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Prevalence of Specific Learning Disorder in Children with Speech Sound Disorder: A retrospective cohort study in a rehabilitation center in South Kerala

Anjana A V[1]
National Institute of Speech and Hearing, Trivandrum
Avani Sasikumar[2]
National Institute of Speech and Hearing, Trivandrum
Fathima Jannah U.K[3]
National Institute of Speech and Hearing, Trivandrum

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Abstract

Speech Sound Disorder (SSD) is associated with an increased risk for Specific Learning Disorder (SLD), yet few studies have investigated predictors of literacy difficulties in this group. This retrospective cohort study examined the prevalence of SLD among children with SSD and explored factors linked to literacy risk. Case files of 378 children aged 3–10 years, diagnosed as SSD between 2020 and 2022, were reviewed. Telephone follow-ups were completed with 275 families, and 48 reported literacy difficulties. Dyslexia screening was conducted using the Dyslexia Assessment for Language of India (DALI). 45 parents contacted, 30 completed the DALI, with 19 children scoring below cutoff. These children were further assessed using the Dyslexia Screening Test–Junior (DST-J), and all were classified as at significant risk for SLD (ARQ > 0.9). Results showed complete agreement between DALI and DST-J classifications. Variables such as family history, speech intelligibility, parental education, and language proficiency were not significantly associated with DST-J scores, while socioeconomic status showed a stronger link to literacy risk. Findings highlight the vulnerability of children with SSD to SLD and point to socioeconomic influences as an important predictor of literacy outcomes.

Keywords: Speech sound disorder, specific learning disorder, prevalence, occurrence, India

1. Introduction

Speech sound disorder (SSD) is characterized by persistent difficulty in the production of speech sounds which reduce the speech intelligibility and interferes verbal communication and social participation (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; DSM-5). Children with SSD are characterized by difficulties in the perception and production of speech sounds. Speech sound errors range from mild articulation problems that only affect a few speech sounds to severe phonological abnormalities that affect many speech sounds and reduce the overall intelligibility of speech. The

[1] Dr. Anjana A. V. is currently working at National Institute of Speech and Hearing, Trivandrum, Kerala. Her research area covers language and literacy acquisition, bilingualism and specific learning disorders. Corresponding author's e-mail address: anjanaavslpa@gmail.com, ORCID: https://orcid.org/0000-0003-3039-6280
[2] Avani Sasikumar was a student at National Institute of Speech and Hearing, Trivandrum, Kerala. ORCID: https://orcid.org/0009-0004-2155-2186
[3] Fathima Janna U. K. was a student at National Institute of Speech and Hearing, Trivandrum, Kerala.

prevalence of SSD is 15.6 percent among 3-year-old children (Campbell et al. 2003), and as the age increases the prevalence reduces to 3–4 percent, that is, among 4- to 6-year-old children (Shriberg, Tomblin, and McSweeny 1999). Conditions such as language disorders (LD), stuttering, and literacy problems are commonly linked with SSD. Pennington and Bishop (2009) noted that the comorbidity among SSD, LD, and reading disorder (RD) is likely to be variable, particularly because the prevalence of these conditions changes with age.

A substantial body of research highlights the heightened vulnerability of children with SSD to literacy difficulties (Anthony et al. 2011; Bird, Bishop, and Freeman 1995; Cabbage et al. 2018), largely due to their phonological deficits and challenges in applying grapheme–phoneme correspondences. Lewis et al. (2002) assert that a substantial percentage (50–75 percent) of young children with SSD face a heightened risk of encountering academic difficulties later on. The existence of an SSD is not only challenging in itself but is also linked to difficulties in acquiring literacy skills and achieving proficiency in reading. This association has far-reaching consequences for school readiness and overall academic achievement, highlighting the broader impact of SSD on a child's educational journey. Dodd, Gillon, and Crosbie (1995) suggest that children displaying SSD are likely to demonstrate deficiencies in the phonological representation of familiar words, posing an increased risk of encountering reading difficulties due to compromised phonological awareness abilities.

Numerous studies suggest that, as a group, children with SSD are more likely to experience reading and spelling difficulties than their typically developing peers (Lewis et al. 2011; Bishop & Snowling, 2004). Meta-analytic evidence confirms that SSD is a robust risk factor for persistent language and literacy challenges, with children showing significant deficits in reading and spelling across longitudinal studies (Walquist-Sørli et al., 2024, 2025). This vulnerability persists regardless of concomitant language impairment (Lewis et al. 2018) and even when speech errors appear normalized (Tambyraja et al. 2020; Lewis et al. 2015; Raitano et al. 2004). At the same time, evidence indicates that comorbid LI significantly increases the risk of literacy difficulties in children with SSD (Bishop & Adams 1990; Catts 1993).

A large body of research underscores that word decoding depends heavily on intact phonological skills, particularly phonological awareness (Bradley and Bryant 1983; Catts et al. 2015; Hogan et al. 2005; Wagner & Torgesen 1987) and rapid automatized naming (Wolf & Bowers 2000). Accordingly, children with SSD—whose speech sound difficulties are often phonologically based (Cabbage et al. 2018; Preston et al. 2013; Raitano et al. 2004)—are at increased risk of difficulties in understanding and applying grapheme–phoneme correspondences essential for decoding. Yet, there remains limited evidence identifying which specific skills predict reading risk among children with SSD.

From a psycholinguistic perspective, SSD reflect a more broadly impaired phonological processing system (Stackhouse & Wells, 1997). Such deficits can affect a range of phonological and lexical skills, ultimately constraining the ability to decode written words. Because speech production reflects the integrity of the phonological system, it may be closely linked to children's ability to establish and apply phoneme–grapheme correspondences during

literacy acquisition. Examining the contribution of different speech processing skills, including speech accuracy, to word decoding may therefore help identify children with SSD who are at risk for RD.

Although the high prevalence of SLD among children with SSD is well documented (Peterson et. al., 2009; Tambyraja et. al. 2020), relatively few studies have examined predictors of literacy difficulties in this population. Existing research indicates that literacy risk in SSD is associated with the persistence of speech difficulties, the nature of speech errors, comorbid language impairments, and family history of speech or language disorders (Pennington & Bishop, 2009). Indeed, many children with SSD have a sibling or parent with a history of communication difficulties, although the extent to which parental speech or language problems contribute to the development of SSD in children remains unclear.

Other potential predictors that have been studied include biological and environmental variables such as gender, birth weight, gestational age, socio-economic background, maternal education, fine motor skills, early sound play (e.g., babbling), cognition, and neurobiological factors. Incorporating the psycholinguistic model of speech processing (Stackhouse & Wells, 1997) and the double-deficit hypothesis (Wolf & Bowers, 2000), Tambyraja et al. (2020) found that, after accounting for children's language skills, age, and socio-economic status, only phonological awareness (PA) and percentage of consonants correct (PCC) were significantly associated with increased risk of being identified as at risk for literacy difficulties. For children with compromised phonological systems, word decoding appears to rely heavily on skills that directly represent phonological knowledge, such as PA and speech production accuracy.

SSD is one of the most common pediatric communication disorders, with school-based speech-language pathologists serving a large number of affected children and supporting their reading and academic success. While SSD is thought to share an underlying phonological deficit with RD, evidence on the prevalence of RD among children with SSD remains limited, particularly among Malayalam-speaking children in Kerala, India. The linguistic and educational context of Kerala, characterized by exposure to Malayalam alongside English and the complex orthographic structure of Malayalam, underscores the need to examine the SSD–RD association within this population. Although studies from India have reported a substantial prevalence of specific learning disorder (SLD), including reading impairment, there is limited evidence regarding the occurrence of SLD among children with speech sound disorder (SSD). This gap is particularly notable in Kerala, where a population-based study among school-going children in Ernakulam reported an SLD prevalence of 16.49%, including a 12.57% prevalence of reading impairment (Chacko & Vidhukumar, 2020). However, the extent to which children with SSD are at increased risk for reading difficulties or SLD has not been adequately investigated in the Indian context. Identifying predictors of RD in this subgroup is essential, as early detection can guide intervention, ensure adequate services, and mitigate later literacy difficulties. To address this gap, the present study conducted a retrospective cohort analysis to examine predisposing factors for literacy challenges in children with SSD.

The present study examined the prevalence of SLD among Malayalam-speaking school-aged children with SSD and aimed to identify the possible predisposing factors contributing to their later literacy difficulties.

The present study addressed the following research questions

1. What are the demographic and clinical characteristics of Malayalam-speaking school-aged children with SSD based on a retrospective review of available case records?
2. What proportion of Malayalam-speaking school-aged children with SSD are at risk for SLD?
3. Which factors, including language abilities, severity and nature of SSD errors, speech intelligibility, persistence of SSD, SES and history of intervention— are associated with the risk of SLD among Malayalam?

2. Methodology

The current study followed a retrospective cohort research design to identify the proportion of children with SSD who are at risk of SLD. The study was carried out with the approval of the Research Advisory Committee (RAR) at the National Institute of Speech and Hearing, Trivandrum (NISH187551) and informed written consent was obtained from the parents in the second and third stages of the study. The study was conducted in three phases as shown in Figure 1.

2.1. *Phase I: File review and collection of client details.*

A retrospective review of case files was conducted for cases who attended the National Institute of Speech and Hearing (NISH) between 2020 and 2022. The case files of 378 children who have been diagnosed with speech sound disorder were reviewed. Only the records of cases aged between 3 and 10 years at the time of their initial assessment were included in the study. Cases whose native language was not Malayalam (a south Indian language spoken at Kerala state) were excluded. Case files with associated language impairment, stuttering, and academic difficulties were also considered for the current study. However, cases with comorbid conditions such as intellectual disability, cerebral palsy, autism spectrum disorder, ADHD, hearing loss, or visual impairment were excluded from the study. Available case records were reviewed to extract demographic information, including age, gender, socioeconomic status, and parents' educational background. Clinical information related to speech and language, including receptive and expressive language age, types and patterns of speech sound errors, speech intelligibility, and performance on the Malayalam Articulation Test (MAT), was also extracted from the records.

2.2. Phase II: Parental questionnaire-based screening of academic difficulties

Researchers contacted all participants identified in Phase I via telephone to gather updated information on the cases' current status. Of the total, 275 participants responded, 58 did not answer, 32 were unreachable, and 13 cases were identified with ankyloglossia. Data regarding the current speech, language, and literacy status of their children were collected during these

calls. Among the 275 respondents, only 48 reported concerns related to academic performance. These concerns included below-average academic performance, difficulty reading complex words, spelling errors, difficulty copying and completing notes, and difficulty answering questions during examinations. Parents of those children who reported to have associated literacy difficulties (48) were informed about the purpose of the study, and their consent for participation was sought. Initial screening of dyslexia was carried out using Screening tools of Dyslexia Assessment for Language of India (DALI, Singh, 2015). The questionnaire was shared as a Google form with 48 parents, of whom 3 declined to participate. DALI includes two screening tools: the Junior Screening Tool (JST) for children in Classes 1 and 2 (ages 5–7), comprising 15 items, and the Middle Screening Tool (MST) for children in Classes 3 to 5 (ages 8–10), comprising 21 items. Children are rated based on these items, with cutoff scores of 12 or above for JST and 23 or above for MST. When parents had difficulty understanding the English-language questions or were not proficient in English, the researchers translated and explained each item orally in the parents' native language. The meaning and intent of the original questions were maintained during translation to ensure that the items were understood accurately. Of the 45 parents contacted, 30 completed the DALI questionnaire. Nineteen children who scored below the cutoff (i.e., failed the DALI screening) were selected for the next phase of the study.

2.3. Phase III: Administration of Indian version of Dyslexia Screening test- Junior (DST-J India Fawcett and Nicolson,2012)

Subsequent assessment of dyslexia was conducted using DST- J India. Of the 19 cases identified in the previous phase, 12 met the age eligibility criteria for the DST-J India, of whom 10 provided consent to participate. The DST-J comprises12 domains: rapid naming, bead threading, one-minute reading, postural stability, phonemic segmentation, two-minute spelling, backward digit span, nonsense passage reading, one-minute writing, verbal fluency, semantic fluency, and vocabulary. The risk index for each task was derived from the test scores, and the total of these scores was divided by 11 to obtain the At Risk Quotient (ARQ). An ARQ of 0.9 or higher indicates strong evidence of being at risk, while a score between 0.6 and 0.8 suggests a mild level of risk. The DST-J India was individually administered by the investigator to the 10 cases diagnosed with SSD.

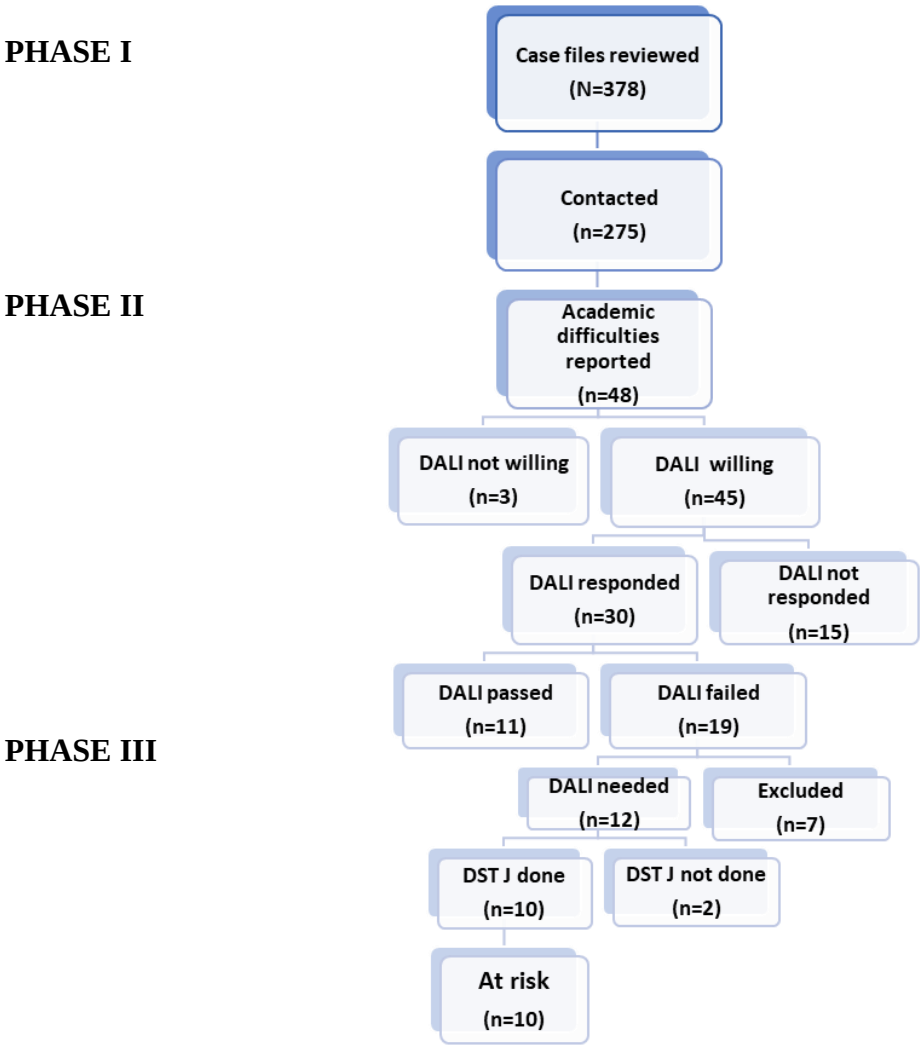

Figure 1. Flow chart representing the selection of participants and procedure in each phase

3. Findings

The present study aimed to determine the proportion of school-aged children with SSD who were at risk for SLD and to examine the factors associated with this risk. A retrospective research design was employed, and the study was conducted in three sequential phases. The results are presented under separate headings corresponding to each phase of the study, providing a systematic description of the participant characteristics, identification of cases at risk for SLD, and analysis of the factors associated with SLD risk.

3.1 Descriptive Analysis of the demographic details of cases

A total of 378 cases aged between 3 and 10 years were diagnosed with SSD at the research center between 2020 and 2022. Of these, 251 cases were reported in 2022, 91 in 2021, and 35 in 2020. Age-wise distribution showed that 178 cases (47.2%) were between 3–5 years, 142 cases (37.7%) were between 5–7 years, and 43 cases (11.4%) were between 7–9 years, indicating

that the majority of cases were identified at a younger age. The mean age of the participants was 5.7 years, with a standard deviation (SD) of 1.5 years.

Table 1 presents the frequency distribution of cases reported to the institute based on age, gender, parental education, family history of communication difficulties, and socio-economic status. Of the 378 case files reviewed, the majority of cases were male (76.7%), while 23.3% were female. Regarding socio-economic status, 66 cases (18.2%) belonged to the lower class, 87 (24.0%) to the middle class, and 210 (57.9%) to the upper class. In terms of parental education, most fathers (63%) and mothers (76%) had attained at least an undergraduate degree as shown in Table 1. With respect to family history of speech and language difficulties, 209 cases (57.1%) reported no significant history, while 157 cases (42.9%) reported a positive family history. However, due to missing data in several files, further analysis of family history was not carried out.

Table 1
Demographic characteristics of cases with SSD

Demographic details	Categories	% (N=378)
Age	3-5	47.2
	5-7	37.7
	7-9	11.4
Sex	Male	76.7
	Female	23.3
Socioeconomic status	Lower	18.2
	Middle	24.0
	High	57.9
Educational qualification of father	SSLC (Secondary School Leaving Certificate)	36.8
	Under Graduation	42.1
	Post Graduation	21.1
Educational qualification of mother	SSLC (Secondary School Leaving Certificate)	23.9
	Under Graduation	47.5
	Post Graduation	28.6
Family history	Negative	57.1
	Positive	42.9

3.2 Descriptive Analysis of Speech and Language Characteristics in the Study Sample

Receptive and expressive language skills, types of speech sound errors, phonological processes, and speech intelligibility of cases diagnosed with SSD between 2020 and 2022 at the institute were analyzed using frequency distribution. The distribution of cases across these variables is presented in the table below.

Table 2

Frequency distribution of cases with respect to speech and language characteristics

Skills	Categories	%(N=378)
Language skills	Age Adequate	85.2
	Inadequate Language	14.8
Type of Speech Sound Errors	Substitution	94.4
	Omission	60.7
	Distortion	39.3
	Addition	5.9
Phonological process	Absent	38.2
	Present	61.8
Speech intelligibility (AYJNIHH speech rating scale- 7 points)	0	0.3
	1	18.5
	2	36.4
	3	33.2
	4	10.2
	5	1.0
	6	0.3

Descriptive analysis revealed that 85.2% (n = 281) of cases diagnosed with SSD exhibited age-appropriate language skills, while 14.8% demonstrated language delays. In terms of error types, substitution errors were the most prevalent (94.4%), followed by omission (54.4%) and distortion errors (39%). Addition errors were the least common, observed in only 20 cases (5.9%). Phonological errors were present in 207 cases (61.8%). According to the AYJNIHH Speech Intelligibility Rating Scale, the majority of cases scored either 2 (36.4%) or 3 (33.2%), indicating moderate to reduced intelligibility. The mean score on the MAT was 87, with a standard deviation of 8.

3.3 Descriptive Analysis of Comorbid Conditions

Table 3 presents the frequency distribution of comorbid conditions documented in the 378 case files reviewed during the initial evaluation. As shown, the majority of cases (74.7%) had no reported comorbid conditions. Among those with co-occurring difficulties, stuttering was the most frequently observed (10.3%), followed by academic difficulties (7.5%) and language

disorders (6.4%). The occurrence of multiple comorbid conditions was rare, with the highest co-occurrence—SSD with both stuttering and academic difficulties—reported in only 0.6% of the cases.

Table 3
Frequency distribution of comorbid conditions

Associated condition	**N**	**% (N=378)**
No comorbid conditions	268	74.7
Stuttering	37	10.3
Language Disorder	23	6.4
Academic	27	7.5
Stuttering and language disorder	1	0.3
Stuttering and academic difficulty	2	0.6
Language disorder and academic difficulty	1	0.3

3.4 *Analysis of the data in phase 2*

All the cases diagnosed with SSD in the years 2020 to 2022 were contacted over phone by the primary and secondary investigators and data regarding their academic difficulties and the associated conditions were collected. Findings of this phase addresses the second research question. The primary investigator could contact 275 out of 378 cases diagnosed as SSD from 2020 to 2022 to get an idea about the current academic status of the participants. Table 4 presents the cases' current problems based on phone reports from parents.

Table 4
Frequency distribution of present complaints

Associated condition	N	Percentage of distribution
No comorbid conditions	66	17.5
Speech Sound Errors	142	37.6
Stuttering	13	3.4
Language disorder	3	0.8
Academic	45	11.6
Stuttering and Language disorder	2	0.3
Stuttering and Academic difficulty	1	0.6
Language disorder and academic difficulty	2	0.3

Out of 275 cases only 48 (17.4 %) were reported to be having current academic difficulties. Out of the 48 cases 45 were willing to do the DALI questionnaire (93.8%) and 3 were not willing to participate in the study (6.3%). From the above-mentioned 45 cases who were willing to do DALI only 30 cases responded to the questionnaire sent by the researchers (66.7%) and the remaining 15 have not responded to DALI even after follow-up . Out of 30

cases who have responded to DALI , 19 cases failed in the screening questionnaire DALI (63.3%) and 11 passed the DALI (33.3%).

3.5 Analysis of Data in Phase 3

Of the 19 cases, the DST-J was administered to 10 cases who met the age eligibility criteria and provided consent to participate in the study. The test scores for each case were compared against age-specific normative data and converted into standardized scores, which included associated risk indicators. An at-risk index was computed for each domain per case and is presented in Table 5. The ARQ was also calculated and is displayed in the bottom row of Table 5.

Table 5

DST J India at-risk quotient across domains

Participants	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
Rapid naming	- -	- -	- -	- -	- -	- -	- - -	-	-	- - -
Bead threading	0	- -	- -	0	- -	-	- -	-	- -	- - -
1 min reading	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Postural stability	0	0	0	0	-	0	0	0	0	0
Phonemic segmentation	- -	0	0	- -	-	0	- -	- -	0	- -
2 min spelling	- - -	- -	- -	- -	- - -	- -	- - -	- -	-	- - -
Backward digit span	0	0	0	0	-	0	0	0	0	0
Nonsense passage reading	- - -	0	- - -	- - -	- - -	- - -	- - -	-	- -	- - -
1 min writing	-	- - -	- -	0	-	0	- -	0	0	-
Verbal fluency	- - -	-	- -	- -	- - -	-	- - -	-	-	- - -
Semantic fluency	- -	0	-	-	- -	0	- -	0	0	- -
Vocabulary	0	0	-	0	- -	0	-	-	0	- -
AT RISK SCORE	19	13	18	15	24	12	24	12	10	25
AT RISK QUOTIENT	1.73	1.18	1.64	1.36	2.18	1.81	2.18	1.09	0.91	2.81

The at-risk index across various domains revealed that all cases demonstrated a high level of risk in the 'one-minute reading' task. In the 'two-

minute spelling' task, all cases except case 9 showed moderate to high risk, while case 9 exhibited only a mild level of risk. For the 'verbal fluency' task, cases 2, 6, 8, and 9 showed mild risk, whereas the remaining cases presented moderate to high risk. Overall, risk assessment across domains indicated that 100% of cases were at high risk in 'one-minute reading,' followed by 70% in 'nonsense passage reading,' 40% in 'two-minute spelling,' and 40% in 'verbal fluency.' Rapid naming emerged as a consistent risk factor across all cases.

Postural stability was within normal limits for all cases except case 5. Performance on the phonemic segmentation task was normal for four cases, while the remaining cases exhibited mild to moderate risk. All cases except case 5 performed within the normal range on the backward digit span task. In the one-minute writing task, four cases demonstrated average performance, while the rest showed scores ranging from mild to high risk. Semantic fluency and vocabulary tasks also reflected varied performance across cases. The ARQ scores indicated that all cases are at significant risk for SLD, with values exceeding 0.9. Furthermore, all cases identified as at-risk through the DALI screening tool were also classified as at-risk for SLD based on the DST-J India assessment.

3.1. Analysis of the association among variables

To address the third research question of this study an analysis was conducted to explore the relationship between various predisposing variables and the ARQ of cases identified as being at risk for SLD. Cross-tabulation of these variables revealed a notable association between SES and DST-J India scores. Interestingly, although the initial phase of the study indicated a higher prevalence of SSD among cases from upper socioeconomic backgrounds, the DST-J results showed that 5 out of the 10 cases identified as at risk for SLD belonged to the lower socioeconomic class. This suggests a potential shift in risk manifestation across SES categories.

In contrast, other examined variables—such as family history, speech intelligibility, parental educational qualifications, and the child's language proficiency—did not show a statistically meaningful association with DST-J scores. These findings indicate that, among the variables studied, SES may play a more prominent role in influencing literacy-related risk as captured by the DST-J, while other individual and familial factors may not directly contribute to the risk levels in this sample.

4. Discussion

In the current study, we aimed to examine the occurrence of SLD among children with SSD and to explore any potential predisposing factors that may elevate the risk of SLD in these children. This study contributes to the limited evidence on the occurrence of SLD among children with SSD in the Indian context. This is particularly important considering that a substantial number of children with SSD undergo school-based speech therapy, and it falls within the purview of speech-language pathologists to address challenges related to reading difficulties, as noted by the American Speech-Language-Hearing Association (2018). Therefore, enhancing the understanding of the possible prevalence of reading difficulties in young children with SSD is essential to guaranteeing early and adequate service provision and thus minimizing

subsequent reading difficulties. To accomplish this, we scrutinized case files and endeavored to investigate factors that could potentially be modified and linked to the risk of SLD in children with SSD.

Our findings support the widely observed trend that SSD is more prevalent in males, aligning with previous research indicating a higher likelihood of males being diagnosed with SSD compared to females (Eadie et al., 2015; Law et al., 2009). Although the exact causes of this gender disparity are not fully understood, it is believed to result from a complex interplay of biological, genetic, and environmental factors. The prevalence of SSD is particularly high during the preschool years (Law et al., 2000), with estimates reaching as high as 10–15% (Williams et al., 2010) and our findings also align with the observation that the majority of identified cases occurred between the ages of 3 and 5 years. However, the prevalence of SSD ranges from 3.8 to 6.4% for 5- to 8-year-old children and an overall decreasing prevalence of identified SSDs with increasing grade level (McKinnon et al., 2007). Multiple factors have been identified as predictors of SSD, including sex, family history, maternal vocabulary, socioeconomic status (SES), and parent-reported speech, language, and motor skills at 24 months (Fox, 2002). Interestingly, our findings also indicated a higher rate of SSD among children from higher socioeconomic backgrounds. This is consistent with earlier findings (Kealy, 1976), which may be attributed to greater awareness and more proactive identification among parents in higher SES groups. Families from such backgrounds typically have increased expectations for communicative competence, fewer competing basic needs, better infrastructure, and more effective strategies for accessing intervention and support services (McKinnon et al., 2007).

In the current study, the most prevalent comorbid condition was stuttering and in 10% of the population, this co-occurrence was seen. A higher rate of comorbidity of stuttering and SSD is reported in the literature, varying from 16-46%. The comparatively less comorbidity seen in the current study could be attributed to methodological differences as noted by Couture et al. (1993) and Wolk et al. (2000). The heightened comorbidity of stuttering and SSD may be due to problems in the development of phonological representations, a well-documented core deficit of developmental dyslexia (Stanovich, 1988; Snowling & Hulme, 1994; Swan & Goswami, 1997). The second most frequently seen comorbid condition was literacy difficulties. Recent research has shed light on the high frequency of comorbidity between SSD and academic difficulties (7%) and also indicate that preschoolers with SSD are at increased risk for later RD), or developmental dyslexia (Bird, Bishop, & Freeman, 1995; Larrivee & Catts, 1999; Lewis & Freebairn, 1992). Similarly, children with RD have elevated rates of previous SSD (Pennington & Lefly, 2001; Scarborough, 1990). The two disorders are comorbid at a rate of approximately 25%–30% (Gallagher, Frith, & Snowling, 2000; Lewis, 1996; Pennington & Lefly, 2001). In summary, stuttering was more prevalent than academic difficulties, with an overall prevalence rate lower than that reported in Western literature

The outcomes from the second phase of the study demonstrated a rise in prevalence from 7.5% to 11.6%, suggesting an increased vulnerability to SLD among children with SSD. However, it's noteworthy that only 37% of the cases

continued to exhibit SSD, indicating that a majority had achieved normalized speech production. These findings suggest that, as children age, the prevalence of SSD tends to decrease, but the prevalence of SLD increases. This shift may be attributed to parents becoming more aware of literacy-related challenges as their children grow older. This aligns with prior research, such as the work by McKinnon et al. (2007), indicating an association between increasing age and a decreasing prevalence of SSD. The agreement in diagnosis between DALI and DST-J highlights the sensitivity of DALI, reported to be greater than 70% in all languages by the authors. This underscores the potential of DALI to serve as a valuable screening tool for identifying children with SSD who are at risk of SLD.

It has been known for some time that children with SSDs are at increased risk for language disorders relative to children with typically developing speech (Shriberg & Austin, 1998). Similarly, findings of the initial phase of our study also show that 6% of children with SSD showed comorbid language disorder. However, in the the second phase, only one child who was identified as at risk displayed comorbid language impairment (LI), while others did not. Henceforth, it may be interpreted that regardless of whether they have concurrent language impairment (Lewis et al., 2018) or even if their speech errors are considered normalized (Tambyraja et al., 2020), children with SSD are more prone to encounter challenges in reading and spelling.

The scores obtained from the DST-J indicate that the RAN task posed significant challenges for all participating children, consistent with previous findings (Anthony et al., 2011; Lewis et al., 2011) demonstrating that children with SSD—particularly those with persistent errors—frequently exhibit RAN deficits predictive of difficulties in reading fluency and decoding. Clark et al. (2013) similarly reported that preschoolers with SSD displayed impairments in both phonological awareness and RAN, underscoring the value of these measures as early indicators of later RD. Interestingly, in contrast to earlier studies, four children in the present sample did not show risk for phonemic segmentation. This discrepancy may be attributable to prior intervention they received (though details of the intervention were not documented in this study) that targeted phonological awareness skills.

Comparable to performance on the RAN task, results from the nonsense passage reading task revealed high risk scores for all participants, suggesting deficits in the phonological route necessary for decoding unfamiliar words. Core weaknesses in phonological processing can contribute to broader challenges in phonological awareness, verbal short-term memory, and lexical retrieval—skills that are foundational for the development of proficient literacy (Wagner & Torgesen, 1987). Anthony et al. (2011) proposed that a core phonological deficit, involving the quality and accessibility of phonological representations, may account for these difficulties.

Moreover, performance on the one-minute reading and two-minute spelling tasks reflected underlying phonological processing deficits that not only impact reading but also contribute to spelling and written language difficulties (Lewis & Freebairn, 1998; McNeill et al., 2019). Finally, the observed challenges in verbal fluency tasks on the DST-J further highlight limitations in phonological access among these children.

Finally, the study did not successfully identify any predisposing factors associated with the development of literacy problems in children with SSD other than SES. SES is reported to be a predictor of the risk of SLD in children with SSD (Burgess, 2022; Nittrouer, 1996). Lower SES is associated with less frequent parental language input, often taking the form of directives, as well as poorer phonemic awareness, leading to weaker reading skills in childhood compared to children from middle-class families. Children from lower SES backgrounds generally engage in fewer literacy-related activities, have less exposure to adult modeling of reading, and limited access to printed materials.

5. Conclusion

SSD is a diverse group of disorders, exhibiting a range of outcomes including a high likelihood of recovery or normalization. However, despite potential recovery, these children face elevated risks of developing reading difficulties. Factors such as SES have been identified as influencers of these risk factors. The findings support a higher prevalence of SSD in males, aligning with existing research, and emphasize the elevated prevalence during preschool years. The second phase indicated an increased vulnerability to SLD among children with SSD, highlighting the importance of early intervention. The strong agreement observed between the DALI and DST-J assessments further confirmed the sensitivity of the DALI as a screening tool for detecting children with SSD at risk for SLD. Comorbidities with language disorders and literacy difficulties were observed, emphasizing the need for comprehensive assessment and intervention. Performance on the DST-J tasks indicated significant challenges in phonological processing, lending support to the hypothesis of a core phonological deficit underlying these difficulties. Importantly, the study identified SES as a significant predisposing factor for literacy problems among children with SSD, in alignment with previous research (Tambyraja et al., ,2020).

Although the present study represents the first of its kind within the Indian context especially in Malayalam language, several limitations should be acknowledged. The current study did not account for important factors such as the persistence of SSD, subgroup classification based on co-occurring language impairments, details of interventions received, school performance, literacy environment, and age-based comparisons. These elements are essential for achieving a comprehensive understanding of the impact of SSD on children. Future studies should consider these factors to provide a more comprehensive understanding of the relationship between SSD and SLD. Future longitudinal studies are needed to examine the likelihood of developing SLD among children with SSD and to identify factors that may influence their literacy outcomes over time. Future studies should examine children with SSD with and without co-occurring language difficulties across different Indian languages to better understand variations in their risk for literacy difficulties.

Author contribution statement:

Dr Anjana A. V.: designed the research, manuscript preparation, editing
Avani Sasikumar: collected the data, transcribed and coded the data, wrote the text

Fathima Jannah U.K.: collected the data, transcribed and coded the data wrote the text

The usage of GenAI: GenAI was only used for language editing and grammar correction, it was not used in research design, data collection, statistical analyses or interpretation of findings.

References

Anthony, Jason L., Christopher J. Lonigan, Stephen R. Driscoll, Bethany Phillips, and Michelle L. Burgess. 2011. "Phonological Sensitivity: A Quasi-Parallel Progression of Word Structure Units and Cognitive Operations." *Reading Research Quarterly* 46 (2): 193–212. https://doi.org/10.1598/RRQ.46.2.3

Bird, Jo, Dorothy V. M. Bishop, and Nigel H. Freeman. 1995. "Phonological Awareness and Literacy Development in Children with Expressive Phonological Impairments." *Journal of Speech and Hearing Research* 38 (2): 446–62. https://doi.org/10.1044/jshr.3802.446.

Bishop, Dorothy V. M., and Catherine Adams. 1990. "A Prospective Study of the Relationship between Specific Language Impairment, Phonological Disorders and Reading Retardation." *Journal of Child Psychology and Psychiatry* 31 (7): 1027–50. https://doi.org/10.1111/j.1469-7610.1990.tb00844.x.

Bradley, Lynette, and Peter E. Bryant. 1983. "Categorizing Sounds and Learning to Read—A Causal Connection." *Nature* 301 (5899): 419–21. https://doi.org/10.1038/301419a0.

Cabbage, Katharine L., Amy L. Hogan, Tiffany P. Mason, M. Jeanne Wymbs, and Sherine H. Tambyraja. 2018. "Language and Literacy Outcomes of Children with Speech Sound Disorders." *American Journal of Speech-Language Pathology* 27 (3): 1039–52. https://doi.org/10.1044/2018_AJSLP-17-0166.

Campbell, Thomas F., Jack L. Dollaghan, James J. Rockette, Barbara E. Paradise, Heidi Feldman, and Marcia A. Shriberg. 2003. "Risk Factors for Speech Delay of Unknown Origin in 3-Year-Old Children." *Child Development* 74 (2): 346–57. https://doi.org/10.1111/1467-8624.7402002.

Catts, Hugh W. 1993. "The Relationship between Speech-Language Impairments and Reading Disabilities." *Journal of Speech and Hearing Research* 36 (5): 948–58. https://doi.org/10.1044/jshr.3605.948.

Catts, Hugh W., Tiffany P. Nielsen, Marcia A. Bridges, and Jessica L. Liu. 2015. "Early Identification of Reading Disabilities within an RTI Framework." *Journal of Learning Disabilities* 48 (3): 281–97. https://doi.org/10.1177/0022219413498115.

Chacko, D., & Vidhukumar, K. (2020). The prevalence of specific learning disorder among school-going children in Ernakulam District, Kerala, India: Ernakulam Learning Disorder (ELD) Study. *Indian Journal of Psychological Medicine, 42*(3), 250–255. https://doi.org/10.4103/ijpsym.ijpsym_199_19

Dodd, Barbara, Gail T. Gillon, and Sharon Crosbie. 1995. "Phonological Disorders in Children: Underlying Cognitive Deficits." *Journal of Speech and Hearing Research* 38 (3): 643–54. https://doi.org/10.1044/jshr.3803.643.

Hogan, Tiffany P., Hugh W. Catts, and J. Bruce Little. 2005. "The Relationship between Phonological Awareness and Reading: Implications for the Assessment of Phonological Awareness." *Language, Speech, and Hearing Services in Schools* 36 (4): 285–93. https://doi.org/10.1044/0161-1461(2005/029).

Lewis, Barbara A., Thomas F. Shriberg, J. Bruce Freebairn, Susan M. Hansen, and Harry A. Stein. 2002. "The Genetic Bases of Speech Sound Disorders: Evidence from Spoken and Written Language." *Journal of Speech, Language, and Hearing Research* 45 (6): 1294–1309. https://doi.org/10.1044/1092-4388(2002/104).

Lewis, Barbara A., Thomas F. Shriberg, J. Bruce Freebairn, Susan M. Hansen, Harry A. Stein, and Laurie I. Taylor. 2011. "The Genetic Bases of Speech Sound Disorders: Evidence from Spoken and Written Language." *Journal of Speech, Language, and Hearing Research* 54 (5): 1628–43. https://doi.org/10.1044/1092-4388(2011/10-0274).

Lewis, Barbara A., Sudha Arunachalam, Audra A. Stein, and Mary E. Freebairn. 2015. "Literacy Outcomes of Children with Speech Sound Disorders: Impact of Endophenotypes." *Journal of Speech, Language, and Hearing Research* 58 (3): 970–82. https://doi.org/10.1044/2015_JSLHR-L-14-0312.

Lewis, Barbara A., Mary E. Freebairn, Sudha Arunachalam, Audra A. Stein, and Lisa A. Tag. 2018. "Comorbid Speech Sound Disorder and Language Impairment: Longitudinal Outcomes." *Journal of Speech, Language, and Hearing Research* 61 (8): 2026–38. https://doi.org/10.1044/2018_JSLHR-L-17-0368.

Peterson, R. L., Pennington, B. F., Shriberg, L. D., & Boada, R. (2009). What influences literacy outcome in children with speech sound disorder? *Journal of Speech, Language, and Hearing Research, 52*(5), 1175–1188. https://doi.org/10.1044/1092-4388(2009/08-0024)

Pennington, Bruce F., and Dorothy V. M. Bishop. 2009. "Relations among Speech, Language, and Reading Disorders." *Annual Review of Psychology* 60: 283–306. https://doi.org/10.1146/annurev.psych.60.110707.163548.

Preston, Jonathan L., Laura A. Hull, Patricia H. Edwards, Lisa M. Todd, and Heather M. Dowd. 2013. "Phonological Processing Skills of Adolescents with Residual Speech Sound Disorders." *Language, Speech, and Hearing Services in Schools* 44 (4): 341–52. https://doi.org/10.1044/0161-1461(2013/12-0067).

Raitano, Nancy A., Susan Ellis Weismer, Jan Edwards, and Maryellen MacDonald. 2004. "Phonological Processing in Adolescents with a History of Speech Sound Disorders." *Journal of Speech, Language, and Hearing Research* 47 (1): 160–73. https://doi.org/10.1044/1092-4388(2004/014).

Shriberg, Lawrence D., Barbara A. Tomblin, and J. Bruce McSweeny. 1999. "Prevalence of Speech Delay in 6-Year-Old Children and Comorbidity with Language Impairment." *Journal of Speech, Language, and Hearing Research* 42 (6): 1461–81. https://doi.org/10.1044/jslhr.4206.1461.

Singh, N. C. (2015). *Dyslexia assessment for languages of India (DALI).* National Brain Research Centre.

Stackhouse, Joy, and Bill Wells. 1997. *Children's Speech and Literacy Difficulties: A Psycholinguistic Framework*. London: Whurr Publishers.

Tambyraja, Sherine R., M. Jeanne Wymbs, Lauren A. Wilson, and Rhea Paul. 2020. "Longitudinal Associations between Speech Sound Disorder and Reading Outcomes in Early Elementary School." *Journal of Communication Disorders* 84: 105976. https://doi.org/10.1016/j.jcomdis.2020.105976.

Wagner, Richard K., and Joseph K. Torgesen. 1987. "The Nature of Phonological Processing and Its Causal Role in the Acquisition of Reading Skills." *Psychological Bulletin* 101 (2): 192–212. https://doi.org/10.1037/0033-2909.101.2.192.

Wolf, Maryanne, and Patricia G. Bowers. 2000. "The Double-Deficit Hypothesis for the Developmental Dyslexias." *Journal of Educational Psychology* 92 (1): 66–82. https://doi.org/10.1037/0022-0663.92.1.66.