

Children with speech and language delay aged 2–10 Years in Palestine: A case-control study of socio-demographic, biological, familial, and environmental factors

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Abstract

Introduction: Speech and language delay (SLD) is a common developmental problem that affects 3–20% of children globally, with significant long-term consequences if left untreated. Despite extensive research on SLD risk factors, regional studies in Palestine remain limited. This study sought to identify key characteristics impacting SLD in Palestinian children aged 2 to 10 years. **Methods:** Between January and March 2025, a case-control study was conducted at ten specialized institutes in Palestine. The study included 184 children with SLD and 136 controls who were matched for age and gender. Data were collected using standardized questionnaires that assessed socio-demographic, biological, familial, and environmental factors. SPSS v26 was used for statistical analysis, which included chi-square tests and logistic regression (p-value < 0.05 indicated significance). **Results:** Significant risk variables for SLD were rural residency (OR = 4.4, p = 0.008), lower parental education (paternal p = 0.003; maternal p < 0.001), and low family income (OR = 2.5, p = 0.030). Maternal employment showed a protective effect (OR = 0.273, p < 0.001). Biological characteristics such as ENT issues (OR = 3.9, p = 0.012) and a family history of SLD (OR = 8.6, p = 0.001) were significantly linked with SLD. There was no substantial correlation between the multilingual surrounding environment and family size. **Conclusion:** The study emphasizes the diverse characteristics of SLD in Palestinian children, with a focus on socioeconomic disparities, biological factors, and familial history. These findings emphasize the necessity of targeted early therapies, particularly in rural and low-income populations, to mitigate the long-term impact of SLD.

Keywords

children, speech, developmental disorders, socioeconomic status, maternal employment

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Introduction

The global prevalence of speech and language delay (SLD) ranges from 3% to 20%, with approximately 5% of primary school-aged children exhibiting a delay in speech and language.¹ 40–60% of children with untreated SLD may experience persistent difficulties, raising their chance of developing cognitive, emotional, behavioral, and social problems as adults.^{1–4} Children with this issue may experience difficulties with autonomy and possess a higher risk for psychological disorders in adulthood.⁵ Teenagers with speech difficulties show significant behavioral and emotional symptoms compared to their typically developing peers, with 35–50% requiring assistance.⁶

Screening for speech and language delays or disorders among children who do not have a known condition that affects speech and language development aims to detect these conditions early and provide effective interventions before they interfere with school learning or psychosocial adjustment.⁷ Numerous factors are associated with SLD. Research conducted in Eastern India and Iran found a higher frequency of SLD among males,^{8,9} however, SLD was more common in women in Nepal.¹⁰ SLD are significantly correlated with consanguinity, low parental education, poor communication, monolingualism, and family history.^{8,10–13} Preterm delivery, infectious diseases, birth asphyxia, oropharyngeal anomalies, convulsions, neonatal difficulties, and prenatal alcohol consumption are all important predictors of SLD.^{4,11–14} According to research from Bangladesh and Nepal, inadequate nutrition was linked to a higher incidence of SLD.¹⁰ Furthermore, this condition is linked to negative home situations, difficult family dynamics, and excessive screen time.^{4,9} Otitis media is an additional risk that can result in hearing loss as well as difficulties with speech and language development.¹⁵ Using pacifiers, dummies, thumbs, or bottles, among other sucking practices, can result in oro-motor dysfunction and oral sensory problems.¹⁶

Every child has to have their speech, language, and hearing issues evaluated. Delays in diagnosis and treatment might result in irreversible cognitive decline, which can include low IQ, communication problems, and illiteracy.¹⁶ While language or speech disorders relate to situations where speech or language ability deviates from what is anticipated as normal development, language or speech delays refer to situations where the development of the ability to understand and speak is right but slower than what is considered normal.^{17,18} Disorders of language and speech can occur independently or in combination with one another.¹⁸ There are, however, difficulties associated with the identification of children who have language and speech delays through the use of universal screening. These children are a diverse group that is difficult to analyze using a straightforward screening instrument due to the fact that they are influenced by cultural, socioeconomic, and contextual factors.¹⁹ In addition, SLD research in Arab countries is scarce, and none to our knowledge, have analyzed Palestinian cohorts. The development of strategies for preventing SLD may result from an analysis of risk variables, and it is essential to comprehend the underlying causes. Thus, the purpose of this study is to investigate the factors that influence speech and language delay in children between the ages of two and ten in Palestine.

Methods

Study setting, period, and design

A case-control study was undertaken from January through March 2025 at ten different institutes specializing in the treatment and education of children with speech impairments, all located in urban centers. Given the variety of speech and language therapy choices accessible nationwide, these facilities were chosen as research locations. This grants access to children from diverse socioeconomic backgrounds, yielding a representative sample for the study. Age- and gender-matched control participants were recruited from nearby primary schools, kindergartens, and daycare centers within the same catchment areas as the participating institutes.

Dependent variables

Speech and language delays in children aged 2–10 years.

Independent variables

Sociodemographic characteristics include age, gender, domicile, maternal and paternal education, mother's and father's occupations, monthly income, economic status, nature of father's employment, type of school attended by the child, and number of siblings. Biological characteristics (illness, severe injury, or hospitalization; hearing problems; seizure disorders;

middle ear infection; other ear, nose, or throat (ENT) problems; oral cleft or deformity; oropharyngeal deformity; maternal history of hypertensive disorder during pregnancy; consanguinity of parents; father's and mother's ages at childbirth). Feeding-related features (thumb-sucking history, pacifier-use history, and feeding history). Features associated with the family (number of family members, divorce, father's absence from home, multilingual family environment, SLD history, and family type). Environmental factors include the child's screen time and any recent stress or trauma they have experienced.

Inclusion and exclusion criteria

Inclusion criteria: The case group included children who had been diagnosed with SLD by qualified speech-language pathologists. These children were chosen after consulting speech-language pathologists and family caregivers, as well as doing a thorough review of their medical records. This review attempted to rule out the presence of additional medical diseases, such as autism, cerebral palsy, hydrocephalus, or genetic illnesses like Down syndrome. Furthermore, these children meet the eligibility standards by being between the ages of two and ten and receiving speech therapy. The control group included children aged 2 to 10 years old who did not have a clinical diagnosis of SLD or received any speech and Language therapy services. The absence of speech or language impairments among control participants was confirmed via parental or caregiver report.

Exclusion criteria: Children were excluded if their medical records showed autism hydrocephalus, cerebral palsy, or genetic abnormalities.

Sample size determination and sampling method

The minimum required sample size was calculated using the double population proportion formula in Epi Info version 7.2.2.6, assuming a 95% confidence interval, 80% statistical power, a 5% margin of error, and a planned 1:2 case-to-control ratio.²⁰ The best estimated sample size among the risk factors was 107. To account for a 10% non-respondent rate, the sample size was expanded to 120, comprising 40 cases and 80 controls. This figure represented the statistically derived minimum enrollment threshold, not a cap on total recruitment.

Recruitment followed a consecutive sampling approach throughout the study period (January–March 2025), whereby all children meeting the predefined eligibility criteria at the ten participating institutes whose guardians provided written informed consent were enrolled. Controls were similarly recruited from primary schools, kindergartens, and daycare centers within the same geographic catchment areas. As the number of eligible participants identified across the participating sites exceeded the minimum required sample, recruitment was not restricted to the calculated threshold. This approach was adopted to enhance statistical power, improve representativeness across diverse geographic and socioeconomic groups, and reduce the risk of type II error.

The final sample comprised 320 participants (184 cases and 136 controls), substantially exceeding the minimum requirement and thereby improving the precision and reliability of the study findings. The final case-to-control ratio (approximately 1:0.74) differed from the initially planned 1:2 ratio, reflecting differences in participant availability during recruitment rather than any modification to the study design. Unequal case-to-control ratios are methodologically acceptable in case-control studies, and all participants were enrolled strictly according to the predefined eligibility criteria.

Data collection and procedures

Following a thorough analysis of pertinent literature sources, the structured questionnaires included in the interviews were meticulously created.^{9,11,20–31} The questionnaire (Supplementary file) was divided into five categories based on biological, sociodemographic, familial, nutritional, and environmental factors. The response alternatives in the questions were supposed to be mutually exclusive. Questions were formulated using data from pediatric medical records. The initial version of the questionnaire was prepared in English and subsequently translated into Arabic by a qualified professional translator. To ensure linguistic accuracy and conceptual equivalence, the Arabic version was back-translated into English by independent language experts.

Prior to data collection, the questionnaire was reviewed by experts in speech and language disorders, a pediatrician, therapists, and an English language expert to ensure content validity. A pilot study was then conducted with 25 participants (7.8% of the total sample) to assess item clarity, relevance, and feasibility. No major modifications were needed, so these participants were included in the final analysis.

Given that the questionnaire consisted primarily of categorical and independent variables rather than items measuring a single underlying construct, the reliability of the instrument was supported through expert validation and pilot testing.

Data processing and analysis

Data analysis was performed using SPSS version 26 (Version 26.0. Armonk, NY: IBM Corp). Descriptive statistics, including frequencies and percentages, were utilized for categorical data, whilst means and standard deviations were applied to continuous variables. The correlation between speech and language delay and associated factors was evaluated by Chi-square analysis, subsequently followed by logistic regression.

Ethical consideration

The Institutional Review Board (IRB) of An-Najah University granted ethical approval for this work (BioMed. Dec. 2024/63). Official permission was obtained from all participating institutes, schools, kindergartens, and daycare centers prior to data collection. Before participating in the study, all minor participants' legally authorized representatives (parents or guardians) provided written informed consent; individuals who did not sign the consent form were unable to participate. The consent form delineated the study's objective and guaranteed anonymous and voluntary involvement, with no penalties for nonparticipation. Prior to inclusion in the study, all individuals provided signed informed consent.

Results

Sociodemographic characteristics of study participants

The study included a total of 320 children, 184 of whom were cases and 136 of whom were controls, aged 2 to 10. The response rate was 100%. The age and gender distributions were comparable between groups, with most participants aged between 5 and 7 years, and 60.3% of participants were male in both cases and controls. Mothers predominantly completed the questionnaires in both the case (72.3%) and control (95.6%) groups, with fathers accounting for the remaining responses (27.7% in cases and 4.4% in controls). A statistically significant correlation was observed between SLD and place of residence with a higher proportion of cases residing in rural areas compared to controls ($p < 0.001$). Statistically significant associations were also found between SLD and paternal and maternal educational status ($p = 0.003$ and $p < 0.001$, respectively). The father's occupation alone did not exhibit a significant association with SLD ($p = 0.094$). However, the character of the father's occupation and the mother's occupation were significantly associated with SLD ($p < 0.001$ for both). Socioeconomic status and monthly income also showed statistically significant associations with SLD ($p < 0.001$ for both). The number of siblings did not, however, exhibit a significant association with SLD ($p = 0.651$). SLD was significantly correlated with the type of school children attended and the school's influence on speech delay ($p < 0.001$ and $p = 0.011$, respectively). [Table 1](#) provides a concise overview of the socio-demographic characteristics of the study participants and possible influencing factors for SLD.

Biological characteristics of study participants

[Table 2](#) identifies numerous potentially important biological variables related to SLD among study participants. There was a significant relationship between SLD and a history of serious accident, illness, or hospitalization, with patients having a greater portion than controls. Similarly, hearing problems were associated with SLD ($P = 0.040$). Middle ear infection and other ear, nose, or throat problems also showed a clear association with SLD, with higher percentages among the case group than the control group, ($P = 0.009$ and $P = 0.002$, respectively).

Feeding-related features of study subjects

[Table 3](#) details the feeding-related characteristics of the study participants, emphasizing potential factors affecting SLD. Of the feeding parameters examined, only pacifier usage demonstrated a significant correlation with SLD ($P = 0.001$). No other feeding practices were significantly associated with the SLD.

Familial characteristics of study subjects

This study examined several familial characteristics, including family structure, family size, history of speech and language disorders, divorce, paternal absence, and the presence of a multilingual environment. The family type ($P = 0.015$), family history of speech and language problems ($P < 0.001$), paternal absence ($P = 0.032$), and multilingual family environment ($P = 0.010$) were substantially correlated with SLD, as illustrated in [Table 4](#).

Table 1. Sociodemographic features of Palestinian children aged two to ten years were involved in the study.

Sociodemographic Characteristics	Cases (total =184)	Controls (total = 136)	P-Value
	N (%)	N (%)	
Gender			0.995
Male	111 (60.3%)	82 (60.3%)	
Female	73 (39.7%)	54 (39.7%)	
Age			0.671
2-4 years	55 (29.9%)	38 (27.9%)	
5-7 years	92 (50%)	65 (47.8%)	
8-10 years	37 (20.1%)	33 (24.3%)	
Place of residence			<0.001
Rural	61 (33.2%)	6 (4.4%)	
Urban	123 (66.8%)	130 (95.6%)	
Paternal educational status			0.003
Illiterate	5 (2.7%)	1 (0.7%)	
Primary	29 (15.8%)	5 (3.7%)	
Secondary	75 (40.8%)	58 (42.6%)	
University	68 (37%)	61 (44.9%)	
Postgraduate	7 (3.8%)	11 (8.1%)	
Maternal educational Status			<0.001
Illiterate	1 (0.5%)	1 (0.7%)	
Primary	16 (8.7%)	2 (1.5%)	
Secondary	57 (31%)	22 (16.2)	
University	98 (53.3%)	92 (67.6%)	
Postgraduate	12 (6.5%)	19 (14%)	
Father's occupation			0.094
Employed/Self- employed	165 (89.7%)	129 (94.9%)	
Unemployed	19 (10.3%)	7 (5.1)	
Nature of father's occupation			<0.001
Employee	56 (30.4%)	48 (35.3%)	
Worker	103 (56%)	49 (36%)	
Businessman	25 (13.6%)	39 (28.7%)	
Mother's occupation			<0.001
Housewife	117 (63.6%)	30 (22.1%)	
Employed/Self- employed	67 (36.4%)	106 (77.9%)	
Socio-economic status			<0.001
High	19 (10.3%)	29 (21.3%)	
Medium	144 (78.3%)	104 (76.5%)	
Low	21 (11.4%)	3 (2.2%)	
Monthly income			<0.001
< 1860 ILS	26 (14.1%)	3 (2.2%)	
1860-3000 ILS	74 (40.2%)	30 (22.1%)	
3000-6000 ILS	43 (23.4%)	22 (16.2%)	
> 6000 ILS	41 (22.3%)	81 (59.6%)	
Number of siblings			0.651
One	41 (22.3%)	34 (25%)	
Two	46 (25%)	37 (27.2%)	
Three	40 (21.7%)	31 (22.8%)	
Four	29 (15.8%)	18 (13.2%)	
Five	15 (8.2%)	12 (8.8%)	
Six or more	13 (7.1%)	4 (2.9%)	
Type of school a child goes to			<0.001
Normal	122 (66.3%)	125 (91.9%)	
Special	62 (33.7%)	11 (8.1%)	

(continued)

Table 1. (continued)

Sociodemographic Characteristics	Cases (total =184)	Controls (total = 136)	P-Value
	N (%)	N (%)	
School's role in speech delay			0.011
No	124 (67.4%)	70 (51.5%)	
Yes	20 (10.9%)	27 (19.9%)	
Maybe	40 (21.7%)	39 (28.7%)	

P-value was obtained using the Chi-square test. P-value < 0.05 was considered significant.

Environmental characteristics of study participants

Table 5 investigates potential environmental factors influencing SLD among study participants. Neither recent trauma or stress ($P= 0.847$) nor daily screen exposure time ($P= 0.932$) was significantly associated with SLD.

Table 2. Biological parameters among children aged 2–10 years old who participated in the study.

Biological Characteristics	Cases (total=184)	Controls (total= 136)	P-value
	N (%)	N (%)	
Serious injury, illness, or hospitalization			0.009*
Yes	41 (22.3%)	15 (11%)	
No	143 (77.7%)	121 (89%)	
Seizure disorders			1.000^
Yes	3 (1.6%)	2 (1.5%)	
No	181 (98.4%)	134 (98.5%)	
Hearing problems			0.040*
Yes	29 (15.8%)	11 (8.1%)	
No	155 (84.2%)	125 (91.9%)	
Middle ear infection			0.009*
Yes	41 (22.3%)	15 (11%)	
No	143 (77.7%)	121 (89%)	
Other ear, nose, or throat (ENT) problems			0.002*
Yes	36 (19.6%)	10 (7.4%)	
No	148 (80.4%)	126 (92.6%)	
Oropharyngeal deformity			0.526^
Yes	7 (3.8%)	3 (2.2%)	
No	177 (96.2%)	133 (97.8%)	
Oral cleft or deformity (problems in throat, mouth, or tongue)			0.103*
Yes	11 (6%)	3 (2.2%)	
No	173 (94%)	133 (97.8%)	
Maternal history of hypertensive disorder in pregnancy			0.286*
Yes	20 (10.9%)	10 (7.4%)	
No	164 (89.1%)	126 (92.6%)	
Consanguinity of parents			0.093*
Yes	36 (19.6%)	17 (12.5%)	
No	148 (80.4%)	119 (87.5%)	
Father's age at the time of child's birth			0.612*
Under 40-years	158 (85.9%)	114 (83.8%)	
Over 40 years	26 (14.1%)	22 (16.2%)	
Maternal age at the time of childbirth			0.599*
Under 40 years	175 (95.1%)	131 (96.3%)	
Over 40 years	9 (4.9%)	5 (3.7%)	

P-value < 0.05 was considered significant. P-value was obtained using the Chi-square test (*)/fisher's exact test (^).

Table 3. Feeding-related features of study subjects.

Feeding	Cases (total = 184)	Controls (total = 136)	P-value
	N (%)	N (%)	
Feeding History			0.138
Breastfeeding	111 (60.3%)	93 (68.4%)	
Bottle-fed	73 (39.7%)	43 (31.6%)	
History of thumb-sucking			0.369
Yes	22 (12%)	12 (8.8%)	
No	162 (88%)	124 (91.2%)	
History of pacifiers use			0.001
Yes	84 (45.7%)	87 (64%)	
No	100 (54.3%)	49 (36%)	

P-value < 0.05 was considered significant. P-value was obtained using the Chi-square test.

Analysis of the associations between SLD and influencing factors of study participants by binary logistic regression

Using variables that were significant in the Chi-square and Fisher's exact tests, a binary logistic regression was carried out to find independent predictors of SLD (Table 6). Children who lived in rural regions had a 4.4-fold higher chance of experiencing SLD than children who lived in urban areas, according to the study ($P = 0.008$, 95% CI: 1.476–13.102). These findings warrant caution due to the substantial imbalance in rural representation between cases ($n = 61$, 33.2%) and controls ($n = 6$, 4.4%), which may have inflated the odds ratio.

Maternal employment status was also independently associated with SLD: children of working or self-employed mothers had significantly lower odds ($OR = 0.27$, $p < 0.001$, 95% CI: 0.13–0.57) compared to those of housewives. Similarly, household monthly income of 1860–3000 ILS was linked to higher SLD risk, with 2.5 times greater odds than incomes >6000 ILS ($OR = 2.5$, $p = 0.030$, 95% CI: 1.09–5.86).

School type emerged as a strong predictor, with children in special schools facing 5.5 times higher odds of SLD than those in regular schools ($OR = 5.5$, $p < 0.001$, 95% CI: 2.32–13.05). Other ear, nose, and throat (ENT) problems conferred nearly

Table 4. Familial characteristics of study subjects.

Family factors	Cases (total =184)	Controls (total = 136)	P-Value
	N (%)	N (%)	
Type of family			0.015
Joint	94 (51.1%)	88 (64.7%)	
Nuclear	90 (48.9%)	48 (35.3%)	
Count of family members			0.057
≤4	71 (38.6%)	67 (49.3%)	
>	113 (61.4%)	69 (50.7%)	
Family history of SLD			<0.001
Yes	55 (29.9%)	4 (2.9%)	
No	129 (70.1%)	132 (97.1%)	
Divorce			0.953
Yes	7 (3.8%)	5 (3.7%)	
No	177 (96.2%)	131 (96.3%)	
Father's absence from home			0.032
Six hours	34 (18.5%)	29 (21.3%)	
Eight hours	80 (43.5%)	74 (54.4%)	
Ten hours or more	70 (38%)	33 (24.3%)	
Multilingual family environment			0.010
Yes	20 (10.9%)	29 (21.3%)	
No	164 (89.1%)	107 (78.7%)	

P-value was obtained using the Chi-square. P-value < 0.05 was considered significant.

Table 5. Environmental characteristics of study participants.

Environmental related factors	Cases (total =184)	Controls (total = 136)	P-Value
	N (%)	N (%)	
History of recent trauma			0.847
Yes	16 (8.7%)	11 (8.1%)	
No	168 (91.3%)	125 (91.9%)	
The daily screen exposure time of the child			0.932
Two hours or less	106 (57.6%)	79 (58.1%)	
More than two hours	78 (42.4%)	57 (41.9%)	

P-value was obtained using the Chi-square test. P-value < 0.05 was considered significant.

fourfold increased odds (OR = 4.0, $p = 0.012$, 95% CI: 1.36–11.38), and family history of speech and language disorders raised odds by 8.6-fold (OR = 8.6, $p = 0.001$, 95% CI: 2.30–31.82). Results are presented in [Table 6](#).

Discussion

Although substantial research has been conducted on SLD, comprehensive examinations of the contributing factors remain restricted in Palestine. This study sought to identify important associated factors for SLD in Palestinian children aged 2 to

Table 6. Analysis of the associations between SLD and influencing factors of study participants by binary logistic regression.

Variable (reference)	<i>B</i>	<i>P</i> -value	OR	95% CI	Upper
				Lower	
Place of residence: rural (urban)	1.481	0.008	4.398	1.476	13.102
Paternal educational status: illiterate (postgraduate studies)	-1.718	0.514	0.179	0.001	31.287
Paternal educational status: primary (postgraduate studies)	0.247	0.812	1.281	0.166	9.869
Paternal educational status: secondary (postgraduate studies)	-0.819	0.288	0.441	0.097	1.999
Paternal educational status: university (postgraduate studies)	-0.215	0.760	0.807	0.203	3.208
Maternal educational status: illiterate (postgraduate studies)	-1.201	0.532	0.301	0.007	12.994
Maternal educational status: primary (postgraduate studies)	0.956	0.408	2.601	0.271	24.972
Maternal educational status: secondary (postgraduate studies)	0.366	0.607	1.441	0.357	5.814
Maternal educational status: university (postgraduate studies)	-0.156	0.797	0.855	0.260	2.812
Nature of father occupation: worker (employee)	0.161	0.717	1.175	0.492	2.807
Nature of father's occupation: businessman (employee)	0.007	0.987	1.007	0.415	2.445
Mother's occupation: employed/self-employed (housewife)	-1.300	<0.001	0.273	0.131	0.568
Socioeconomic status: medium (high)	0.048	0.921	1.049	0.410	2.685
Socioeconomic status: low (high)	0.409	0.648	1.505	0.261	8.691
Monthly income: < 1860 ILS (>6000 ILS)	1.326	0.129	3.767	0.681	20.840
Monthly income: 1860-3000 ILS (>6000 ILS)	0.928	0.030	2.529	1.092	5.859
Monthly income: 3000-6000 ILS (>6000 ILS)	0.439	0.350	1.550	0.618	3.893
Type of school child goes to: special (normal)	1.705	<0.001	5.504	2.321	13.052
School's role in speech delay: yes (no)	-0.135	0.772	0.874	0.350	2.182
School's role in speech delay: maybe (no)	-0.466	0.238	0.628	0.289	1.361
Serious injury, illness, or hospitalization: (no)	0.429	0.351	1.536	0.623	3.784
Hearing problems: (no)	0.391	0.498	1.478	0.478	4.571
Middle ear infection: (no)	0.393	0.409	1.481	0.583	3.765
Other ear, nose, or throat (ENT) problems: (no)	1.369	0.012	3.932	1.358	11.380
History of pacifier use: (no)	-0.349	0.292	0.705	0.368	1.351
Family Type: (nuclear)	0.000	0.999	1.000	0.523	1.911
Family history SLD: (no)	2.146	0.001	8.551	2.298	31.823
Father's absence: eight hours (six hours)	0.563	0.209	1.756	0.730	4.223
Father's absence from home: ten hours or more (six hours)	0.890	0.062	2.434	0.958	6.186
Multilingual family environment: (No)	-0.224	0.630	0.799	0.321	1.987

P-value was obtained using the multivariate binary logistic regression test. P-value < 0.05 was considered significant.

10 years. The age and gender distributions were comparable between cases and controls. This aligns with global epidemiological patterns, where males are consistently overrepresented in SLD cohorts, potentially due to neurobiological and genetic vulnerabilities.^{32,33} The preponderance of cases in early school years highlights the necessity of early detection and intervention during important developmental periods.³⁴ Additionally, the finding that cases were seen in the 5–7 age period is suggestive of referral patterns because many students are referred for formal evaluation when they begin lower elementary school, making the challenges more noticeable due to greater social and academic demands.

Several studies have shown that males have a twofold greater risk of SLD, however this study found no statistically significant association between gender and SLD. This gap may indicate cultural, environmental, or sample variables that require additional investigation.^{35,36} Furthermore, mother-tongue language may play a role in this context; in a study with children (mean age 2 years 9 months) whose rate of language acquisition was attuned to the complexity of their mother tongue, they found that language and, family, but not the child's gender, accounted for a significant proportion of individual differences in child speech.³⁷ Furthermore, child-centered audio-recording research of 1,001 children from 12 nations spanning six continents found that child gender did not explain considerable diversity in child speech.³⁸

Rural residence was significantly associated with SLD. However, this finding should be interpreted with caution, as controls were recruited exclusively from urban schools and daycare centers within the catchment areas of participating institutes, likely underrepresenting rural participants and introducing selection bias that may have inflated the observed association. Future studies should ensure more balanced rural–urban representation in control selection. The observed disparity is also consistent with evidence from low- and middle-income countries, where limited access to early intervention services, specialist healthcare, and educational resources in rural areas contributes to worse developmental outcomes.³⁹ Rural-urban disparities in developmental outcomes are well-documented, frequently exacerbated by poverty and infrastructural limitations.⁴⁰ These places are “concurrently more challenged by limited access to formal child care, affordable housing, living-wage jobs, and social services”.⁴¹

Lower parental education levels and socio-economic status were also strongly linked to SLD. These findings align with evidence that parental education enhances language-rich home environments and cognitive stimulation, which is critical for language acquisition.⁴² Lower socio-economic status (SES) and income further compound risks, as economic deprivation limits access to enriching resources and exacerbates familial stress, hindering language development.⁴³ In contrast, highly educated parents read and interact with their children more regularly, which is proven to increase language development. Thus, our findings coincide with literature suggesting that poor parental education - a sign of limited “language stimulation” at home - is associated with delayed speech in offspring.^{11,35,44,45} Child socioeconomic status was another strong determinant. Children from lower-income families were much more likely to have SLD in our sample. This is consonant with extensive evidence that poverty impairs language development. For instance, Perkins et al. (2014) note that poverty consistently produces deficits in vocabulary, phonological awareness, and syntax throughout childhood.⁴⁶

The father's occupation did not substantially correlate with SLD, but the overall occupational profile of both parents did. This could indicate that parental jobs function as indicators for family income, social class, and available time for kid engagement. Parents with demanding or restrictive occupations may have less time for one-on-one speech interactions with their kids. White-collar or professional occupations, on the other hand, are frequently associated with better socioeconomic status and education, both of which we have previously found to be protective. In the literature, parental occupation is less commonly researched than education, although it is conceptually interwoven with socioeconomic issues.¹¹

Family size and number of siblings showed no significant association with SLD, consistent with some prior studies. Some studies have found that larger families dilute parental attention, increasing the likelihood of delays. Karbasi et al., for example, found that a large family size was a substantial risk factor for speech delay.⁴⁷ However, in agreement with Kanhere et al., we did not observe such an effect: in our sample, having multiple siblings neither protected against nor exacerbated SLD risk.⁴⁵ Siblings may also provide language input (older siblings may converse with younger siblings), and larger families may benefit from family support networks to buffer delays.

A novel aspect of this study was the finding that educational environment -both the type of school attended and the school's perceived role in speech development-was significantly associated with SLD. This indicates that school-related factors influence speech outcomes. Although causality cannot be inferred, it is plausible that children enrolled in special or language-focused programs are most likely to be enrolled in special schools as the normal governmental school in Palestine does not offer (in majority) special needs classes.

The observed association between SLD and a history of serious injury, illness, or hospitalization aligns with prior research linking early medical adversity to neurodevelopmental disruptions.⁴⁸ Such events may impair cognitive development through mechanisms such as prolonged stress, inflammation, or missed educational opportunities during critical learning periods.⁴⁹ One well-established cause of speech delay is hearing loss. However, there are a number of complex factors that contribute to speech-language delays, including the child's environment and biological development.^{50,51}

A striking positive family history was observed among SLD cases, compared to controls. This is consistent with a positive family history of speech-reading difficulties (dyslexia, delayed speech, unclear speech, stuttering, and limited vocabulary), which has been linked to speech and language delay in first-degree relatives.^{53,52} Furthermore, it is consistent with the current understanding of the genetic and familial components of language development. Several studies have shown the importance of genetic predispositions in impacting speech and language difficulties, with heritable factors frequently contributing to delays in speech acquisition.^{53–55} Finally, multilingualism was less common among SLD cases, contradicting assumptions that multilingualism inherently delays language acquisition.⁵⁶ Rather, this may reflect that multilingual households tend to have higher education levels, offering enriched linguistic environments and structured language input.

The limitations that must be acknowledged when analyzing the results. The case–control design restricts the capacity to ascertain causal links between the identified risk factors and SLD. Secondly, selection bias may have occurred, as cases were sourced from specialized institutions predominantly situated in urban areas, whereas controls were obtained from schools and daycare centers, thus resulting in an underrepresentation of rural participants in the control group. This disparity, especially regarding residence, may have affected the observed correlations. Third, data collection was partially dependent on self-reports from parents or caregivers, which may be prone to recall bias or mistakes, particularly with history or behavioral characteristics. Fourth, despite attempts to incorporate a comprehensive array of socio-demographic, biological, and environmental factors, several potentially pertinent variables—such as the quality of parent–child connection, specific linguistic exposure, and the severity of SLD—were not evaluated. Moreover, this study included a broad age range (2–10 years), which may introduce developmental heterogeneity, as language abilities and clinical characteristics vary across age groups. Although all cases were previously diagnosed by specialists and age was considered in the analysis, residual confounding related to developmental stage cannot be fully excluded. Future studies may benefit from age-stratified analyses. The employment of a structured questionnaire featuring primarily categorical variables may constrain the analytical depth and hinder the capture of subtle differences in exposure. The study was conducted in a specific cultural and geographic context (Palestine), perhaps restricting the generalizability of the findings to other groups. Nevertheless, despite these constraints, the substantial sample size and incorporation of several contributing factors yield significant insights on SLD in this little-explored context.

Conclusion

The study provides novel insights into the factors contributing to speech and language delay in Palestinian children, being one of the first assessments of SLD determinants within a Palestinian clinical population, hence contributing original data to the field. Highlighting the significance of social and regional disparities. The results emphasize the necessity of improved early screening and equitable access to intervention programs, especially in marginalized groups. The strong correlation with familial history indicates potential genetic influences. These findings emphasize the necessity of integrating early developmental surveillance into healthcare systems and implementing tailored therapies.

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Ethical considerations

The Institutional Review Board (IRB) of An-Najah University granted ethical approval for this work (BioMed. Dec. 2024/63). Official permission was obtained from all participating institutes, schools, kindergartens, and daycare centers prior to data collection. Before participating in the study, all minor participants' legally authorized representatives (parents or guardians) provided written informed consent; individuals who did not sign the consent form were unable to participate. The consent form delineated the study's objective and guaranteed anonymous and voluntary involvement, with no penalties for nonparticipation. Prior to inclusion in the study, all individuals provided signed informed consent.

Consent for publication

The authors grant permission to the publishers to publish the work.

Author contributions

SAL and MA: Conceptualization, methodology, investigation, formal analysis, writing – review & editing. RD, TN, AH, and MR: Formal analysis, and writing – review & editing. NAS, AB, NK, MJ, AHY, WAJ, and LEL: Methodology, and writing – original draft preparation. MG, MD, MA, and SA: Methodology, investigation, formal analysis, and writing – original draft preparation.

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The data that support the findings of this study are available from the corresponding author upon reasonable request.

Supplemental Material

Supplemental material for this article is available online.

References

- McLaughlin MR. Speech and language delay in children. *American family physician* 2011; 83(10): 1183–1188.
- Morgan A, Ttofari Eecen K, Pezic A, et al. Who to Refer for Speech Therapy at 4 Years of Age Versus Who to “Watch and Wait”? *The Journal of Pediatrics* 2017; 185: 200–204, e1. <https://doi.org/10.1016/j.jpeds.2017.02.059>
- Hoque F, Akhter S and Mannan M. Risk factors identification of speech and language delay in children in a tertiary level hospital: A pilot study. *World J Adv Res Rev* 2021; 11(1): 103–112. <https://doi.org/10.30574/wjarr.2021.11.1.0323>
- Moges FY, Mengistu Z and Tilahun SW. Determinants of speech and language delay among children aged 12 months to 12 years at Yekatit 12 Hospital, Addis Ababa, Ethiopia: a case–control study. *BMC Pediatrics* 2024; 24(1): 393. <https://doi.org/10.1186/s12887-024-04862-4>
- Whitehouse AJ, Watt HJ, Line EA, et al. Adult psychosocial outcomes of children with specific language impairment, pragmatic language impairment and autism. *International journal of language & communication disorders* 2009; 44(4): 511–528. <https://doi.org/10.1080/13682820802708098>
- Yew SG and O’Kearney R. Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: meta-analyses of controlled prospective studies. *Journal of child psychology and psychiatry, and allied disciplines* 2013; 54(5): 516–524. <https://doi.org/10.1111/jcpp.12009>
- Feltner C, Wallace IF, Nowell S, et al. U.S. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews *Screening for Speech and Language Delay and Disorders in Children Age 5 Years or Younger: An Evidence Review for the US Preventive Services Task Force.* : Agency for Healthcare Research and Quality (US), 2024.
- Saeed H, Abdulaziz B and Al-Daboon S. Prevalence and risk factors of primary speech and language delay in children less than seven years of age. *J Community Med Health Educ* 2018; 8(2): 608.
- Meher BK, Pradhan DD, Nayak L, et al. Prevalence and Risk Factor Associated with Language Delay in Children below 3 Years Attending a Well-Baby Clinic: A Cross-Sectional Study. *Research and Reviews in Pediatrics* 2022; 23(1): 21–25.
- Bishwokarma A, Shrestha D, Bhujel K, et al. Developmental delay and its associated factors among children under five years in urban slums of Nepal. *PLOS ONE* 2022; 17(2): e0263105. <https://doi.org/10.1371/journal.pone.0263105>
- Kumar A, Zubair M, Gulraiz A, et al. An Assessment of Risk Factors of Delayed Speech and Language in Children: A Cross-Sectional Study. *Cureus* 2022; 14(9): e29623. <https://doi.org/10.7759/cureus.29623>
- Wang L, Liang W, Zhang S, et al. Are infant/toddler developmental delays a problem across rural China? *Journal of Comparative Economics* 2019; 47(2): 458–469. <https://doi.org/10.1016/j.jce.2019.02.003>
- Silva GM, Couto MI and Molini-Avejonas DR. Risk factors identification in children with speech disorders: pilot study. *CoDAS* 2013; 25(5): 456–462. <https://doi.org/10.1590/S2317-17822013000500010>
- Nguefack S, Kamga KK, Moifo B, et al. Causes of developmental delay in children of 5 to 72 months old at the child neurology unit of Yaounde Gynaeco-Obstetric and Paediatric Hospital (Cameroon). *Open Journal of Pediatrics* 2013; 3(3): 279–285. <https://doi.org/10.4236/ojped.2013.33050>

15. Arshad SH. Does exposure to indoor allergens contribute to the development of asthma and allergy? *Current allergy and asthma reports* 2010; 10(1): 49–55. <https://doi.org/10.1007/s11882-009-0082-6>
16. Thorpe K, Rutter M and Greenwood R. Twins as a natural experiment to study the causes of mild language delay: II: Family interaction risk factors. *Journal of child psychology and psychiatry, and allied disciplines* 2003; 44(3): 342–355. <https://doi.org/10.1111/1469-7610.00126>
17. Wallace IF, Berkman ND, Watson LR, et al. Screening for Speech and Language Delay in Children 5 Years Old and Younger: A Systematic Review. *Pediatrics* 2015; 136(2): e448–e462. <https://doi.org/10.1542/peds.2014-3889>
18. Jullien S. Screening for language and speech delay in children under five years. *BMC pediatrics* 2021; 21(Suppl 1): 362. <https://doi.org/10.1186/s12887-021-02817-7>
19. Desmarais C, Sylvestre A, Meyer F, et al. Systematic review of the literature on characteristics of late-talking toddlers. *International journal of language & communication disorders* 2008; 43(4): 361–389. <https://doi.org/10.1080/13682820701546854>
20. Tan S, Mangunatmadja I and Wiguna T. Risk factors for delayed speech in children aged 1-2 years. *Paediatrica Indonesiana* 2019; 59(2): 55–62. <https://doi.org/10.14238/pi59.2.2019.55-62>
21. Scopel RR, Souza VC and Lemos SMA. Family and school environment influences on language acquisition and development: literature review/A influencia do ambiente familiar e escolar na aquisicao e no desenvolvimento da linguagem: revisao de literatura. *Revista CEFAC: Atualizacao Cientifica em Fonoaudiologia e Educacao* 2012; 14(4): 732–742.
22. Yasin A, Aksu H, Özgür E, et al. Speech and language delay in childhood: a retrospective chart review. *ENT Updates* 2017; 7: 22–27. <https://doi.org/10.2399/jmu.2017001004>
23. Raju A and Bharanidharan .S. A study of prevalence and factors associated with language delay among 0-3 year old children in a tertiary teaching hospital. *International Journal of Contemporary Pediatrics* 2020; 7(2): 273–276. <https://doi.org/10.18203/2349-3291.ijcp20195641>, S B.
24. High AOS. screen time-A trigger for Social Communication Disorder in Toddlers? *Qualitative Study* 2021; 7: 8.
25. Álvarez IV, Borges GVA, Sánchez EG, et al. Biological factors associated to delayed primary language development in the under five years-old children. *Revista Cubana de Pediatría* 2013; 85(4): 466–475.
26. Tseng WL, Chen CH, Chang JH, et al. Risk Factors of Language Delay at Two Years of Corrected Age among Very-Low-Birth-Weight Preterm Infants. *A Population-Based Study* 2023; 10(2).
27. Fouché LC, Kritzing A and Le Roux T. Gestational age and birth weight variations in young children with language impairment at an early communication intervention clinic. *South African Journal of Communication Disorders* 2018; 65(1): 1–9. <https://doi.org/10.4102/sajcd.v65i1.584>
28. Lankinen V, Lähteenmäki M, Kaljonen A, et al. Father–child activities and paternal attitudes in early child language development: The STEPS study. *Early Child Development and Care* 2020; 190(13): 2078–2092. <https://doi.org/10.1080/03004430.2018.1557160>
29. Valade F, Béliveau MJ, Breault C, et al. Individual and cumulative risk factors in developmental language disorder: A case-control study. *Clin Child Psychol Psychiatry* 2023; 28(1): 398–414. <https://doi.org/10.1177/13591045221113389>
30. Hariningtyas NH, Kusmiyati Y, Djanah N, et al. Prematurity and language development of 9-18 months child: A correlation study. *Jurnal Kesehatan Ibu dan Anak* 2022; 16(1): 56–63. <https://doi.org/10.29238/kia.v16i1.1220>
31. Fan S, Zhang Y, Qin J, et al. Family environmental risk factors for developmental speech delay in children in Northern China. *Scientific reports* 2021; 11(1): 3924. <https://doi.org/10.1038/s41598-021-83554-w>
32. Law J, Boyle J, Harris F, et al. Prevalence and natural history of primary speech and language delay: findings from a systematic review of the literature. *International journal of language & communication disorders* 2000; 35(2): 165–188. <https://doi.org/10.1080/136828200247133>
33. Harrison LJ and McLeod S. Risk and protective factors associated with speech and language impairment in a nationally representative sample of 4- to 5-year-old children. *Journal of speech, language, and hearing research : JSLHR* 2010; 53(2): 508–529. [https://doi.org/10.1044/1092-4388\(2009/08-0086\)](https://doi.org/10.1044/1092-4388(2009/08-0086))
34. Bishop D and Snowling M. Developmental Dyslexia and Specific Language Impairment: Same or Different? *Psychological Bulletin* 2004; 130: 858–886. <https://doi.org/10.1037/0033-2909.130.6.858>
35. Mondal N, Bhat B, Plakkal N, et al. Prevalence and Risk Factors of Speech and Language Delay in Children Less Than Three Years of Age. *Journal of Comprehensive Pediatrics* 2016, In press.
36. Cheung RW, Willan K, Dickerson J, et al. Risk factors for early language delay in children within a minority ethnic, bilingual, deprived environment (Born in Bradford's Better Start): a UK community birth cohort study. *BMJ paediatrics open* 2023; 7(1): e001764. <https://doi.org/10.1136/bmjpo-2022-001764>
37. Ibbotson P and Browne WJ. The effects of family, culture and sex on linguistic development across 20 languages. *Developmental science* 2024; 27(6): e13547. <https://doi.org/10.1111/desc.13547>
38. Bergelson E, Soderstrom M, Schwarz I-C, et al. Everyday language input and production in 1,001 children from six continents. *Proc Natl Acad Sci U S A* 2023; 120(52): e2300671120. <https://doi.org/10.1073/pnas.2300671120>

39. Ertem IO, Krishnamurthy V, Mulaudzi MC, et al. Similarities and differences in child development from birth to age 3 years by sex and across four countries: a cross-sectional, observational study. *The Lancet Global health* 2018; 6(3): e279–e291. [https://doi.org/10.1016/S2214-109X\(18\)30003-2](https://doi.org/10.1016/S2214-109X(18)30003-2)
40. Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet (London, England)* 2011; 378(9799): 1325–1338. [https://doi.org/10.1016/S0140-6736\(11\)60555-2](https://doi.org/10.1016/S0140-6736(11)60555-2)
41. De Marco A and Vernon-Feagans L. Rural Neighborhood Context, Child Care Quality, and Relationship to Early Language Development. *Early education and development* 2013; 24(6): 792–812. <https://doi.org/10.1080/10409289.2013.736036>
42. Hoff E. Interpreting the early language trajectories of children from low-SES and language minority homes: implications for closing achievement gaps. *Developmental psychology* 2013; 49(1): 4–14. <https://doi.org/10.1037/a0027238>
43. Fernald A, Marchman VA and Weisleder A. SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental science* 2013; 16(2): 234–248. <https://doi.org/10.1111/desc.12019>
44. Sidhu M, Malhi P and Jerath J. Early language development in Indian children: A population-based pilot study. *Annals of Indian Academy of Neurology* 2013; 16(3): 371–375. <https://doi.org/10.4103/0972-2327.116937>
45. Sunderajan T and Kanhere SV. Speech and language delay in children: Prevalence and risk factors. *Journal of family medicine and primary care* 2019; 8(5): 1642–1646. https://doi.org/10.4103/jfmpc.jfmpc_162_19
46. Perkins SC, Finegood ED and Swain JE. Poverty and language development: roles of parenting and stress. *Innovations in clinical neuroscience* 2013; 10(4): 10–19.
47. Karbasi SA, Fallah R and Golestan M. The prevalence of speech disorder in primary school students in Yazd-Iran. *Acta medica Iranica* 2011; 49(1): 33–37.
48. Smith MV, Gotman N and Yonkers KA. Early Childhood Adversity and Pregnancy Outcomes. *Maternal and child health journal* 2016; 20(4): 790–798. <https://doi.org/10.1007/s10995-015-1909-5>
49. Erdei C, Liu CH, Machie M, et al. Parent mental health and neurodevelopmental outcomes of children hospitalized in the neonatal intensive care unit. *Early human development* 2021; 154: 105278. <https://doi.org/10.1016/j.earlhumdev.2020.105278>
50. Wooles N, Swann J and Hoskison E. Speech and language delay in children: a case to learn from. *The British journal of general practice : the journal of the Royal College of General Practitioners* 2018; 68(666): 47–48. <https://doi.org/10.3399/bjgp17X694373>
51. Shriberg LD, Kent RD, Karlsson HB, et al. A diagnostic marker for speech delay associated with otitis media with effusion: backing of obstruents. *Clinical linguistics & phonetics* 2003; 17(7): 529–547. <https://doi.org/10.1080/0269920031000138132>
52. Hayiou-Thomas ME, Carroll JM, Leavett R, et al. When does speech sound disorder matter for literacy? The role of disordered speech errors, co-occurring language impairment and family risk of dyslexia. *Journal of child psychology and psychiatry, and allied disciplines* 2017; 58(2): 197–205. <https://doi.org/10.1111/jcpp.12648>
53. Mondal N, Vishnu BB, Plakkal N, et al. *Prevalence and risk factors of speech and language delay in children less than three years of age*, 2016.
54. Othman AJF. *Child developmental delays and disorders: speech and language delay*, 2021, vol 510, pp. 17–21.
55. Camprubi Robles M, Campoy C, Garcia Fernandez L, et al. Maternal Diabetes and Cognitive Performance in the Offspring: A Systematic Review and Meta-Analysis. *PloS one* 2015; 10(11): e0142583. <https://doi.org/10.1371/journal.pone.0142583>
56. Hoff E. Why bilingual development is not easy. *Advances in child development and behavior* 2021; 61: 129–167. <https://doi.org/10.1016/bs.acdb.2021.03.002>