKenzie,

& Murray, 2008). Sensitivity is the ability to correctly identify true positives (in this case those with an intellectual disability), while specificity is the ability to correctly identify true negatives (those who do not have an intellectual disability). This was based on a cut-off score, determined by a receiver operating characteristic (ROC) curve analysis (Schoonjans, 1998), which provided the best balance between sensitivity and specificity. The *LDSQ* total percentage scores were found to correlate significantly with Full Scale IQ ( $r = 0.751$ ) and to discriminate between those with and without ID, with those with ID having a significantly lower score. In terms of inter-rater reliability, kappa values for each of the items indicated fair to excellent agreement, with the highest levels of agreement relating to current living situation, literacy and employment (McKenzie & Paxton, 2006).

When considering forensic settings, the *LDSQ* was found to have sensitivity and specificity values of 82.3% and 87.5% respectively, to correlate significantly with Full Scale IQ ( $r = 0.71$ ) and to discriminate between those with and without ID, with those with ID again having a significantly lower score (McKenzie et al., 2012).

Research using a Mokken Scaling analysis (a non-parametric Item Response Theory method that can be used to investigate important and clinically useful properties of scales) was also conducted combining data from both community and forensic settings, (Murray & McKenzie, 2013). This showed that, with the exception of the item relating to writing ability, the *LDSQ* items conformed to a Mokken scale, suggesting that the difficulties measured by the *LDSQ* which are indicative of having ID form a hierarchy. This allows inferences to be made about severity of the difficulties when the available information is incomplete. A subsequent analysis (Murray & McKenzie, 2014) found that while mean *LDSQ* scores increased across diagnostic categories from 'severe impairment' to 'no ID', the classification accuracy for those with ID was insufficient to categorise them according to severity of ID.

Recent research (Murray, Booth, & McKenzie, in press) has suggested that the *LDSQ* shows measurement invariance in relation to gender. This suggests that it estimates level of intellectual disability in a manner that is not biased in favour of either males or females.

The *LDSQ* was validated against formal clinical diagnosis, given independently by the health professional working in the community or health setting. This was based on the assessment of the three criteria of ID (significant impairment of intellectual and adaptive functioning and childhood onset: British Psychological Society [BPS], 2001). As the BPS, the professional body in the UK, does not make a formal recommendation in relation to choosing a particular measure of adaptive functioning (BPS, 2001) a wide range of standardised and non-standardised assessments were used by the independent diagnosing clinician. Unfortunately this meant that there were insufficient data from any one assessment to assess the relationship between *LDSQ* and adaptive functioning scores.

The Wechsler scales are commonly used to assess intellectual functioning (Reynolds, Ingram, Seeley, & Newby, 2013) and, as noted above, previous research has found that the *LDSQ* correlated significantly with the Wechsler Adult Intelligence Scales Third Edition (*WAIS III*: Wechsler, 1998) in both community (McKenzie & Paxton, 2006) and forensic clinical (McKenzie et al., 2012) populations.

It is recognised that factors such as the Flynn effect i.e. the observed rise in IQ scores over time (Flynn, 1984), have relevance for the accuracy of assessments administered after the initial norming of the assessment, and can make the norms of older assessments obsolete (Trahan, Stuebing, Fletcher, & Hiscock, 2014). For example, while the exact magnitude of

the Flynn effect can vary according to the test used and age of participant (Beaujean & Sheng, 2014) it has been found to impact at all levels of ability (Trahan et al., 2014). There is also some evidence that it may impact differentially according to intellectual ability, with people with lower levels showing greater IQ gains over time (see Colom, Lluís-Font, & Andrés-Pueyo, 2005).

In recognition that the Wechsler scales are affected by these issues (Beaujean & Sheng, 2014) they are updated periodically. The WAIS III was superseded by the WAIS-IV UK edition in 2010 (Wechsler, 2010) and, while there remain concerns about the psychometric properties of the WAIS-IV in relation to people with ID (see Reynolds et al., 2013), this assessment is now commonly used to determine if an individual meets the criterion for ID of significant impairment in intellectual functioning. As such, it is important that the validity of the *LDSQ* is re-assessed in relation both to the WAIS-IV and clinical diagnoses based partly on the use of the WAIS-IV. The present study, therefore, reports on the performance of the *LDSQ* against diagnoses of ID, based on the WAIS-IV.

## **Method**

### **Ethical approval**

Caldicott guardian approval was obtained to gather pre-existing assessment information. In Scotland, the Caldicott guardian acts to ensure the appropriate use of existing National Health Service (NHS) data in situations where obtaining individual patient consent would not be feasible.

### **Procedure**

Data were gathered from a health board area in Scotland, which included community and forensic ID services. National Health Service provision in Scotland, with the exception of a

few specialist services which are provided on a national basis, are organised by geographical areas which are classified as health board areas. All service provision information was obtained from existing case notes and from the assessing clinician in relation to the following: basic demographic information, including age at assessment, gender, and diagnosis in relation to ID; WAIS-IV scores; and information to score the LDSQ items. All data were anonymised and no identifying information was gathered. The data relating to the LDSQ items had been gathered independently by the diagnosing clinician (an applied psychologist) during the assessment process, either directly from the client or by a third party respondent, such as a carer or relative, depending on the item. This is in keeping with the administration procedure of the LDSQ, which was designed to be completed with the individual him/herself or by someone who knows him/her well.

### **Inclusion criteria**

Data were included for all adults who had been assessed by the ID services in the participating health board area using the WAIS-IV, and for whom the LDSQ could be completed from existing information.

### **Participants**

The total sample size was 103 and data were included for 83 individuals who met the inclusion criteria. Of these 59 had a diagnosis of ID and 24 did not. Of those with ID, 37 were male and 22 were female, with a mean age of 32.1 (SD = 15.4; range = 16 to 66) years at assessment. The average Full Scale IQ (FSIQ) of those with ID was 58.9 (SD = 6.5; range = 41 to 69) and 44 participants had IQ scores that ranged from 55 to 69 and the remaining 15 participants had IQ scores below 55. Of those without a diagnosis of ID, 13 were male and 11 were female, with a mean age of 30.8 years at assessment (SD = 11.9; range = 16-55 years). The average FSIQ was 78.4 (SD = 10.9; range = 67- 115). Two individuals had a FSIQ less

than 70, but were considered by the assessing clinician not to have ID because they did not meet the other two diagnostic criteria. There were no significant differences between the two groups in terms of gender or age at assessment.

## **Measures**

### **Learning Disability Screening Questionnaire**

This screening tool was designed to be used by a range of individuals without requiring a particular professional background or training. It comprises seven questions, as outlined previously which are scored as ‘yes’ or ‘no,’ with each item receiving a score of ‘0’ or ‘1’. These are added to provide a total score which is converted to a total percentage score, based on the number of items completed (with a minimum requirement that 5 items are completed). The scoring of the LDSQ as a single dimension is supported by previous studies in which no evidence for multi-dimensionality has been found (Murray & McKenzie, 2013; Murray et al., in press). The LDSQ can be completed with the individual suspected of having ID or someone who knows him/her well and takes approximately five minutes to complete. It has been found to have good psychometric properties including high sensitivity and specificity in both community (McKenzie & Paxton 2006; Paxton et al., 2008) and forensic (McKenzie et al., 2012) clinical samples as outlined in the introduction.

### **Wechsler Adult Intelligence Scales fourth edition UK version**

The WAIS-IV is considered among the foremost of intellectual assessments in terms of its psychometric properties across a range of demographic groups and ability levels (Wechsler, 2008). It is based on an extensive legacy of test development, although some concerns have

been raised in relation to its use with people with ID. These include possible floor effects (Whitaker, 2012), the limited representation of people with ID in the original standardisation sample and whether the factor structure underpinning the *WAIS-IV* is valid when applied to this group (see Reynolds et al., 2013). Notwithstanding these concerns, as the *WAIS-IV* is commonly used to measure intellectual functioning, the present study validated the *LDSQ* against this assessment.

### **Statistical Procedure**

We assessed the convergent validity of the *LDSQ* with the *WAIS-IV* by computing the Pearson correlation between *WAIS-IV* FSIQ and index scores and *LDSQ* total percentage scores. With a range of 8 possible scores (the percentage scores corresponding to endorsing between 0 and 7 items), we judged it justifiable to treat the *LDSQ* as a continuous measure.

We used a ROC curve analysis (Schoonjans, 1998) to estimate the sensitivity and specificity of the *LDSQ* i.e. ability to discriminate between those with and without ID. We also used the cut-point for ID defined in previous research and recommended in the *LDSQ* manual as a comparator to identify the positive and negative predictor values of the *LDSQ*.

## **Results**

### **Descriptive Statistics**

#### **Convergent validity**

The *LDSQ* total percentage scores were found to correlate significantly with *WAIS-IV* FSIQ and index scores, as shown in table 1. In addition, we provide the correlations corrected for range restriction on FSIQ using an assumption of direct range restriction on FSIQ, specifically, Thorndike case II. Note that this correction assumes that there is no additional attenuation on *LDSQ* beyond that due to its association with FSIQ. It also assumes that the

relation between FSIQ and LDSQ is linear and homoscedastic for all levels. Given that neither of these assumptions can be verified in practice, these corrected correlations represent only an approximate guide to the effect of range restriction in the current sample.

Insert table 1 about here

### **Sensitivity and specificity**

From the ROC analysis, the area under the curve was .945 (SE = .027) demonstrating that the LDSQ had a significant ( $p < 0.001$ ) ability to discriminate between individuals with and without ID. Taking the cut-off point obtained from the original validation study of the LDSQ, which was also derived using ROC analysis (Paxton et al., 2008) as a comparator, the sensitivity and specificity values of the LDSQ were 91.5% and 91.7% respectively. This same cut-off point remained optimal in terms of a balance of sensitivity and specificity in the present sample.

In addition, based on the original cut-off score, determined by previous research, overall, 6/83 (7.2%) individuals were incorrectly classified. Of these, 4/59 (6.8%) of individuals with ID were classified by the LDSQ as not having an ID and 2/24 (8.3) of those who did not have ID were classified as having ID.

### **Discussion**

Receiving a diagnosis of ID can have significant implications for an individual in terms of accessing resources and support, particularly in settings where they may be vulnerable, such as criminal justice services (Scheyett, Vaughn, Taylor, & Parish, 2009). On the other hand, it

may expose the individual to social stigma and reduced opportunities (see Paterson, McKenzie, & Lindsay, 2011). It is, therefore, crucial that the assessments used as part of the diagnostic process are valid and reliable. Screening tools, such as the *LDSQ*, are designed to give an indication of whether someone is likely to have ID or not in order to identify where full diagnostic assessment is appropriate. In this capacity, they may be used to identify potentially vulnerable individuals in a range of settings including health (McKenzie & Paxton, 2006), education (see McKenzie & Megson, 2011) and criminal justice services (Søndena, Palmstierna, & Iversen, 2010). As such, screening tools also need to have strong psychometric properties but, in particular, high sensitivities and specificities with respect to a diagnosis of ID (Glascoe, 2005).

The present study, therefore, aimed to re-assess the performance of the *LDSQ* as compared against the gold standard criterion of formal clinical diagnosis of ID, when the criteria of significant impairment in intellectual functioning was assessed using the *WAIS-IV*. We found that the *LDSQ* showed good convergent validity with the *WAIS-IV*, as indicated by significant positive correlations between the *LDSQ* total percentage scores and the *WAIS-IV* FSIQ and index scores. A perfect association between *WAIS-IV* FSIQ and *LDSQ* scores would not be expected because the *LDSQ* also aims to measure adaptive functioning aspects of ID. Both adaptive functioning and intellectual functioning impairments are necessary for a diagnosis of ID but these two aspects are to some degree dissociable ((Murray, McKenzie, & Murray, 2013). Unfortunately, a limitation of the present study was that we were unable to assess the specific relationship between *LDSQ* scores and adaptive functioning as there were insufficient data from any single assessment to conduct this analysis.

The original optimal cut-off score for the *LDSQ* was used as a comparator to give an indication both of the sensitivity and specificity of the *LDSQ* based on clinical assessment using the *WAIS-IV* and the percentage of individuals with and without ID who were

correctly and incorrectly classified using the *LDSQ*. It was found that this cut-off was also optimal for the present sample and yielded very similar sensitivity values to those found in the original validation study (91.2% versus 91.5% ), but higher specificity values (87% versus 91.7%), with only 6 out of the 83 individuals being incorrectly classified overall. This is encouraging and suggests that the *LDSQ* can continue to be used with some confidence in the context of the updated *WAIS IV* being used by ID services to assess intellectual functioning.

The study did, however, have some limitations. While our sample was representative of the composition of referrals to the participating clinical services, it was modest in size and future studies in larger samples and in samples drawn from different populations in which there is elevated risk of ID would be beneficial. Another limitation concerns the gold standard of ID diagnosis itself, which several authors (e.g. Whitaker, 2012) have noted is subject to mis-classification errors due to factors such as the limited reliability of intellectual assessments at low levels of ability.

## **Conclusion**

In summary, the *LDSQ* was found to have good convergent validity and to discriminate well between those with and without ID as assessed against clinical diagnosis of ID, with the *WAIS-IV* being used to assess intellectual functioning. It also showed good sensitivity and specificity based on the original cut-off scores, and indeed this score was also optimal for the current sample. This suggests that the *LDSQ* can continue to be used with confidence to help identify those who are likely to have ID and who may benefit from further diagnostic assessment.

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Validating the *LDSQ* against the *WAIS IV*

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Table 1  
 Pearson's correlations between the *LDSQ* percentage scores and the *WAIS-IV* FSIQ and index scores

	Full Scale IQ (n= 82)	Verbal Comprehension Index (n = 81)	Perceptual Reasoning Index (n = 80)	Working Memory Index (n= 77)	Processing Speed Index (n = 76)
<i>LDSQ</i> percentage score	.713 (.787)	.543 (.683)	.688(.905)	.581(.934)	.577(.927)

Note: All correlations were significant at  $p < 0.001$ . Range restriction corrected correlations in parentheses.