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Can a parental questionnaire about children's reading ability identify dyslexia in school children?

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Abstract. In today's society, great demands are placed on people's reading and writing ability. Studies have shown that children with dyslexia are at greater risk of developing depression and anxiety than other children. Therefore, a time and cost-effective screening instrument is needed to identify dyslexia at an early age. The present study aims to further investigate and evaluate whether dyslexia can be identified in school children through the parental questionnaire Short Dyslexia Scale (SDS). The study includes a dyslexia group and a control group where the parents filled out the questionnaire. Scores from a standardized word decoding test and listening comprehension test were also collected. The study's results show that SDS can be used to identify dyslexia in school children as it showed significant differences between the groups and no overlap in individual results. There was a large difference in performance between the groups on testing and their test results were in good agreement with the parents' SDS ratings.

Keywords: dyslexia, screening, parental questionnaire, diagnosis, reading

Kan ett föräldraskattningsformulär om barns läsförmåga identifiera dyslexi hos skolbarn?

Sammanfattning. I dagens samhälle ställs stora krav på människors läs- och skrivförmåga. Studier har visat att barn med dyslexi löper större risk att utveckla depression och ångest än andra barn. Man eftersträvar därför ett tids- och kostnadseffektivt screeninginstrument för att identifiera dyslexi i tidig ålder. Föreliggande studie syftar till att vidare undersöka och utvärdera om föräldraskattningsformuläret Short dyslexia Scale (SDS) kan identifiera dyslexi hos skolbarn. Studien inkluderar en dyslexigrupp och en kontrollgrupp där barnens föräldrar fått fylla i frågeformuläret. Poäng från ett standardiserat ordavkodningstest samt hörförståelsetest samlades också in. Studiens resultat visar att SDS kan identifiera dyslexi hos skolbarn då det visade signifikanta skillnader mellan grupperna och inget överlapp i enskilda resultat. Det blev stor skillnad i prestation mellan grupperna på testning samt deras resultat överensstämde väl med föräldrarnas skattningar.

Nyckelord: dyslexi, screening, föräldraskattningsformulär, diagnos, läsning

Reading skills and poor reading

In today's society, a great demand is placed on people's literacy skills. In school, teachers tend to focus on ensuring that children develop good reading abilities at an early age, because failure to do so is likely to put an individual at a disadvantage throughout life (Torgesen, 2000). If children with reading difficulties begin to lag behind in the reading development compared to their classmates, they may miss critical milestones, such as developing important reading comprehension strategies and interest in reading (Torgesen, 2000). The consequence of poor reading ability may result in decrease in general knowledge at a great cost to society at large (Lyon, Shaywitz & Shaywitz, 2003; Lueder et al., 2009).

Reading is complex and this ability is enhanced during several years. The term *dyslexia* is used in cases where this ability develops very slowly or incompletely (Smyrnakis et al., 2017). It is important to note however that, *dyslexia* is not a monolithic term and that there is more than one type of poor reader. For instance, poor readers can have one of several kinds of reading problems, with or without spelling problems (Ise et al., 2011). More specifically, the term *dyslexia* is typically used to refer to people with problems in word decoding and reading fluency. For example difficulties in reading (decoding) complex words (Smyrnakis et al., 2017), which affect the ability to comprehend and learn from text (Snowling, 2013). Other parts in reading that can be challenging for a child with dyslexia are word recognition, reading speed and prosody. Co-occurring spelling problems are also very common (Azizifar et al., 2019). Usually, these difficulties are due to a deficit in the phonological component of language (Smyrnakis et al., 2017). It should, however, be acknowledged that the term dyslexia is somewhat controversial, due to variations in definitions and usage. In the book *The dyslexia debate* (Elliot & Grigorenko, 2014), the authors investigate the various methods and assessment procedures of dyslexia. It has been found that poor reading children do not always receive the help and support that the child is entitled to, because the assessments of dyslexia is carried out differently and indeed interpreted differently. It has been difficult to reach consensus on exclusionary and inclusive criteria for dyslexia. It has also been difficult to reach a consensus regarding how phonological processing ability should be defined, and how measurement of decoding, phonological ability and other reading-related abilities should be performed (SRAT, 2017).

Here we assume that being specific with regards to the profile of strengths and difficulties is more important than the label. Indeed, there are different taxonomies, or models, for distinguishing poor readers. *Simple view of Reading* (Gough & Tunmer, 1986) is a model that explains reading comprehension as a product of two basic abilities: word decoding and listening comprehension, such that,

$$\text{Reading comprehension} = \text{Word decoding} \times \text{Listening comprehension}$$

A slow and inaccurate reading can lead to difficulties in reading comprehension (Snowling, 2013). The relationship between the components in *Simple view of Reading* and their impact on reading comprehension varies during the school years. When the child has just learn to read, it is the decoding ability that has the greatest impact on reading comprehension, but when decoding ability is automatized, language comprehension has the greatest impact (Catts & Vaughn, 2018). Gough and Tunmer (1986) focused heavily on the decoding ability where they wanted to explain the

importance of decoding as an anchor for understanding. *Simple view of Reading* is the basis for another model called the *Reading Component Model* (Catts, Hogan & Fey, 2003), which focuses on the difference between poor readers in the reading process. According to the *Reading Component Model*, the starting point in children's difficulties in reading can be divided into the following three subgroups:

1. Poor readers with problems in word recognition
2. Poor readers with problems in listening comprehension
3. Poor readers with problems in both word recognition and listening comprehension

The first group in the *Reading Component Model* represents a large proportion of poor readers, and because of their primary problems in word recognition, they are commonly referred to as having dyslexia in the literature (Catts, Hogan & Fey, 2003). The second group in the model represents children with primary problems in listening comprehension. They have adequate word recognition ability and due to their reduced listening comprehension, they are referred to as having hyperlexia or as being poor comprehenders (Cain & Oakhill, 2008). The third group represents children with problems in both word recognition, listening comprehension and they are often characterized by having low results on verbal IQ-tests. In many cases, this can be identified as language-learning disabilities (LLD) (Catts, Hogan & Fey, 2003).

In the current study, we follow the definition proposed in the Swedish guidelines for assessment of dyslexia among speech and language pathologists in Sweden (SRAT) in which dyslexia is a term used to describe a condition where word reading and spelling develops unexpectedly slow or incompletely, often associated accompanied by phonological problems. Guided by the Reading Component Model we also argue that in order to diagnose dyslexia, the child should also be performing age-typical in listening comprehension.

What is known about causes and correlates of dyslexia?

Dyslexia is the most common developmental reading disorder among children (Smyrnakis et al., 2017). In a normal population, the prevalence of dyslexia is reported to be about 5-10% (Selenius & Hellström, 2015). At the same time, it is widely acknowledged that dyslexic difficulties represent the lower tip in the normal variation in reading skills, meaning that there are no sharp boundaries between dyslexia and individual differences in reading skills (Elliott & Grigorenko, 2014). It has been found that dyslexia and reading skills in general have a genetic basis, but dyslexia can also occur even when there is no obvious heredity in the family (Lueder et al., 2009). Dyslexia is a disorder that is persistent in a person's life, yet the outcome varies greatly among people with dyslexia diagnosis. Some adults study at university while others find it harder to get through everyday life in reading and writing (Snowling, 2013). One reason why the variation in performance may vary for people with dyslexia may be that they received different support and aids through schooling (Gaab, Zuk & Yu, 2018).

Research has also shown that dyslexia is strongly related to problems in phonological awareness (Swang & Catts, 1994). Phonological awareness refers to the ability to process the sound structure of language, i.e., how sounds relate to each other in creating words (Carroll & Snowling, 2004). Well-functioning phonological awareness means,

for instance, being able to partially repeat nonwords or invented words, and also being able to rhyme and “play” with phonemes. These abilities depend on decoding the sound structure of individual words - knowing which words start or end with the same sound, being able to repeat them by sounds alone and in the case of rhyming: matching similar sounds in different words (Cheung, 2007). Neuroscientific research has revealed differences in activity in the left hemisphere by dyslexic and typical readers during phonological processing tasks (Richlan, Kronbichler & Wimmer, 2011). Specifically, during phonological processing, people with dyslexia show hypoactivation in different parts of the left hemisphere (Poldrack et al., 1999). Raschle, Stering, Meissner & Gaab (2014) studied children with a family history of dyslexia and found underactivation during phonological processing in the bilateral occipito-temporal, left temporoparietal areas, as well as the cerebellum. During auditory processing they also noted differences in activations in the left frontal brain regions.

Phonemic awareness and rapid automatic naming (RAN) are the most important longitudinal predictors of early word reading difficulties. RAN is a test that measures how quickly individuals can name objects, pictures, colors, or symbols. Already at preschool, it may be important to measure children’s knowledge of letter-names and letter-sounds, to predict if the child may have difficulty with word reading. Children with identified dyslexia often experience difficulty in learning the alphabet at an early age. This leads to impaired reading fluency and incorrect reading, which in turn creates difficulties with reading comprehension (Schatschneider & Torgesen, 2004). A study has shown that preschool children with only phonological language disorder rarely develop reading difficulties if they have a good rapid automatic naming. Having a good rapid automatic naming ability seems to be a factor that reduces the risk of decoding difficulties (Peterson et al., 2009). In short, attention should be paid to children who show tendencies to delayed language and difficulties in learning the sounds and letters of the alphabet (Lyytinen, Erskine, Hämäläinen, Torppa & Ronimus, 2015).

Why is it important to identify dyslexia?

Identifying dyslexia is important in order to provide support quickly and to ensure access to certain services throughout life, such as support during higher education especially during testing. Sometimes dyslexia can be identified in early childhood, but in others the difficulties are more apparent when the person is confronted with increasingly complex reading and writing tasks (Lueder et al., 2009). In students with decoding difficulties and dyslexia, there is a great risk that the growth of vocabulary, reading fluency and reading comprehension will stop or deaccelerate. This is because the student with dyslexia risks avoiding reading in everyday life, which creates a potentially negative spiral (Schatschneider & Torgesen, 2004).

It has also been confirmed that dyslexia is often comorbid with other neurodevelopmental disorders (Snowling, 2012), most notably the attention-deficit/hyperactivity disorder (ADHD) (Willcutt & Pennington, 2000). Reading and writing skills are not only related to academic achievement but also to socio-emotional and behavioral development (Kempe, Gustafson & Samuelsson, 2011). Internalizing and externalizing behavioral problems have been reported in several cases of dyslexia. Internalizing involves behaviors such as fear, sadness, loneliness, depression and anxiety, while externalizing is characterized by aggression and a threatening behavior. It has been found that there are more depressive symptoms and lower energy in children

with reading difficulties compared to a group of typical readers (Dahle, Knivsberg & Andreassen, 2011). Growing up while being different from one's classmates regarding the expected development, can lead to negative consequences on self-esteem and self-confidence. Dyslexia therefore affects both the ability to perform inside and outside the school environment, as it can affect learning and academic performance but also the child's own self-image (Smyrnakis et al., 2017). Therefore, it is important to identify children with dyslexia and other reading and writing difficulties early in order to provide necessary support, and reduce the gap that may arise between the child and the classmates (Lyytinen, et al., 2015).

In Sweden, more than 50 different tests are used to detect and investigate children with dyslexia. There are tests that can predict dyslexia even before children have been taught to read and write. Possible areas of difficulty that can be tested prior to school are phonological awareness, rapid automatic naming ability and letter knowledge (SBU, 2014). Dyslexia is usually noticed when the child is in third grade, when reading ability begins to lag behind compared to the classmates (Smyrnakis et al., 2017). Common to all dyslexia tests covered in the Swedish SBU report is that none of them have been scientifically evaluated by independent research. For instance, there are no studies that investigate the reliability of the tests and whether they measure what is intended. To the greatest extent possible, all tests should be standardized, and that is why all tests require more primary studies (SBU, 2014).

Performing a dyslexia investigation requires that several factors are taken into consideration. Background information about the child will be collected and in Sweden, several different areas will be tested, for example decoding abilities, reading comprehension, spelling, short-time memory and text production (SRAT, 2017). Screening in large populations can easily lead to delays and large costs. Therefore, it is important to discover new screening materials that can help to easily find out who is in need of help due to their difficulties (Smyrnakis et al., 2017).

Screening for dyslexia - why is there a need for a quick and useful questionnaire?

Screening is defined as a systematic assessment of a population. The purpose is to detect and treat various diseases and conditions as early as possible with the aim of reducing the negative consequences for the people affected (Spix & Blettner, 2012). In Sweden, 4 year olds have been screened for speech and language impairments since 1970 (Mattsson, Mårild & Pehrsson, 2001). Parent report has been used for some time and there are some forms that are used to identify different types of difficulties, for example Colorado Learning Difficulties Questionnaire (CLDQ), Five to Fifteen (FTF) and Children's Communication Checklist (CCC). CLDQ is a parental questionnaire that is divided into 20 items and used for children aged 6-18 years (Willcut et al., 2011). The FTF is designed to be used for children between the ages of 5-15 and it consists of 181 items divided into 8 domains; motor control, executive functions, perception, memory, language, learning, social skills and emotional/behavioral problems. The child's abilities are rated on a three-point scale from 0-2 (Kadesjö et al., 2004). Parental ratings also occur in language investigations, an example of such a survey is the CCC. The CCC is used for children between 4-16 years old and consists of 70 items (Pearson, 2012). From the beginning, the intention was for teachers to rate their students based on pragmatic aspects of language/communication. When the form was developed

to CCC-2, “communicative skills”, it was decided that the parents, rather than the teachers, would rate their child’s communicative skills (Bishop & McDonald, 2009).

There are several advantages to allowing parents to share their thoughts and experiences of their child. First, Dale (1997) argues that children can be misleading during "direct assessment" due to shyness or if the child does not feel comfortable with the examiner. This can lead to "false positive" results in standardized tests (Bishop, Laws, Adams & Norbury, 2006). Therefore, parent ratings may be an important complement to “direct assessment”. It has emerged that CCC-ratings are as effective in identifying language impairments as obtaining answers from standardized tests with the child (Bishop et al., 2006). Second, the parent can supplement the formal assessment with important information about the child’s communication, strengths and weaknesses as someone who knows the child well (Bishop & McDonald, 2009). A parent can also give information about behaviors and strategies that can be difficult for an assessor to see during the short time spent with the child (Diamond & Squires, 1993). One problem with parental questionnaires however that is difficult to avoid is that the parents can make their own interpretations, misunderstand the questions or give unclear answers. By necessity the ratings are subjective. Diamond and Squires (1993) add that parental questionnaires should be followed up with direct assessment to get a clearer picture of the child’s strengths and weaknesses. Although parent’s information is valuable, their ratings should not be used as an alternative to an assessment, but as a complement.

The current study focuses on a parental rating scale tentatively named Short Dyslexia Scale (SDS). The purpose of the instrument is to be a time- and cost-effective tool to identify children with word reading problems/dyslexia. Hopefully it can also support/supplement other information in diagnostic decisions. The SDS was previously evaluated in a population based sample of children attending third grade in primary school, in the municipality of Gothenburg (Parra & Wass, 2016). In their study, they did not use any kind of specific criteria when recruiting poor readers. The result suggested the scale was functioning well as a screening tool to identify children with reading and spelling impairments. Unlike this assessment, the present study extends the findings to both a group of children with a dyslexia diagnosis as well as a control group of children without a diagnosis. In particular, unlike the previous study, here we include listening comprehension assessment in order to ensure that the dyslexic group generally has good listening comprehension and, as a consequence, better test whether the SDS can identify children with specific word reading problems (dyslexia) as opposed to broader problems with language and communication.

The SDS has also been applied in a large scale twin study in which the aim was to investigate the overlap between dyslexia and neuropsychiatric functional impairment in 1688 children (Brimo et al, submitted for publication).

Aims

The aim of this study is to further evaluate the SDS as an assessment instrument and as a supplement to investigations of reading and writing difficulties. Time- and cost-effective tools for screening reading and writing difficulties are needed. The reason is to quickly and easily identify children with dyslexia and reduce the risk that the child’s difficulties go unnoticed. Since there are great demands on people’s reading and writing

skills in society, it is important that children in need of support receive this at an early stage, and therefore reduce the risk of depression and anxiety in school children.

In particular, the aim is to evaluate whether SDS can identify clinically diagnosed cases of dyslexia in school children, because this has not been studied before.

Research questions

The following questions will be addressed:

1. Does the parental questionnaire SDS differed between children with and without dyslexia?
2. How well does parental rating correlate with the child's test results with measures of word reading, phonological decoding and listening comprehension?

Methods

Participants

The study included a total of 39 primary school children aged 9-13 ($M = 10,9$ years old) of which 25 were girls and 14 were boys. These children were divided into a control group and a dyslexia group (see Table 1).

Table 1

Table of participants.

| | Dyslexia group (n=13) | Control group (n=26) |
|--------------|-----------------------|----------------------|
| Gender (F/M) | 7/6 | 18/8 |
| Age (M) | 10,9 | 11,0 |

Some children were multilingual but all of them had Swedish as their primary language. Parents reported that in three households additional languages were spoken. One parent in the dyslexia group reported Thai as another language besides Swedish in the home, and in the control group one parent reported Finnish and another one reported Turkmen.

The inclusion criteria in the dyslexia group were a dyslexia diagnosis with no other language disorder and the SDS should also be completely filled out. The exclusion criteria in the dyslexia group were if the child could not master the Swedish language. Eleven of the 13 children with dyslexia were recruited at the reception for speech and language therapy in Alingsås by a certified speech therapist. One child in the control group was moved to the dyslexia group after the parent reported that the child in fact had a formal dyslexia diagnosis, and poor reading according to testing. Finally, one child participated in the study through "word-of-mouth" to one of the investigators since the parents had heard about the study and was concerned about their child's reading problems. This child had no previous dyslexia diagnosis, but was identified as

displaying such problems following assessment and received support (training and compensation) in school for dyslexic difficulties. The control group was recruited from two schools in the municipality of Lerum in Gothenburg. Exclusion criteria in the control group were whether the child had a dyslexia diagnosis, if the child could not master the Swedish language or if the child's parents did not answer all the questions. One child in the control group was excluded from the study because he was newly arrived in Sweden and could not speak Swedish.

Materials & Instrument

In the study, the SDS was used as a parent rating instrument. This questionnaire, compiled by Åsberg Johnels and Lundström (unpublished), consists of items from the FTF ("Five to Fifteen") and CLDQ ("Colorado Learning Difficulties Questionnaire") forms, both used for evaluation of reading and writing skills, among children. SDS contains seven items with focusing on catching dyslexic difficulties, and these are rated on a scale of 0-2:

- 0 – Incorrect
- 1 - Partially correct
- 2 - Correct

The items in SDS are;

1. He/she has difficulties with spelling.
2. He/she has difficulties with learning to read compared to learning in other areas.
3. He/she has difficulties to understand what he/she is reading.
4. He/she guesses a lot while he/she reads.
5. He/she doesn't like to read (for example, avoid reading books and other things).
6. He/she had difficulties learning the letters.
7. He/she needs extra help in reading.

The Swedish original is placed in the appendix. Five of the items are selected from the FTF (item 1-5), the other two are selected from the CLDQ (item 6-7) (Parra & Wass, 2016). The higher score you rate in SDS, the more extensive difficulties the child has. The child can receive a maximum of 14 points. Parra and Wass (2016) proposed a score of 8 as a diagnostic cut off (high specificity according to an area under the curve analysis). This means that if you get 8 points or higher on SDS, you will very likely have reading and writing problems.

When the SDS had been filled out by the parents, ambiguities were discovered on two occasions. At one occasion, one parent put a cross between two squares (0 and 1 point). This was considered as an invalid answer. This was solved by rounding down the points. This was done since, arguably, it is better to be conservative and not to draw hasty conclusions. At another occasion, one parent omitted to provide an answer to one statement. This was solved by imputation of the mean rating from the other six items.

The children were then tested with CELF-4 (Clinical Evaluation of Language Fundamentals – Fourth Edition) listening comprehension and LäSt decoding test of words and nonwords. These two tests are standardized material where the test score can be converted to standard points, for example stanine points and percentiles (Paslawski,

2005; Hogrefe, 2020). The children were also assessed with other tests as part of a larger scale research project, for example tests of social perception and eye tracking. The purpose of eye tracking was to examine how the children oriented their eyes in word reading and repetition of nonwords. The other data are not considered in this paper.

Procedures

This study is a quantitative study that compares a control group and a group with diagnosed dyslexia, using the SDS. This study is part of a bigger project that deals with how children, with and without dyslexia, orient their eyes to the mouth in linguistically demanding tasks, such as nonword repetition, as a support for phonological processing.

During 2018-2020, a control group and a dyslexia group were recruited. The authors has participated in the collection and testing of 12 children in the control group. Prior to each test, the same information was given about how the testing would proceed and the tests followed the same order at each test occasion. Each student's identity was replaced with a code to ensure anonymity.

The children in the dyslexia group were asked a few weeks or in some cases months after their dyslexia assessment in Alingsås if they wanted to participate in the study. The parents brought home an envelope with information. The envelope contained a presentation of the study, the SDS, a form for consent and a form regarding other functional impairments, for example hearing loss and visual impairment. If the parents approved the participation, the forms were filled out. The testing of participants in the dyslexia group took place at the speech and language therapy clinic in Alingsås. The children with dyslexia were tested by the research group, and during this testing the speech and language pathologist students were not included. One child with dyslexia was tested at Gillberg neuropsychiatry centre in Gothenburg and another one was tested at his school in Lerum.

In order to collect a control group, a request for interest to participate in the study was sent out to the principal of two municipal schools in Lerum municipality. The study was presented and after the principals gave their approval to participate, the envelope was handed to each student to take home to their parents. The envelope contained the same information and forms as the dyslexia group received. If the parents approved the participation and gave their consent for their child to participate in the study, all papers were filled out and sent to Gillberg neuropsychiatry centre. The testing took place 2-3 weeks after the envelopes were sent to the parents. The testing took place at the school and was performed with one child at a time, in a separate room and took approx. one hour per individual.

The children in both groups were tested for word reading, phonological decoding and listening comprehension. The testing was carried out by the research group and two speech- and language pathologist students. The tests were conducted in the same order and in the same way at each test occasion. The surveys from the control group were compared with the surveys from the dyslexia group. Then, the correlation between the parents' ratings and the child's test results in word reading, phonological decoding and listening comprehension was examined.

The speech- and language pathologist students corrected the tests together.

Ethical aspects

The study was approved by the ethics committee with reference number: 1090-17. If the children showed interest in participating in the study, the parents then had to decide whether or not to participate. The form filled out by the parents, also contained informed consent. Each participant was assigned a code during the testing to ensure anonymity. No individual participant's result can be read out since the results were analyzed at group level.

The basic principle of the study was that all children who want to participate in the study could be included. For example, when the control group was tested, a child with dyslexia that wished to participate was allowed to join and be tested with the classmates. The child was then moved to the dyslexia group following discussions with the parents.

All test results, questionnaires and other information about the participants were kept locked in at Gillberg neuropsychiatry centre in Gothenburg, and the authors' supervisors have been responsible for the material. Scoring of tests and statistical analyses took place at the Gillberg neuropsychiatry center because none of the material could leave the building. Calculations in SPSS were also performed only at this location.

Statistical analyses

Calculations of collected data were analyzed in IBM SPSS Statistics, version 26. The first research question was about finding out how the parental questionnaire differed between children with and without dyslexia. To answer this question, a comparison was made of all parent's ratings of their children. A mean value on the SDS was calculated for the dyslexia group and the control group. A minimum and maximum score on SDS was also analyzed for the two groups in order to examine possible overlap in scores between the two groups.

Cronbach Alpha. To investigate the internal reliability of the items in SDS, Cronbach's alpha was used. If the questions show internal consistency, which means that the test measures the same concept, then the value of Cronbach alpha rises. The alpha value becomes a number between 0-1, where 0,5 are considered a credible result (Taber, 2018).

Mann-Whitney U-test. To compare the total score from SDS of the two groups, a Mann-Whitney U test was calculated.

Spearman's non-parametric correlation analysis. The second research question was about finding out how parent's ratings correlated with children's test scores with measures of word reading, phonological decoding and listening comprehension in each group. To answer this, Spearman's non-parametric correlation analysis was used to calculate between parent's ratings of children's reading and writing ability, and children's test results on LäSt word stanine, LäSt nonword stanine and CELF-4 listening comprehension scale score.

Results

Research question 1: How does the parental questionnaire SDS differed between children with and without dyslexia?

Initially, Cronbach alpha (α) was calculated to investigate the reliability of the statements in the SDS. The analysis showed a high value ($\alpha = 0,96$) which means that the items measured the same thing, in this case reading. Values above 0,5 are considered acceptable, values above 0,7 are considered good and values above 0,9 are considered excellent and strong (Taber, 2018).

The dyslexia group demonstrated a weak stanine value on word reading ($M = 1,6$) and phonological decoding ($M = 2,0$). The scale score at group level on CELF-4 listening comprehension ($M = 9,2$) indicates that the dyslexia group performs well within the normal range on listening comprehension, as the population mean is 10 and the standard deviation is 3. The control group obtained higher stanine values at group level on both word reading ($M = 4,5$) and phonological decoding ($M = 4,8$). The children in the control group are within the normal distribution in their stanine value since stanine 5 with a standard deviation of ± 2 is within the normal average. The scale score at group level on CELF-4 listening comprehension ($M = 9,0$) also indicates that the control group, like the dyslexia group, is within the average of listening comprehension.

The parents of the children in the dyslexia group rated them with high points on the SDS, which resulted in a high mean score ($M = 11,2$, $s = 1,9$), considerably above the diagnostic threshold for reading problems/dyslexia of 8 points suggested by Parra and Wass (2016). The parents of the children in the control group rated their children with much lower scores ($M = 0,8$, $s = 1,4$). The lowest total score (min) of SDS in the dyslexia group was 7 points and the highest total score (max) was 14 points. The lowest total score (min) in the control group was 0 points and the highest total score (max) was 5 points. This means that there was no overlap between the groups' results; the lowest score in the dyslexia group is not lower than the highest score in the control group.

Mann-Whitney U test was conducted to compare the total score between the dyslexia group and the control group. The results showed significantly higher ratings in the dyslexic group ($z = -5,21$, $p < ,001$). The purpose of this calculation was to investigate whether significant differences could be detected. Since the z-value is less than the critical z-value (-1,96) indicates that there is a strong significant difference between the groups regarding the parents' rating of the child's reading and writing ability on SDS.

Research question 2: How do the parent's ratings correlate with the child's test results with measures of word reading, phonological decoding and listening comprehension in each group?

Spearman's correlations were calculated between parent's SDS ratings and children's test results (see Table 2). In the correlation analysis between parents' ratings, word reading, phonological decoding and listening comprehension, the following relationship was found. There were significant correlations between SDS ratings and word reading and phonological decoding. This means that the higher the parents have rated their child, the lower the child's test score will be. By contrast, the correlation between SDS ratings and listening comprehension was non-significant.

Table 2

Spearman's correlation between parents' ratings of children's reading and writing ability and children's test results, N=39.

| | Phonological decoding | Listening comprehension | SDS |
|-------------------------|-----------------------|-------------------------|---------|
| Word reading | ,768** | ,187 | -,753** |
| Sig 2-tailed | ,000 | ,253 | ,000 |
| Phonological decoding | | ,175 | -,610** |
| Sig 2-tailed | | ,286 | ,000 |
| Listening comprehension | | | -,139 |
| Sig 2-tailed | | | ,397 |

** Correlation is significant at the 0,01 level 2- tailed

Discussion

The main purpose of this study was to further explore the validity of the parental questionnaire Short Dyslexia Scale (SDS). The validity of the SDS as a screening tool was previously examined, where a Cronbach alpha value of 0,87 was obtained (Parra & Wass, 2016). This can be compared with the present study which measured a value of 0,96, which is even higher. Unlike the previous research effort, in addition to a clinical sample, we include a sample of children without diagnosis as a reference group. Specifically, the present study includes a total of 39 children. Twenty-six children belonged to the control group and thirteen of them belonged to the dyslexia group, based on previously established diagnosis. All except one who did not have dyslexia diagnosis but who received the support and aids that a dyslexic is entitled to.

Our Cronbach alpha value indicated that the SDS is a credible form with high reliability of the items (0,96). Parra & Wass (2016) also noted this, even though they got a lower Cronbach alpha value (0,87). Brimo (2019) also got a good value (0,90) and this indicates that SDS has excellent internal consistency. The results of this study show that the parental questionnaire could be used in, for example, epidemiological contexts or as screening.

The hypothesis in regard to the SDS centered around two questions: the first was whether children in the dyslexia group would score higher based on the scores from the parental questionnaire and second, whether the scores from SDS correlated with test scores of reading and listening comprehension. The results show that indeed the dyslexia group scored much higher than the control group. There was no overlap between the groups' results which means that the one with the lowest score on SDS in the dyslexia group still scored higher than the one with the highest score in the control group. This indicates that there is a big difference between the groups regarding the

parent's ratings. Compared with prior research, the current study is unique since it included a control group and we made sure the dyslexia group scored within the normal range on listening comprehension. The results of the second research question show that there is a significant negative correlation between parents' assessment of the child's skills, word reading and phonological decoding. This means that children with more pronounced reading and writing problems are highly rated as such by their parents and perform poorly on testing. The correlation between parents' ratings and listening comprehension was not significant, which means that there is no established relationship between them as would be expected if the SDS assess reading skills specifically.

This study is an important contribution for method development in reading and writing assessment, which has been identified as a knowledge gap in SBU (Swedish agency for health technology assessment and assessment of social services) (SBU, 2014). SDS is potentially a time- and cost-effective way to complement reading and writing investigations. However, it is important to note that SDS alone is not meant to be used for diagnostic purposes. Rather, it should act as a supplement to an existing standardized testing, as results can then be compared with children of the same age. In addition, SDS does not identify what kind of reading and writing difficulties the child has. Due to the fact that SDS is a simple, short and easy questionnaire, it can also advantageously reach more participants via, for example, mail. Translating the form into other languages also provides an opportunity to reach more people by providing parents with a questionnaire in their language. This ultimately will allow more children with reading and writing difficulties to be identified. Since all of our participants had Swedish as their best language, it can be assumed that parents were also comfortable with a Swedish questionnaire, but in the future parental preferred language should be taken into account. It is possible that in families where Swedish is not preferred as parental language, there may be misunderstandings or missing answers if the parents have not fully understood the questions.

Early identification of the children in need of intervention is important for their well-being. Previous studies have shown that children with dyslexia are at greater risk of low energy, depression and anxiety compared to a group of typical readers (Dahle, Knivsberg & Andreassen, 2011). SDS is an efficient way of reaching the population and reducing the risk of children not being investigated for reading and writing difficulties. The previous study along with the present investigation clearly indicates that SDS is a valid way to identify children with reading and writing difficulties. Because of this, this short questionnaire can potentially be introduced to the schools giving teachers the opportunity to send out SDS to parents and in this way finding out parents' opinion about their child's reading and writing ability.

During the course of the study, questions have been raised about whether the child's teacher could also be a suitable candidate for filling out the questionnaire. Since the questionnaire should be filled out by someone who knows the child well and has good insight into the child's reading and writing ability (Bishop & McDonald, 2009), it is primarily the parents who have been contacted in prior research. However, it is important to consider the fact that some parents may lack insight about their child's reading and writing ability, and rating their child's skills may be difficult since they might have little insight into the general development of children. Thus future research with SDS with teachers involved would be of great interest. By then, the teachers could

have quickly identified which children are in need of a dyslexia investigation and referred to a speech- and language pathologist.

Also, given the heritability of dyslexia it is possible that assessment by a parent is difficult due to the parent's own impairments (for example, parents may also have problems with reading and writing and/or may be dyslexic). We have not collected any such information in the current study which also would be an interesting line of study in the future. For all these reasons, it is again important to stress that the questionnaire is supplemented with standardized testing in diagnostic decision making. In cases such as these, it is easy to consider the teacher as an alternative due to his/her insight and knowledge about the child's abilities in comparison to same-age peers. At the same time, we think it can be a good alternative to involve both the teacher and the parents to take part in SDS, to get as much information as possible about the child's reading and writing ability.

Limitations

In this study, we came across several limitations of note. In future studies on this topic, it should be possible to gather a larger group of participants, to have an equal number of participants in each group and the children should come from more varying socioeconomic areas including more children with a multilingual background. It is important to note, however, that the mean scores on the reading and listening comprehension tests were close to age typical performance according to the norms. Still, in future research, when there is more time for testing, it may be good to meet more children from different schools, to also gain a greater variety of reading and writing abilities. It can also be questioned whether the group was large enough to interpret the results as reliable.

One child in the dyslexia group had not been diagnosed with dyslexia, which violated our a priori set inclusion criteria. However, the child received additional support at school and scored lower on the standardized test than many other children in the dyslexia group. While the child did not have a formal dyslexia diagnosis, it was assigned to the dyslexia group since she showed all the signs of dyslexia and was treated as such in her school.

Even though one parent in the control group left a question unanswered, that child was not excluded from the study. The reason for this is because we could solve the problem since it was just one question, and we did not want to lose a participant.

In summary, the results provides further data indicating that SDS is useful as an assessment material for identifying dyslexia in screening or as part of clinical assessment. In connection with clinical assessment of dyslexia, much information is obtained from a medical anamnesis and direct testing with the child, but SDS should be used as a complement since these statements specifically focus on the reading and writing ability. In parent ratings you also get the parents' thoughts about the child's reading and writing ability during the dyslexia assessment. Hopefully, the present study contributes with knowledge of how to effectively identify children in need of help before their reading and writing difficulties affect their mental health and create exclusion in society.

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Appendix 1

The SDS questionnaire where parents select the alternative that best matches their child's reading and writing ability.

| Ange hur Du uppfattar att Ditt barn fungerar då det jämförs med jämnåriga barn. Tänk på hur barnet fungerat sista tiden, dvs. under senaste 6 månaderna. | 0 - Stämmer inte | 1 - Stämmer i viss mån | 2 - Stämmer bra |
|---|-------------------------|-------------------------------|------------------------|
| 1. Han/hon har svårt att stava | | | |
| 2. Han/hon har svårare med läsinlärning än vad man kan tänka sig med tanke på hur barnet lär sig inom andra områden. | | | |
| 3. Han/hon har svårt att förstå vad han/hon läser. | | | |
| 4. Han/hon gissar mycket då han/hon läser. | | | |
| 5. Han/hon tycker inte om att läsa (t.ex. undviker att läsa böcker och annat). | | | |
| 6. Han/hon hade svårt att lära sig bokstäverna | | | |
| 7. Han/hon behöver extra hjälp i läsning | | | |