SPOKEN LANGUAGE ASSESSMENT WITHIN DYSLEXIA EVALUATIONS

by

AVERY WATERS

(Under the Direction of Hannah Krimm)

ABSTRACT

Dyslexia is a reading disability characterized by poor decoding skills (Snowling, 2020). Specific language impairment (SLI) is defined as difficulty acquiring language despite adequate intelligence and adequate opportunity to learn language (Tomblin et al., 1997). Although dyslexia and specific language impairment (SLI) are distinct disorders, it is common for them to co-occur (Catts et al., 2005; Snowling et al., 2019). Spoken language assessment is critical for differential diagnosis of dyslexia, SLI, and co-occurring dyslexia and SLI. The purpose of this preliminary, exploratory study is to answer the following research questions:

1. What proportion of children diagnosed with dyslexia were given a language measure?
2. If a language measure was given, which domain(s) of language were assessed?

INDEX WORDS: Dyslexia, Specific Language Impairment, Evaluation Practices, Interventions

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DEDICATION

For Ann.

I promised I would make you proud.

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CHAPTER 1

INTRODUCTION

Although dyslexia and specific language impairment (SLI) are distinct disorders, it is common to find co-occurrence between them (Catts et al., 2005; Snowling et al., 2019). In a 2019 study where one of the main research aims was to estimate the co-morbidity rate between dyslexia and SLI, 43% of children previously diagnosed with dyslexia were found to have co-occurring language impairment (Snowling et al., 2019). Similarly, 58% of children previously diagnosed with language impairment were found to have co-occurring dyslexia (Snowling et al., 2019). Differential diagnosis of dyslexia, SLI, and co-occurring dyslexia and SLI is imperative because intervention approaches will differ based on the diagnosis (e.g., phonologically based interventions for dyslexia only, morpho-syntactically-based intervention for SLI only, and a combination for those who have both dyslexia and SLI) and child's strengths and weaknesses (I.e., if oral language is not assessed, it is unknown if the child requires intervention for oral language). Thus, comprehensive spoken and written language assessment is critical for differential diagnosis of dyslexia, SLI, and co-occurring dyslexia and SLI.

Literature Review

Dyslexia is a reading disability characterized by poor decoding skills that are not explained by perceptual deficits, intellectual disability, or medical causes (Adlof & Hogan, 2018; Snowling, 2020). Children with dyslexia often have deficits in reading accuracy, reading rate/fluency, and spelling (Adlof & Hogan, 2018). These difficulties typically result from a deficit in the phonological domain of language, specifically in one or several aspects of

phonological processing (Catts et al., 2005; Gough & Tunmer, 1986; Snowling et al., 2019). Phonological processing comprises phonological awareness, phonological memory, and phonological recoding (Catts et al., 2005; Wagner & Torgesen, 1987).

Phonological Processing

Phonological Awareness

Phonological awareness is the ability to analyze the sound structure of oral language (Anthony & Lonigan, 2004; Schuele & Boudreau, 2008). Children with intact phonological awareness skills can divide words into syllables, create and manipulate rhymes, and identify and manipulate individual phonemes (Schuele & Boudreau, 2008; Stahl & Murray, 1994). Phonological awareness skills are foundational for mapping sounds onto alphabetic symbols and thus are critical for reading acquisition (Schuele & Boudreau, 2008; Snowling et al., 2019; Torgesen et al., 1994). The understanding that alphabetic symbols represent the sounds of spoken language is called the alphabetic principle; decoding requires applying the alphabetic principle to accurately read/pronounce a word (Schuele & Boudreau, 2008; Torgesen et al., 1994). According to Scarborough's Reading Rope, decoding and phonological awareness work together to enable word recognition (Scarborough, 2001). As decoding and phonological awareness become more automatic, a child moves toward skilled reading (Scarborough, 2001). Without adequate phonological awareness (and decoding), an individual will struggle with word recognition and thus struggle with reading (Scarborough, 2001).

Phonological Memory

Phonological memory is the ability to accurately recall sound sequences from short-term/working memory (Gathercole & Adams, 1993). Phonological memory is crucial for reading because after decoding a word, the constituent sounds must be kept temporarily in working

memory before being blended to reproduce the word (Baddeley, 1984). Phonological memory often is measured by tasks such as nonword repetition and digit span (Melby-Lervag & Lervag, 2011). During nonword repetition tasks, an individual is asked to repeat phonological sequences of various lengths and complexities (Gathercole & Adams, 1993). During digit span tasks, an individual is asked to remember number sequences of increasing length and repeat them either in the same order they were heard or in reverse order from what they heard (Gathercole & Adams, 1993).

Phonological Recoding

Phonological recoding is the ability to recall a phonological segment accurately and fluently from long-term memory. Phonological recoding often is measured by rapid automatized naming (RAN) tasks. RAN tasks require verbally naming as quickly as possible familiar stimuli (e.g., letters, numbers, colors) presented in a random order (Norton & Wolf, 2012). For example, an individual completing a RAN task would be instructed to name as many commonly known objects (e.g., "dog, chair, spoon, apple, eye") as possible in a set amount of time.

Effect of Phonological Processing Skills on Word Reading

Difficulties with phonological processing are strong diagnostic indicators of dyslexia and/or SLI because children with dyslexia and/or SLI often have poor phonological awareness abilities (Catts et al., 2005; Dollaghan & Campbell, 1998; Snowling & Melby-Lervag, 2016; Werfel & Krimm, 2017). Werfel & Krimm (2017) compared the pattern of reading subtypes of children with SLI to those with typical language and evaluated the phonological and nonphonological language abilities within each of four potential reading outcomes (typical reading, dyslexia, specific reading comprehension impairment, and garden variety reading impairment). There were 32 children with SLI and 39 children with typical language in second

through fourth grade. They found that children with dyslexia performed lower on measures of phonological awareness than typical readers. They also found that children with SLI were more likely to have reading impairment, demonstrated by poor performance on all measures of reading (i.e., the Test of Word Reading Efficiency-Second edition [Torgesen et al., 2012] and Woodcock Reading Mastery Test-Third edition [Woodcock, 2011]) when compared to the typical language group.

Torgesen et al., (1997) examined the contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second- to fifth-grade children. They conducted a longitudinal, correlational study on over two hundred children starting in second grade. All children were administered measures of phonological skills, including measures of phonological awareness (e.g., phoneme elision, phoneme segmentation, blending phonemes into words), phonological memory, and rapid automatized naming (e.g., naming digits serially, naming letters serially). Participants were also given measures of reading ability (e.g., word identification, word analysis, passage comprehension, word-reading speed-isolated trials, word reading efficiency, orthographic choice, lexical verification). Finally, all children were given a measure of general verbal aptitude (e.g., Stanford-Binet vocabulary). The researchers found that rapid automatized naming and phonological awareness skills strongly predicted reading differences two years later (Torgesen et al., 1997).

Poor phonological awareness (PA) skills (e.g., blending, segmenting, isolation, deletion) often result in poor reading ability (Stahl & Murray, 1994). Poor phonological awareness skills often contribute to poor decoding skills (Snowling et al., 2019). Individual sounds are not easy to deduce from a spoken word because the sounds have been blended into a singular unit (Stahl & Murray, 1994). Thus, accurate decoding skills rely on strong phonological awareness skills

(Vellutino et al., 2004). Those with difficulty acquiring phonological awareness will most likely have difficulties connecting alphabetic symbols to sounds and therefore have decoding deficits (Vellutino et al., 2004). Phonological awareness provides a unique predictor of reading growth (Torgesen et al., 1997). Interventions that lead to improvement in phonological awareness lead to improved decoding skills, even interventions provided beyond the elementary school years (Alexander et al., 1991; Ehri et al., 2001; Gillon & Dodd, 1995; Schuele & Boudreau, 2008; Troia, 1999). Explicit, comprehensive phonological awareness instruction can prevent long-term reading difficulties in children (Vellutino et al., 2004). Ehri et al., (2016) conducted a meta-analysis to compare the effects of systematic phonics instruction to unsystematic or no phonics instruction on reading ability. Researchers examined sixty-six treatment-control comparisons and concluded that systematic phonics instruction was more effective at helping children learn to read than nonsystematic or no phonics instruction (Ehri et al., 2001).

In terms of phonological memory, Melby-Lervag and Lervag (2011) conducted a meta-analysis of 44 studies and found that in comparison to typical readers, children with dyslexia demonstrated poor non-word repetition skills. Additionally, they found that most variability in severity of a child's non-word repetition deficits was predicted by the child's oral language skills (i.e., the more severe non-word repetition deficits were found in groups of combined dyslexia and SLI; Melby-Lervag & Lervag, 2011). Witteloostuijn et al., (2021), assessed phonological memory in eight- to eleven-year-old children by administering nonword repetition tasks and digit span repetition tasks. There was a control group and dyslexic group, both of which had fifty children. Witteloostuijn et al., (2021) found that phonological memory contributed to grammar performance in children with dyslexia and without dyslexia. They also found that children with

dyslexia make more errors on compound verbs than typically developing children, which demonstrates the connection between phonological memory and grammar abilities.

Like phonological memory difficulty, RAN difficulty is a strong diagnostic indicator of potential reading difficulties (Norton & Wolf, 2012). In a study of 144 second and third grade "severely impaired" readers, Wolf et al., (2002) found that 75% had RAN deficits, with or without concomitant phonological awareness deficits; 19% had only phonological awareness deficits; and 15% had only naming speed deficits. Thus, evaluating phonological processing abilities is critical in distinguishing children with dyslexia and/or SLI from typically developing children.

Evaluating Children for Dyslexia

Dyslexia assessments in the United States typically are conducted by educational psychologists, though other professionals (e.g., speech-language pathologists) can conduct these assessments. Generally, assessment frameworks for dyslexia do not require measurement of oral language skills beyond phonological awareness (Adlof et al., 2018). According to the State of Georgia Dyslexia Informational Handbook, the following should be *considered* when conducting dyslexia evaluations in the schools: phonological awareness; phonological or language-based memory; RAN; receptive vocabulary; phonics skills; decoding of real and nonsense words; oral reading fluency of single words, paragraphs, and sentences; spelling; and writing at the sentence and paragraph level (Georgia Department of Education, 2019). Assessments of word reading, spelling, and working memory should be included in dyslexia evaluations because these are considered by many to be the key deficits in dyslexia (Roitsch & Watson, 2019).

Because poor decoding skills are diagnostic indicators of dyslexia, tasks of decoding real and/or nonsense words are typically completed in a dyslexia evaluation. Decoding typically is

measured by presenting a nonsense word (i.e., non-real word that follows English orthographic conventions [e.g., mog, vip]). Some common tools used to evaluate decoding skills are the Test of Word Reading Efficiency-Second edition (TOWRE-2; Torgesen, et al., 2012), the Woodcock Reading Mastery Test-Third edition (WRMT-III; Woodcock, 2011), and the Test of Integrated Language and Literacy Skills (TILLS; Nelson et al., 2016). The TOWRE-2 measures sight word reading fluency and phonetic decoding fluency for individuals six to twenty-four years old (Tarar et al., 2015; Torgesen et al., 2012). The WRMT-III measures phonemic awareness, phonics, vocabulary, reading fluency, and text comprehension (Woodcock, 2011). The TILLS has fifteen subtests, including the following: decoding; phonemic awareness; nonword repetition, spelling, and reading; reading fluency; digit span forward and backward; and reading and listening comprehension (Nelson et al., 2016). Among these common reading measures, inter-rater reliability ranges from .79-.99 and test-retest reliability ranges from .83-.99 (Mailend et al., 2016; Nelson et al., 2016; Tarar et al., 2015; Torgesen et al., 2012; Woodcock, 2011). Inter-rater reliability is calculated by having multiple administrators independently score a test according to the test manual, and then determining the extent to which their scores agree (McHugh, 2012). For example, two administrators independently watch a measure be administered and independently score the individual's performance according to the testing manual (McHugh, 2012). Then, for percent agreement, their answers are put into a matrix where the two testing administrators are placed in columns and each variable placed in rows (McHugh, 2012). High inter-rater reliability (i.e., reliability > .80) suggests that scores are likely to be consistent across administrators and implies that the testing manual provides adequate information on scoring procedures such that the test is scored as it was intended (McHugh, 2012). Test-retest reliability is calculated by administering the same test to the same participant at two relatively close times

(e.g., two weeks, four weeks) and correlating the two scores (Schmidt et al., 2003). High test-retest reliability suggests that a test is stable over a short amount of time, meaning that it will yield a similar score regardless of when it is administered (Schmidt et al., 2003). Test-retest reliability is one way to confirm the internal validity of a measure, or how well the results of the test represent the targeted population (Schmidt et al., 2003).

In addition to the aforementioned measures of decoding, it is beneficial to include measures of phonological processing in evaluations for dyslexia. For example, because reading relies on accurately and fluently recalling phonological segments from long-term memory, rapid automatized naming (RAN) is highly predictive of word reading skill and often is impaired in individuals with dyslexia (Norton & Wolf, 2012). In a systematic review, Wolf et al., (2000) found that those with reading disabilities consistently had RAN deficits and found this to be true regardless of what language individuals spoke. Wolf et al., (2000) also found that while RAN deficits typically co-occurred with PA deficits in children with reading difficulties, this was not always the case; some children had reading difficulties with only PA deficits or only RAN deficits. Thus, RAN tasks should be included when there are suspected reading deficits.

Additionally, it is typically beneficial to include a measure of writing during a dyslexia evaluation. Reading is imperative to understanding the instructions of writing tasks as well as for self-correcting error throughout the writing task (Hebert et al., 2018). Both reading and writing rely on phonological information, where reading requires the decoding of phonological information and writing relies on the encoding of phonological information (Hebert et al., 2018). Bourassa and Treiman (2003) found that children with dyslexia had spelling skills that mimicked that of typically developing, younger children. Similarly, Berninger et al., (2008) found that children with dyslexia performed on average at least one standard deviation below the mean on

spelling tasks from the Wide Range Achievement Test- Third Edition and Weschler Individual Achievement Test- Second Edition (Psychological Corporation, 2002; Wilkinson, 1993). Ouellette and Senechal (2016) found that invented spelling (self-directed attempts to print words without the knowledge that each orthographic symbol represents a sound) in kindergarten predicted reading ability in the first grade. Therefore, including a writing task in a dyslexia evaluation would provide pertinent information on a child's spelling and thus an insight to their phonological skills.

Evaluating Children for SLI

Specific language impairment (SLI) is difficulty acquiring spoken language despite adequate opportunity to learn language as well as adequate intelligence (Tomblin et al., 1997). SLI has many aliases depending on the context, such as developmental language disorder (e.g., Bishop et al., 2017), speech or language impairment (Individuals with Disabilities in Education Act; Green, 2020), and expressive, receptive, or mixed language disorder (International Classification of Diseases of the World Health Organization codes; Reilly et al., 2014). Although many children with SLI have poor phonological processing skills (Catts et al., 2005; Rice et al., 1998; Tomblin et al., 1997), difficulties with morphological and syntactic aspects of language are hallmarks of SLI (Rice et al., 1995; Rice et al., 1998). That is, while morphosyntactic deficits are the strongest diagnostic indicators of language impairment, children with specific language impairment may have deficits in other domains of language.

Tomblin et al., (1997) conducted a study that included just over 7,000 kindergarten children in the Midwest. In this study, children were given a language screening. All children who failed the screening were given a full diagnostic battery. Among the children who passed the language screening, 33% were selected at random to also receive a full diagnostic battery.

Tomblin et al., (1997) found that overall prevalence of SLI in kindergarten children is 7.4%. Of the children identified with SLI, only 29% of their parents reported they had previously been informed that their child(ren) had speech or language problems (Tomblin et al., 1997).

Morphology is the domain of language that involves the smallest meaningful pieces of language (i.e., morphemes) and the rules that determine how these pieces can be used. The grammar of children with SLI is marked by an extended period in which these children omit finiteness markers (e.g., third person singular –s, past tense –ed, BE, and DO) in their spoken language (Rice et al., 1998; Goffman & Leonard, 2000). Rice et al., (1998) compared use of tense marking morphemes across typically developing children and children with SLI and found a bimodal distribution of tense-marking performance. By kindergarten, typically developing children nearly always use tense markers whereas children with SLI continue to omit tense markers (Rice & Wexler, 2001). Goffman and Leonard (2000) examined the growth of language skills in preschool children with SLI. They monitored three groups of children over two consecutive academic years: children with SLI, an age-matched group, and a mean length utterance (MLU) matched group. The authors collected language samples from the children at the beginning and end of each academic year and reported that children with SLI produced finite verb morphology below expected levels when compared to MLU-matched peers. Weiler and Schuele (2021) reported similar findings in a more recent study of kindergarteners in a rural school district using an elicited task. They found a bimodal distribution of performance on the elicited morphological task, which supports tense-marking as a diagnostic indicator of SLI. That is, typically developing children clustered around one, high peak of performance and children with SLI clustered around a lower peak of performance.

Syntax is the domain of language that includes grammar and helps define relationships between words (Koutsoftas, 2013). Syntactic errors are another hallmark of a language impairment (Adlof, 2020). Several studies support this assumption. In a study that examined comprehension of spoken sentences, Robertson and Joanisse (2009) found that children with SLI demonstrated syntactic processing difficulties by having a larger number of errors on the Test for Reception of Grammar (Bishop, 1989) when compared to typically developing children, even when the working memory demands were minimized. Nation & Snowling (2000) measured syntactic awareness by examining the performance of thirty children on a word-order task. The children were given several words out of logical order and were asked to form a correct sentence using all the words. The authors found weak syntactic awareness skills in children who had reading comprehension impairments and typical phonological processing abilities. Schuele and Nicholls (2000) found that children with SLI often omitted obligatory relative clause markers, or a clause within a noun phrase that comes after the noun. Similarly, Frizelle and Fletcher (2013) found that children with SLI had greater difficulty with repeating sentences containing relative clauses than the age-matched typically developing group and the younger typically developing group.

Syntax is important for reading comprehension. Mokhtari & Thompson (2006) found strong correlations between syntactic awareness and reading comprehension. Syntactic deficits are likely to contribute to difficulty with reading comprehension among children with SLI. According to the reading rope model, morphosyntactic skills influence reading comprehension (Scarborough, 2001). Adlof and Catts (2015) examined and compared the morphosyntactic abilities of fourth graders who had poor comprehension to those who were typical readers. Students had to perform between the 40th and 86th percentiles based on fourth grade norms for

the sight words subtest from the Test of Word Reading Efficiency to guarantee average performances (Torgesen et al., 1999). Participants were given the CELF-4, PPVT-4, and CTOPP as the norm-referenced language measures (Dunn & Dunn, 2007; Semel et al., 2006; Wagner et al., 1999) and given three experimental tasks of morphosyntax: irregular past tense grammaticality judgement, BE-DO question grammaticality judgement, and finiteness elicitation. The researchers found that those who were poor comprehenders had weaknesses in finiteness marking on all three experimental tasks. The non-phonological language difficulties associated with SLI lead to reading comprehension deficits. Snowling et al., (2000) found that children with SLI in preschool performed less well than their typically developing peers on reading comprehension tasks at age fifteen. Similarly, Botting et al., (2006) found that children with SLI were more likely to have difficulties with reading comprehension tasks rather than word recognition tasks.

Syntax is one of the strands comprising the reading rope (Scarborough, 2001). More specifically, syntax is one of the strands that comprises language comprehension (Scarborough, 2001). The Simple View of Reading tells us that language comprehension contributes to reading comprehension outcomes (Gough & Tunmer, 1986). Thus, poor syntactic skills lead to poor language comprehension which results in poor reading comprehension.

Pragmatics is the domain of language that includes the rules that govern language use in social situations. Some children with language impairment have difficulty with pragmatic language tasks such as accessing peer interactions and disputing (conflict resolution; Craig, 1993). For example, Craig and Washington (1993) characterized and compared the access skills (the ability to access a social interaction) of children with SLI to their typically developing peers. They found that all children who failed to access peer interaction were children with SLI. The

authors also noted that the two children with SLI who did access peer interaction did so without speaking (e.g., handed their peer a toy to gain access; Craig & Washington, 1993). While pragmatic ability is not diagnostic of SLI, because many children with SLI have pragmatic deficits, assessing pragmatic ability may provide important information to guide intervention.

Assessing Spoken Language

Given that SLI tends to be characterized by nonphonological deficits, specifically deficits in morphosyntax (Catts et al., 2005), it is unsurprising that the most commonly assessed domains of language for children with SLI are semantics, morphology, and syntax (Adlof & Catts, 2015). Ogiela and Montzka (2020) explored language test selection practices among SLPs for evaluating elementary school children with suspected SLI. Three-hundred-seventy SLPs responded to a web-based questionnaire, and results showed that clinicians have a strong preference for omnibus language measures (language measures that examine all or almost all domains of language). The authors also found that follow-up test selection did not align with language difficulties associated with SLI, but tended to be measures of semantics (74% of domain-specific follow-up tests). In a private clinic, a language evaluation would likely include the following: a hearing screening or evidence of a passed hearing screening within the past six months; an articulation screening; an oral mechanism screening; a parent interview; a recorded language sample; a language measure that assesses morphology and/or syntax; and a measure that screens or assesses semantics, pragmatics, and phonology. When assessing for eligibility for special education in schools, an SLP also must include documentation of an educational impact.

Although morphosyntactic deficits are common in children with SLI, they often have deficits in the other domains of language. Semantic skills of children with SLI tend to be a relative strength in comparison to the other domains of language, but children with language

impairment still have limitations in both the breadth (how many words an individual knows) and depth (how well an individual knows words) of their vocabulary (Goffman & Leonard, 2000; McGregor et al., 2013). McGregor et al., (2013) used pre-existing data from the Child Language and Research Center Project to evaluate the semantic skills of 502 monolingual English-speaking children who had hearing within normal limits and scores of 70 or above on the Weschler Intelligence Scale for Children. When the participants were in kindergarten, they received a comprehensive test battery that assessed receptive language, expressive language, vocabulary, syntax (grammar), and narrative. All included participants were given the Comprehensive Receptive and Expressive Vocabulary test in second, fourth, eighth, and tenth grade, as this measure was not given when the children were in kindergarten. Among the children in the study, 325 had normally developing language in their kindergarten year and 177 had language impairment, which was defined in this study as performing at least 1.25 standard deviations below the mean in two of the five assessed areas (McGregor et al., 2013). Researchers found that regardless of grade, children with language impairment showed deficits in the depth and breadth of vocabulary knowledge in comparison to their typically developing peers (McGregor et al., 2013).

Many children with SLI also have poor phonological processing abilities (e.g., phonemic awareness, word retrieval; Catts et al., 2005; Rice et al., 1998; Snowling et al., 2019; Tomblin et al., 1997; Werfel & Krimm, 2017). Kamhi and Catts (1986) found that children with language impairment performed on levels similar to children with reading impairment on measures of word and sentence repetition, while neither performed as well as typically developing children. Children with language impairment in the study performed worse than children with reading impairment on measures of morpheme judgement and word division (Kamhi & Catts, 1986).

Fraser et al., (2010) investigated the similarities in phonological abilities of children with dyslexia and children with SLI. They divided children into four groups: a group with language deficits (SLI), a group with reading deficits (dyslexia), a group with both language and reading deficits, and a chronologically age-matched group. All children were given a phonological skills battery, which included measures of phoneme awareness, aural rhyme oddity, rhyme fluency, and phonological short-term memory. They were also given a nonphonological language skills battery which included measures of vocabulary (semantics), grammar (syntax), and sentence recall. Fraser et al., (2010) found that there were phonological deficits in the SLI group and in the dyslexia group. Additionally, they found that there was a greater phonological impairment in the group with both dyslexia and SLI.

Co-Occurrence of SLI and Dyslexia

Several studies have demonstrated high co-occurrence between dyslexia and SLI. The Wellcome Language and Reading project examined children from three separate groups: children who had a familial risk for dyslexia, children who had a diagnosed preschool language impairment, and typically developing children. The purpose of the Wellcome Language and Reading project was to examine literacy development and reading comprehension abilities of the children over time. Snowling et al., (2019) conducted a study using three groups of eight-year-old children from the Wellcome Language and Reading Project. Group One (n=21) had only dyslexia and no oral language deficits, Group Two (n=38) had SLI with no decoding deficits, and Group Three (n=29) met criteria for both dyslexia and SLI. All children in the study were administered a comprehensive language and literacy test battery. Snowling et al., (2019) found that 48% of those previously diagnosed with SLI met criteria for dyslexia and 58% of those previously diagnosed with dyslexia met criteria for SLI. Similarly, Catts et al., (2005) reported

that one-third of children with SLI had dyslexia using low achievement cutoff criteria for dyslexia and Werfel and Krimm (2017) reported that among children receiving school-based language services, as many as 75% had co-occurring dyslexia.

The weak oral language skills and subsequent reading comprehension difficulties seen in someone with co-occurring dyslexia and SLI will not be remediated by providing intervention on decoding alone (Adlof & Catts, 2015; Snowling et al., 2019). Intervention should be informed by the child's patterns of strengths and needs (al Otaiba, 2018). Fey et al., (2003) suggests that clinicians should examine a child's speech and language patterns for strengths and weaknesses, examine the current impact of those patterns, and evaluate the potential impact of those patterns in the future. Thus, it is critical to include spoken language measures in dyslexia evaluations. The purpose of this preliminary, exploratory study is to determine the extent to which dyslexia evaluations include assessments that measure spoken language skills. We sought to answer the research questions:

1. Do dyslexia evaluations typically include spoken language measures?
2. Which domain(s) of language are most assessed?

Method

The University of Georgia Institutional Review Board approved the methods used in this study.

Participants

Participants were twenty-two children who had been previously diagnosed with dyslexia per parent report. Ages at the time of the diagnostic evaluation ranged from 5 years; 7 months to 13 years; 9 months (mean = 9 years). Three states were represented in the sample: Georgia (n=17), Tennessee (n=3), and Texas (n=2). Highest level of maternal education spanned several levels; fourteen of the participant's mothers had a graduate degree, five had a bachelor's degree, two had an associate degree or two-year degree, and one had a high school diploma or GED. Table 1 provides basic demographic information for participants who provided this information (n = 21); one parent declined to complete the demographic questionnaire.

Table 1

Participant demographics

Variable	n	%
Gender		
Male	11	50%
Female	10	45%
Race		
American Indian or Alaskan Native	2	9%
Asian	0	-
Black or African American	2	9%
Native Hawaiian or Other Pacific Islander	0	-

White	17	77%
Ethnicity		
Hispanic/Latino	2	9%
Not Hispanic/Latino	19	86%

Procedure

Participants were recruited via flyers distributed on social media (e.g., lab twitter account), email listservs, and community partners (e.g., private practice dyslexia interventionists). Parents followed a link on the recruitment materials to a *Qualtrics* survey (Qualtrics, Provo, UT). *Qualtrics* is a simple and secure online survey tool. Within the *Qualtrics* survey, parents (a) granted informed consent, (b) completed an optional demographic/educational history questionnaire (13 questions; Appendix II) about their child, and (c) uploaded their child's dyslexia evaluation report for the research team to review. They also provided personal information to receive compensation ($25 check) for participating in the study.

Attrition

Fifty individuals followed the link in recruitment materials and began the survey, but only 22 (44%) provided informed consent and completed the survey. Attrition may have been high due to lack of clarity on the recruitment materials that participants would be prompted to upload their child's evaluation report upon clicking the link, as opposed to at a later date. Future studies will include a step wherein interested parents contact the lab to receive a link to upload their child's report at their convenience.

Data Coding

Research assistants were the author (a second-year master's student in speech-language pathology) and a graduate research assistant with a master's degree in speech-language pathology. The two research assistants independently coded each report or administration of language measures as described below. Discrepancies were resolved by the faculty advisor.

First, the faculty advisor and the author independently generated lists of all measures that were included in the dyslexia evaluations by manually reviewing the reports. The lists were compared and combined for a complete list of measures. This list was inserted into an Excel spreadsheet. Research assistants independently reviewed each measure's test manual to determine whether each test assessed language according to the publishers. If the test manual claimed that the test assesses language, a "1" was entered on the spreadsheet. If the test manual did not claim that the test assesses language, a "0" was entered on the spreadsheet. When a test manual was not available, the research assistants consulted the publishers' website to determine whether the test is purported to measure language. Thus, a list of all spoken language measures used across participants was generated.

Next, research assistants independently coded each report for use of each language measure. If a specific language measure was included in a child's dyslexia evaluation, a "1" was entered for that measure in the spreadsheet. If a language measure was not included in a child's dyslexia evaluation, a "0" was entered for that measure in the spreadsheet. Thus, a record of which language measure(s) were and were not given was created for each child.

Finally, research assistants coded each language measure for the domain(s) of language assessed (phonology, morphology, syntax, semantics, pragmatics) as reported in the test manual for the language measure (see Table 2 for a list of measures and language domains, see Appendix I for coding manual). When the test manual was not available, this information was

gathered from the publishers' website. A spreadsheet was created with each language domain and each language measure. If the test manual claimed that the test assesses a domain of language (e.g., morphology), a "1" was entered on the spreadsheet. If the test manual did not claim that the test assesses a domain of language (e.g., morphology), a "0" was entered on the spreadsheet.

Data Analysis

The percent of dyslexia evaluations that included at least one spoken language measure was calculated by dividing the number of participants who were given a spoken language measure (n=17) by the total number of participants (n=22) and multiplying by 100. The percent of evaluations that included a spoken language measure with the exception of those only administered a measure of phonology was calculated by dividing the number of participants who were given a spoken language measure beyond phonology (n=12) by the number of participants who were given a language measure (n=17) and multiplying by 100. The percent of evaluations that included a measure for each domain was calculated by dividing the number of participants given a measure for each domain, by the total number of participants who were given a language measure (n=17) and multiplying by 100.

Results

The purpose of this study was to investigate dyslexia evaluation procedures. We addressed two research questions: 1. What proportion of children diagnosed with dyslexia were given a spoken language measure? and 2. If a language measure was given, which domain(s) of language were assessed?

Research Question 1: What proportion of children diagnosed with dyslexia were given a spoken language measure?

Of the 22 participants in this study, 77% (n=17) were given a language measure as part of their dyslexia evaluation. On average, 1.54 language measures were used per evaluation. The number of language measures used ranged from zero to four. The single participant given four language measures was given the CTOPP-2 (Wagner et al., 2013), PPVT-4 (Dunn & Dunn, 2007), OWLS-II (Carrow-Woolfolk, 2011), and EOWPVT-4 (Martin & Brownell, 2011). The four participants given three measures were given the CTOPP-2 (Wagner et al., 2013), WJ-IV (Schrank et al., 2014), and either the PPVT-4 (Dunn & Dunn, 2007) or PPVT-5 (Dunn, 2019). Of the six participants given two measures, all of them were administered the CTOPP-2 (Wagner et al., 2013). Four of them received the WJ-IV (Schrank et al., 2014) as their second measure and the remaining two received the CELF-5 (Wiig et al., 2013), both omnibus language measures. Of the six participants given one language measure, five were given the CTOPP-2 (Wagner et al., 2013) and one was given the PPVT-4 (Dunn & Dunn, 2007). Morphology, syntax, and pragmatics were only assessed through omnibus language measures. Semantics was assessed with both domain-specific and omnibus language measures. Phonology was only assessed with a domain-specific measure.

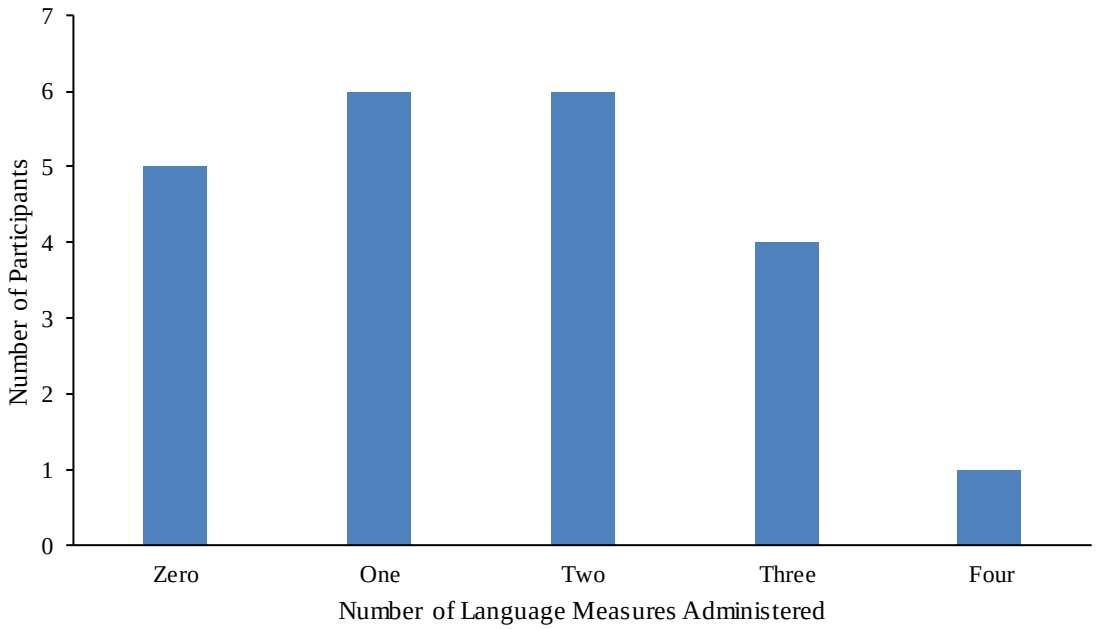

Figure 1.

Histogram of number of measures given to participants.

Research Question 2: If a language measure was given, which domain(s) of language were assessed?

For research question two, each language measure was coded for the domain(s) of language assessed. Figure 1 shows the number of participants administered zero, one, two, three, and four language measures and Table 2 lists the measures used to assess each domain.

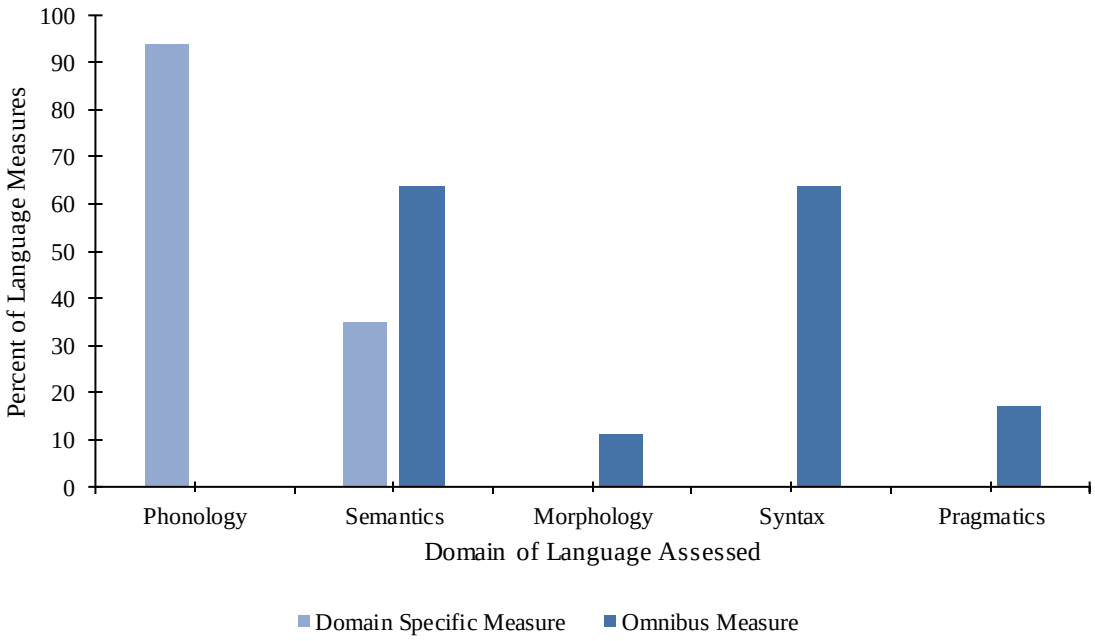

Figure 2.

Percent of domain specific measures and omnibus measures.

Phonology

Almost all (94%) of the participants who were given a language measure were given a measure of phonology as part of their dyslexia evaluation.

CTOPP-2 (Wagner et al., 2013)

The CTOPP-2 (Wagner et al., 2013) was the only measure of phonology administered. This measure evaluates phonological processing skills including phonological awareness, phonological memory, and RAN (Wagner et al., 2013). The CTOPP-2 has an inter-rater reliability from .96-.98 for both subtests and composites and a test-retest reliability of .73-.92 for subtests and .76-.86 for composites (Wagner et al., 2013).

Semantics

A measure of semantics was administered to 70% (n=12) of those given a language measure. Measures that reported to tap semantics were the PPVT-4 (Dunn & Dunn, 2007),

PPVT-5 (Dunn, 2019), OWLS-II (Carrow-Woolfolk, 2011), WJ-IV Oral Language test (Schrank et al., 2014), EOWPVT-4 (Martin & Brownell, 2011), and CELF-5 (Wiig et al., 2013). For those that could be obtained, inter-rater reliability across these semantic measures ranges from .66-.96, and test-retest reliability ranged from .72 to .94.

PPVT-4 or PPVT-5 (Dunn, 2019; Dunn & Dunn, 2007)

Of the twelve participants given a semantic measure, six were given either the PPVT-4 or PPVT-5 (Dunn, 2019; Dunn & Dunn, 2007). The PPVT-4 and PPVT-5 are both measures of receptive vocabulary (Dunn, 2019; Dunn & Dunn, 2007). The testing clinician says a word and the child points to one picture that represents that word out of a field of four possible choices (Dunn, 2019; Dunn & Dunn, 2007). There was no interrater reliability obtained for the PPVT-4 (Dunn & Dunn, 2009) or PPVT-5 (Dunn, 2019). The PPVT-4 (Dunn & Dunn, 2009) has a test-retest reliability of .87-.93 and the PPVT-5 (Dunn, 2019) has a test-retest reliability of .86-.89. Of the six individuals given the PPVT-4 or PPVT-5 (Dunn, 2019; Dunn & Dunn, 2007), four were additionally given both the CTOPP-2 (Wagner et al., 2013) and the WJ-IV oral language test (Schrank et al., 2014). One participant was given the CTOPP-2 (Wagner et al., 2013) and the OWLS-II (Carrow-Woolfolk, 2011) in addition to the PPVT-4 (Dunn & Dunn, 2007). One participant was given only the PPVT-4 (Dunn & Dunn, 2007).

OWLS-II (Carrow-Woolfolk, 2011)

Of the twelve participants given a semantic measure, one was given the OWLS-II (Carrow-Woolfolk, 2011). During the OWLS-II Listening Comprehension subtest, the testing clinician reads a stimulus word aloud and the child selects one picture from a field of four that best matches what the clinician said (Carrow-Woolfolk, 2011). There are also similar semantic items on the Oral Expression and Reading Comprehension subtests (Carrow-Woolfolk, 2011).

The OWLS-II (Carrow-Woolfolk, 2011) has an interrater reliability of .93-.96 and test-retest reliability of .73-.94.

WJ-IV Oral Language (Schrank et al., 2014)

Of the twelve participants given a semantic measure, eight were given the WJ-IV Oral Language test (Schrank et al., 2014). The WJ-IV Oral Language test is an expressive vocabulary task: the clinician points to a picture and asks the child to name it (Schrank et al., 2014). There was no interrater reliability or test-retest reliability available for the WJ-IV Oral Language (Schrank et al., 2014).

EOWPVT-4 (Martin & Brownell, 2011)

Of the twelve participants given a semantic measure, one was given the EOWPVT-4 (Martin & Brownell, 2011). Additionally, this participant was given the CTOPP-2 (Wagner et al., 2013), the PPVT-4 (Dunn & Dunn, 2009), and the OWLS-II (Carrow-Woolfolk, 2011). The EOWPVT-4 is an expressive vocabulary task; the clinician points to a picture and asks the child to name it (Martin & Brownell, 2011). There was no interrater reliability or test-retest reliability available for the EOWPVT-4 (Martin & Brownell, 2011).

CELF-5 (Wiig et al., 2013)

Of the twelve participants given a semantic measure, two were given the CELF-5 (Wiig et al., 2013). Semantics is assessed on the Word Definitions, Semantic Relationships, and Word Classes subtests of the CELF-5. On the Word Definitions subtest, the testing administrator verbally presents a word to the child, the testing administrator uses it in a sentence, and then the child defines the word (Wiig et al., 2013). On the Semantic Relationships subtest, the testing administrator will verbally say a word or phrase. Then, the child is shown and verbally read four separate words and/or phrases and told to select the two that carry the meaning of what the

testing administrator said. The CELF-5 administration manual reports interrater reliability of .66 and test-retest reliability of .72 (Wiig et al., 2013).

Morphology

CELF-5 (Wiig et al., 2013)

A measure of morphology was administered to two participants (11% of those given a language measure). Both participants were administered the CELF-5, an omnibus language measure, meaning they both also received a measure of semantics and a measure of syntax (Wiig et al., 2013). The Structured Writing, Sentence Assembly, and Formulated Sentences subtests assess morphology. The CELF-5 (Wiig et al., 2013) has an interrater reliability of .66 and test-retest reliability of .72. No children were administered a specific measure of morphology.

Syntax

A measure of syntax was administered to 65% (n=11) of those given a language measure.

CELF-5 (Wiig et al., 2013)

Of the eleven participants given a measure of syntax, two were given the CELF-5, an omnibus language measure (Wiig et al., 2013). On the CELF-5, grammar is measured by the Formulated Sentences and Sentence Assembly subtests (Wiig et al., 2013). During the Formulated Sentences subtest, the child is shown a visual stimulus and verbally given one to two target words by the testing administrator. The child then must formulate a grammatically correct sentence using the target word(s) to describe the visual stimulus (Wiig et al., 2013). During the Sentence Assembly subtest, the child is shown grouped words and or phrases and told to arrange the groups to make one sentence and then make a different sentence.

OWLS-II (Carrow-Woolfolk, 2011)

Of the eleven participants given a measure of syntax, one was given the OWLS-II (Carrow-Woolfolk, 2011). The Listening Comprehension, Oral Expression, and Reading Comprehension subtests all include items that assess syntax (e.g., sentence structure/word order items, grammar agreement, etc.; Carrow-Woolfolk, 2011).

WJ-IV Oral Language (Schrank et al., 2014)

Of the eleven participants given a measure of syntax, eight were given the WJ-IV Oral Language test (Schrank et al., 2014). The WJ-IV Oral Language test includes a test of picture vocabulary where child is asked to name a picture ranging from familiar items to less familiar items (Schrank et al., 2014).

Pragmatics

Three participants were given a measure of that could have assessed pragmatics.

CELF-5 (Wiig et al., 2013)

Of the three participants given a measure of pragmatics, two were given the CELF-5 (Wiig et al., 2013). The CELF-5 includes a Pragmatic Activities Checklist for the examiner to use while observing the child's functional communication behaviors (Wiig et al., 2013). The CELF-5 also includes a Pragmatics Profile which can be completed by the child's caregiver(s) or teacher (Wiig et al., 2013). It is unclear whether the two participants who received the CELF-5 were administered either the Pragmatic Activities Checklist or the Pragmatics Profile of the CELF-5 (Wiig et al., 2013), but the coding manual was referenced for this case (Appendix I).

OWLS-II (Carrow-Woolfolk, 2011)

Of the three participants given a measure of pragmatics, one was given the OWLS-2 (Carrow-Woolfolk, 2011). The OWLS-II authors state that certain items of the Oral Expression and Reading Comprehension subtests provide information about a child's pragmatic abilities

(i.e., awareness of the appropriateness of language and the ability to modify how language is used depending on the context; Carrow-Woolfolk, 2011). These items measure a child's knowledge of social norms, asking appropriate questions, appropriate requesting, and appropriate sequencing (Carrow-Woolfolk, 2011). It is unclear if these items were administered, but the coding manual (Appendix I) was referenced for this case.

Table 2.

Measures corresponding to each language domain

Domain of Language	Measure(s)
Phonology	The Comprehensive Test of Phonological Processing- Second Edition[a]
Semantics	The Clinical Evaluation of Language Fundamentals- Fifth Edition[b]
	The Peabody Picture Vocabulary Test- Fourth Edition[c]
	The Peabody Picture Vocabulary Test- Fifth Edition[d]
	The Woodcock Johnson- Fourth Edition Tests of Oral Language[e]
	The Oral and Written Language Scales- Second Edition[f]
	The Expressive One-Word Picture Vocabulary Test- Fourth Edition[g]
Morphology	CELF-5[b]
Syntax	CELF-5[b]
	WJ-IV Oral Language[e]
	OWLS-II[f]
Pragmatics	CELF-5[b]
	OWLS-II[f]

Note. [a]Wagner et al., 2013; [b]Wiig et al., 2013; [c]Dunn & Dunn, 2007; [d]Dunn, 2019; [e]Schrank et al., 2014; [f]Carrow-Woolfolk, 2011; [g]Martin & Brownell, 2011

Discussion

The purpose of this exploratory study was to answer the research questions: (1) What proportion of children diagnosed with dyslexia were given at least one language measure? and (2) If at least one language measure was given, which domain(s) of language were assessed? We hypothesized that (a) few children in our sample would have been given a language measure and (b) semantics would be the most commonly assessed language domain. The majority of children in our sample were given a language measure, and phonology was the most commonly assessed language domain.

Assessment of Phonology

Assessment of phonological processing skills is critical in dyslexia evaluations because phonological processing deficits are common in children with dyslexia (Vellutino et al., 2004). However, only two-thirds of the children in our sample were given a phonological awareness measure. To determine if phonological awareness interventions are warranted, phonological awareness needs to be measured. Torgesen et al., (1997) concluded that phonological awareness and rapid automatized naming measured in kindergarten strongly predicted reading differences two years later. Ehri et al., (2016) found that improvements in phonological awareness led to improvements in decoding skills which allowed children to read better. Spira et al., (2005) tracked 146 children from kindergarten to fourth grade who performed at or below the 30th percentile for reading in the first grade. Phonological awareness, oral language, print knowledge, letter-word identification, and classroom behavior strengths in kindergarten were highly

predictive of reading abilities in early elementary school (Spira et al., 2005). Because improving phonological awareness improves reading outcomes, it is imperative to measure phonological awareness ability in dyslexia evaluations.

Assessment of Semantics

Among the seventeen participants that were given a language measure, 70.5% (n=12) were given a measure of vocabulary. For one participant, a receptive vocabulary measure was the only language measure administered. This approach is problematic because although some clinicians use receptive vocabulary measures during evaluations to "confirm" typical language skills, semantic knowledge tends to be a relative strength for children with SLI and many children with SLI have semantic knowledge broadly within the typical range (Elwer et al., 2013; Gray et al., 1999; Spaulding et al., 2013). Gray et al., (1999) examined whether using any of four different vocabulary measures could discriminate between typically developing children (n=31) and those with SLI (n=31). They administered the Peabody Picture Vocabulary Test-Third edition (PPVT-III; Dunn & Dunn, 1997), Receptive One Word Picture Vocabulary Test (ROWVT; Gardner, 1985), Expressive Vocabulary Test (EVT; Williams, 1997), and Expressive One-Word Vocabulary Test-Revised (EOWVT; Gardner, 1990). Although children with SLI scored lower than their typically developing peers on each of the four different vocabulary tests, on average, children with SLI scored within the typical range on all four vocabulary measures (Gray et al., 1999). Therefore, administering a vocabulary measure during a dyslexia evaluation is unlikely to yield sufficient information to rule out SLI.

Elwer et al., (2013) examined predictors of poor oral comprehension and poor decoding skills in 926 children (463 pairs of twins) who were tested in preschool, at the end of kindergarten, at the end of first grade, at the end of second grade, and at the end of fourth grade.

They concluded that kindergarten vocabulary, when combined with kindergarten RAN, predicted only 27% of poor decoders and only 37% of poor comprehenders (Elwer et al., 2013). Similarly, in a study of 200 eleven-year-old children with SLI, Botting et al., (2006) found that oral vocabulary did not predict reading outcomes as measured by reading comprehension and word-reading ability. Conversely, Adlof et al., (2010) followed 433 children from kindergarten to eighth grade to identify kindergarten predictors of second grade and eighth grade reading comprehension abilities. They reported that although oral vocabulary in kindergarten correlated strongly with eighth grade reading comprehension, the *strongest* predictors of eighth grade reading comprehension were grammatical skills and nonverbal intelligence (Adlof et al., 2010). Although vocabulary (semantics) is important to examine when assessing for SLI, it should not be the *only* domain of language assessed to confirm typical language skills because not all children with SLI have semantic deficits.

Assessment of Morphology

Among the participants who were given a language measure, only 11% (n=2) were given a measure of morphology. Assessment of morphology is critical for identifying children with SLI because difficulty with grammatical morphology is a hallmark of SLI (Goffman & Leonard, 2000; Rice et al., 1995). While children with SLI may have deficits in any domain of language, deficits in morphology and syntax are the strongest diagnostic indicators of SLI. Several studies have reported that evaluating grammatical morphology has considerable utility for distinguishing between children with SLI and their typically developing peers (e.g., Bedore & Leonard, 1998; Haskill & Tyler, 2007; Rice et al., 1998).

For example, Rice et al., (1998) found that children's use of finite verb morphemes associated with verb tense and agreement is especially diagnostic. The authors examined three

groups of children: children with SLI, an age-matched control group, and a language-matched younger control group. For three years, the authors collected data every six months from all three groups of children on spontaneous productions and elicited tasks for BE, DO, and third person singular -s. The authors reported that typically developing children mastered these morphemes at four years old whereas children with SLI did not master these morphemes until after turning seven.

More recently, Haskill and Tyler (2007) compared the morphosyntactic skills of eighty-three preschoolers from different language impairment subgroups, including (a) language impairment only, (b) speech-language impairment with no or minimal final cluster reduction/consonant deletion, (c) speech-language impairment with frequent final cluster reduction/consonant deletion, and (d) no language impairment (control group). The authors collected a language sample from all children and calculated percent correct use of finite morphemes, nonfinite morphemes, plural -s, and third person singular. The authors also used the Index of Productive Syntax (IPSyn) to evaluate each participant's sentence structure skills (Scarborough, 2008). They determined that children with language impairment only performed at the level of younger, typically developing children when examining use of finite morphemes.

Assessment of Syntax

Among the seventeen participants who were given a language measure, 65% (n=11) were given a measure of syntax (e.g., OWLS-II [Carrow-Woolfolk, 2011], WJ-IV Oral Language subtest [Schrank et al., 2014], and CELF-5[(Wiig et al., 2013]). Like assessment of morphology, assessment of syntax is particularly useful for identifying children with SLI, especially those who are likely to struggle with reading comprehension (Adlof & Catts, 2015; Botting et al., 2006; Snowling et al., 2000).

Children with SLI often have poor syntactic ability. For example, Nation & Snowling (2000) assessed syntactic awareness skills in poor comprehenders (n = 15) and in typical readers (n = 15) who were matched for decoding ability, chronological age, and nonverbal ability. Children heard thirty different individual sentences. Each sentence was verbally presented in a random order of words and children were instructed to put the words in the correct order. Nation & Snowling (2000) found that poor comprehenders had weak syntactic awareness skills as demonstrated by their difficulty with the word-order (grammar agreement) task.

Cilibrasi et al., (2019) examined the comprehension of relative clauses in thirty children aged seven to eleven years old. The children had a range of reading abilities from poor to above average according to the York Assessment of Reading for Comprehension (YARC; Snowling et al., 2009). The children had to select one picture from a field of four that best represented the subject and object relative clauses that the examiner said. Researchers additionally manipulated if the subject and object nouns were both singular, both plural, or mismatching. They found when the subject and object nouns matched (either both singular or both plural), there was a large difference in accuracy in those who were poor readers between the subject and object relatives. They also found that as reading skills improved, this difference was almost absent. These findings support the important role of syntactic skills in reading comprehension.

Assessment of Pragmatics

Among the seventeen participants who were given a language measure, three were given a measure that could examine pragmatics. These three participants were all given an omnibus language measure (e.g., a language measure that assesses all or almost all domains of language; the CELF-5; Wiig et al., 2013). While examining pragmatic skills may not be critical for distinguishing between children with dyslexia with and without language impairment, there are

important ramifications of poor pragmatic skills such that these skills should be identified and addressed.

Craig and Washington (1993) found that children with SLI may not initiate interactions, and those that do typically do so in an atypical way. They found that of the five children with SLI, three of them did not access a peer interaction. The two children with SLI who did access a peer interaction did not use spoken language, but rather by giving a peer a toy. While their study showed that some children with SLI could access peer interactions, the authors posed that those who did access did so with atypical methods compared to the typically developing children in the study.

Implications for Assessment

Assessment of phonology, especially phonological processing, is critical in dyslexia evaluations because dyslexia is a phonologically based disorder (Catts et al., 2005; Snowling et al., 2019). Phonology cannot, however, be the *only* domain of language assessed in a dyslexia evaluation because children can have reading problems without phonological deficits (Adlof & Catts, 2015; Nation & Snowling, 2000) and children can have reading problems based in other domains of language (e.g., syntax) along with dyslexia (Adlof & Catts, 2015). Additionally, children with dyslexia are at high risk for SLI, which often goes unidentified in the later elementary school years (Snowling et al., 2019). Snowling et al., (2019) reported that 58% of participants who had been identified with dyslexia, but not with SLI, also met criteria for SLI. Measures of syntax and/or morphology should be included in dyslexia evaluations to determine the possibility of co-occurring SLI.

Test Administrators

Three of the fifteen participants whose dyslexia evaluations were conducted by educational psychologists in private practices were given no language measure. Of the six children who were evaluated for dyslexia by school psychologists, only four were administered a language measure, and that language measure was the CTOPP-2 (Wagner et al., 2013). Although the CTOPP-2 (Wagner et al., 2013) is useful for providing information on a child's phonological abilities, it is not a sufficient measure for determining whether a child presents with co-occurring SLI.

It is unclear in the present study whether parents who received dyslexia evaluation reports from school psychologists also received a separate report from a speech language pathologist. It is possible that the school psychologist could have left the language testing to an SLP, and therefore the language measures were not included in the school psychologist's report.

Implications for Intervention

When treating dyslexia, it is imperative that instruction is explicit, systematic, and code focused (Ehri et al., 2016; Foorman & Torgesen, 2001; al Otaiba et al., 2018). Code-focused interventions are based in the phonological domain of language and focus on phonemic awareness, phonics, and reading fluency (al Otaiba et al., 2018). Foorman & Torgesen (2001) reported that typically developing children easily generalize knowledge about print-sound relationships, but individuals with reading disabilities do not; they need to be explicitly taught print-sound relationships and decoding strategies. In a meta-analysis of 38 studies from which they derived 66 treatment-control group comparisons, Ehri et al., (2016) found that systematic phonics instruction is more effective than nonsystematic instruction; all seven of the systematic phonics instruction methods studied produced a significant positive effect on children's decoding skills.

Although explicit, systematic, code-focused instruction is likely to benefit children with dyslexia, it is likely insufficient to remediate reading difficulties in children with co-occurring dyslexia and SLI. Children with SLI tend to have deficits in phonology, morphology, and syntax (Catts et al., 2005). These deficits translate to difficulties with word reading as well as difficulties in reading comprehension above and beyond those that can be attributed to difficulties with word reading (Adlof & Catts, 2015). It is likely that children with co-occurring dyslexia and SLI require interventions that support spoken language development (e.g., modifying the communicative environment, directly targeting inferential comprehension, shape-coding; Calder et al., 2021; Dawes et al., 2018; Tarvainen et al., 2020) in addition to explicit, systematic, code-focused instruction (Ehri et al., 2016).

Intervention Strategies for Children with SLI

Fey et al., (2003) discussed ten principles for grammatical intervention for children with SLI that could be incorporated into intervention for children with co-occurring dyslexia and SLI. First, Fey et al., (2003) suggest that individuals who correct their grammatical weaknesses in one genre or modality will not generalize these corrections to other genres or modalities. Thus, SLI interventions should be implemented across a wide range of genres and modalities (e.g., conversations, narratives, writing). Another intervention principle is to stress grammatical morphemes to increase their salience. Interventionists can call attention to grammatical forms by emphasizing (e.g., “The dog IS running.”), rephrasing the grammatical form in the final position of a sentence or phrase (e.g., “The girl is winning the race. She really IS.”), and by contrasting grammatical forms (e.g., “We don’t want THIS book, we want THAT book.”). Sentence recasting should also be used to expose children with SLI to more mature grammar forms. Sentence recasting takes a child’s utterance and modifies the structure into an accurate, mature

grammatical form while maintaining the child's meaning. For example, if a child says, "I draw you a picture", the interventionist will recast to say, "You drew me a picture. That was nice of you". Another principle to employ when working with children with SLI is to always present a grammatically accurate model to the child, and avoid telegraphic speech (i.e., two-word phrases). Telegraphic speech is often stripped of grammatical forms, and there is evidence that children with SLI may understand grammatical forms even when they don't use them accurately (Fey et al., 2003; Shipley et al., 1969). The last intervention principle to employ when working with children with SLI is to use elicited imitation. Using elicited imitation while contrasting and demonstrating grammatical forms can be a useful mechanism that not only teaches grammatical forms but maintains a child's attention. For example, a clinician could show a doll cooking and say "Mommy IS cooking dinner" and then stop the doll and say "Mommy cooked dinner" to show the contrast between present and past tense.

Limitations

This preliminary, exploratory study provides an initial glimpse at dyslexia evaluation practices, but several limitations must be noted. First, generalizability of our findings is quite limited. The small sample (n=22) used in this study represents primarily participants in Georgia, and findings are unlikely to generalize across states. Additionally, because participants were recruited across email listservs and social media posts, there is some sample selection bias (i.e., internet access). Finally, our high attrition rate further limits the generalizability of findings.

Conclusions

The purpose of this preliminary, exploratory study was to answer the following questions.

1. What proportion of children diagnosed with dyslexia were given a language measure?

2. If a language measure was given, which domain(s) of language were assessed?

We found that most children in this sample received a language measure as part of their dyslexia evaluation, and half of them received at least one measure of syntax and/or morphology. However, these results suggest that only half of the evaluations included information that could be used to help a clinician rule out co-occurring SLI in children with suspected dyslexia. Because of the high co-occurrence of dyslexia and SLI (Snowling et al., 2019), it is imperative to include a measure of morphology and/or syntax, specifically or within the context of an omnibus language measure, when evaluating children for suspected dyslexia.

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Appendix I: Coding Manual

1. Two researchers independently compile a list of all measures used in uploaded reports.
2. Lists are compared to ensure a complete list.
3. Measures are coded according to domain assessed (e.g., cognitive, language, reading, writing, visual) as reported in the test manual (when available) and/or test description on the publisher's website.
4. Language measures are extracted from the complete list to the data spreadsheet.

Question 1:

5. Two coders independently code all samples for presence (1) or absence (0) of each language measure for each participant.
6. Results are compared. Discrepancies are resolved by a third coder.

Question 2:

7. Language measures are coded according to domain assessed (e.g., phonology, morphology, syntax, semantics, pragmatics, or omnibus) as reported in the test manual (when available) and/or test description on the publisher's website.
8. Two coders code for presence (1) or absence (0) of each domain.
9. Results from (8) are compared. Discrepancies are resolved by a third coder.

Appendix II: Optional Demographic Questionnaire

1. Child's Gender
    a. Male
    b. Female
    c. Non-binary/third gender
2. Child's Date of Birth
3. Child's Race (select all that apply)
    a. American Indian or Alaskan Native
    b. Asian
    c. Black or African American
    d. Native Hawaiian or other Pacific Islander
    e. White
    f. Other
4. Child's Ethnicity
    a. Hispanic/Latino
    b. NOT Hispanic/Latino
5. Mother's highest degree
    a. High school diploma or GED certificate
    b. Associate degree or 2-year college degree
    c. Bachelor's degree
    d. Graduate degree
6. Father's highest degree
    a. High school diploma or GED certificate

b. Associate degree or 2-year college degree

c. Bachelor's degree

d. Graduate degree

7. Does your child have normal vision?

    a. Yes

    b. Corrected-to-normal (e.g., with glasses or contact)

    c. No

8. Do you consider your child's primary language to be English?

    a. Yes

    b. No

9. What do you consider to be your child's primary language?

10. Has your child ever repeated a grade?

    a. Yes

    b. No

11. Which grade(s) did your child repeat? Select all that apply

    a. Kindergarten

    b. 1st

    c. 2nd

    d. 3rd

    e. 4th

    f. 5th

    g. 6th

    h. 7th

i. 8th

j. Other:

k. Please explain:

12. Has your child ever been diagnosed with dyslexia?

a. Yes

b. Unsure

c. No

13. Has your child been diagnosed with any of the following (check all that apply):

a. Autism spectrum disorder

b. Intellectual disability or cognitive impairment

c. Traumatic brain injury

d. Hearing loss

e. Language impairment

f. Speech impairment

g. ADD or ADHD

h. Other developmental difficulties

i. Please explain: