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The Prevalence of Language Impairment in 5-Year-Old Persian-Speaking Children after COVID-19

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ABSTRACT

Background: Children's language skills develop based on physical development and experience. During pandemics such as COVID-19, numerous restrictions were imposed on people's lives. Such restrictions may have compromised children's life experiences. This study investigated the rate of language impairment (LI) among 5-year-old children after the COVID-19 pandemic.

Methods: This cross-sectional study examined the language skills of 340 Persian-speaking children aged 5 years. All participants had no defects identified in preschool screening, had not been recommended for speech therapy or rehabilitation services, and represented all socioeconomic levels based on maternal education and fathers' jobs. Language skills were assessed using the Farsi Language Development Test-3. A cutoff point of 1.25 standard deviations below the mean on the spoken language composite score was considered indicative of LI. The data were analyzed using appropriate statistical tests.

Results: More than 20% of the children obtained standard scores below 6.25 on the relational vocabulary, sentence imitation, and word differentiation subtests. The children's language age in these subtests was three years, corresponding to two years below their chronological age. Spoken language scores were significantly lower in boys, in children whose mothers had lower educational levels, and in those whose fathers were private employees compared with their counterparts ($p < 0.05$).

Conclusion: This study showed that the rate of language impairment (LI) among Persian monolingual individuals increased significantly at the end of the COVID-19 pandemic. This increase may be a consequence of COVID-19-related circumstances or pandemic-related effects on family life.

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Introduction

COVID-19 started in China in 2019 and subsequently developed into a global pandemic. The high death rate caused by this pandemic led to changes in health systems and health policies worldwide [1]. Interpersonal interaction is essential for speech and language development, especially during sensitive periods; therefore, it could be assumed that during COVID-19, the amount and quality of child–parent interactions increased due to lockdown situations. However, studies did not support this assumption, as families' healthy lifestyles were affected in multiple ways [2–8]. In fact, COVID-19 and stay-at-home orders increased parenting stress [9]. Harsh parenting increases children's aggressive behaviors and conduct problems [10]. The co-occurrence of language impairment (LI) and social-emotional and behavioral difficulties has been confirmed at later ages [11]. Thus, there is a possibility that the rate of first language (LI) LI might have been elevated during COVID-19, a hypothesis that requires proper investigation.

The process of language acquisition typically occurs quickly and easily in many children, but some children experience delays or atypical development for known or unknown reasons. The most common difficulties in children with LI involve phonology, syntax, and morphology; however, considerable heterogeneity in their language profiles makes them difficult to identify [12].

By definition, the number of individuals living with verbal LI during a specific period represents the prevalence of verbal LI [13]. In another study, 436 5-year-old children were screened based on parental reports [14]. Nineteen children with LI received careful observation and a 15-minute interaction with the researcher. The number of suspected children decreased to 15 after applying language indicators. Therefore, the prevalence of specific language impairment (SLI) was 3.44%, with 3.61% in boys and 3.25% in girls. International studies on the prevalence of spoken LI can be categorized into two groups. The first group reported prevalence rates regardless of etiology, ranging from 6.6% to 20.6%, whereas the second group focused on spoken LI without known medical diagnoses and reported prevalence rates between 6.4% and 8.5% [13,15]. The reported prevalence of verbal LI varies considerably. It may be attributed to differences in the definition of LI, background characteristics, methodology, and the over- or underestimation of different ethnicities, cultures, and minority groups [13]. The heterogeneity between findings within and outside Iran highlights the need for more rigorous investigation of LI prevalence, particularly in post-crisis contexts [16,17]. Accordingly, the present study was conducted by interviewing teachers and administering a standardized language test [18] to estimate the prevalence of LI among second-grade preschool children after COVID-19.

Methods

This paper reports the cross-sectional component of a larger randomized controlled trial (RCT code: IRCT20180612040069N2), which was approved by Semnan University of Medical Sciences under the ethics code IR.SEMUMS.REC.1401.163. As the first step of the project, this study was conducted cross-sectionally to assess the prevalence of language impairments (LIs) during the period when the Iranian government officially declared that COVID-19 was under control (1401–2022) and that daily activities should return to routine conditions.

Participants

All registered second-grade preschool students participated in this study. The inclusion criteria were being Persian monolingual and having received no recommendations for specialized evaluation during preschool screening (including hearing, vision, speech and language, and cognition). In addition, parents provided written informed consent, and the children verbally expressed their willingness to cooperate. According to statistics from the Semnan Education Department, approximately 3,000 preschool students were enrolled in schools in 2022. Based on Morgan's sample size calculation formula, a sample of 341 students from 43 general schools was required.

To reduce the effects of socioeconomic status (SES), prevent selection bias, and protect against confounding [19], randomization was used. Semnan is divided into three districts, each consisting of three parts. From district 1, parts 1 and 2; from district 2, only part 2; and from district 3, parts 1 and 2 were selected as clusters (a total of five clusters) (Appendix 1 presents a map obtained from https://semnan.ir/). Four parts were excluded from the study because they were bilingual or predominantly inhabited by immigrant populations (Afghan, Balochi, Kurdish, and Khazari being the most common languages or dialects in the excluded areas).

Five schools were randomly selected from each part. However, the number of children in one school in district 1, part 2, was lower than in other parts of the district. Therefore, two additional schools from this part were randomly selected to achieve approximately equal numbers of students per cluster (approximately 70). All assessed children were originally from Semnan or had parents employed in Semnan; therefore, they had experienced similar durations of lockdown and comparable safety policies during the COVID-19 pandemic.

Tools

The Test of Language Development—Primary, Third Edition (TOLD-P3) is one of the most reliable and comprehensive instruments for evaluating language development in English-speaking children. It is based on six main subtests (Picture Vocabulary, Relational Vocabulary, Oral Vocabulary, Grammatical Understanding, Sentence Imitation, and Grammatical Completion) and three supplementary subtests (Word Discrimination, Phonemic Analysis, and Word Articulation). The standard scores of the main subtests can be combined in different ways to obtain various composite scores, including overall language ability (all six main subtests), listening (picture vocabulary + grammatical understanding), organizing (relational

vocabulary + sentence imitation), speaking (oral vocabulary + sentence completion), semantics (picture, relational, and oral vocabularies), and grammar (grammatical understanding, sentence imitation, and grammatical completion). Test results were recorded on a separate scoring sheet for each participant.

The TOLD-P3 has been adapted for Persian-speaking children [20]. Its criterion-related validity ranges from 0.4 to 0.7, and its construct validity was evaluated across age groups, with correlations ranging from 0.28 to 0.60. The TOLD-P3 can significantly discriminate among children with learning disabilities, language delay, intellectual disability, and attention-deficit/hyperactivity disorder. The six main subtests showed significant internal correlations ranging from 0.44 to 0.79 (median = 0.55). Factor analysis revealed that all main subtests assess overall language ability, as reflected in the first composite score. The discrimination power of the six main subtests ranged from 0.90 to 0.97, with values above 0.90 considered excellent [20].

Procedure

The research team obtained permission to enter schools and assess students by contacting the Semnan Department of Education and obtaining a list of eligible schools. Seven experienced female speech-language therapists (SLTs) assessed the students. All SLTs had at least two years of clinical experience and administered the TOLD-P3 in their clinical practice. To enhance inter-examiner reliability, the seven SLTs participated in three calibration meetings, during which they practiced test administration, scoring, score conversion, and reporting procedures.

In schools, the SLTs first attempted to establish an appropriate rapport with each child. Children's language skills were evaluated using the TOLD-P3. All subtests were administered according to standardized instructions, beginning with the main subtests and concluding with the three supplementary subtests. In each subtest, administration was discontinued if a child failed to respond correctly to five consecutive items; the next subtest was then initiated. The child's raw score for each subtest was defined as the number of correct responses.

To convert raw scores into percentiles and standard scores, each child's chronological age was calculated by subtracting the assessment date from the child's birth date (as documented on the birth certificate). Standard scores and percentiles were then derived using the appropriate normative tables provided in the test manual.

The prevalence of language impairment (LI) was determined based on the children's overall composite scores. According to established guidelines, a conservative cutoff point was applied [21], defined as 1.25-1.5 standard deviations below the mean, corresponding to the lowest decile [13, 22]. Based on this criterion, a standard score of 6.25 or higher was considered indicative of typical language performance, whereas scores below this threshold were classified as LI. For the composite score, values of 81.25 or higher were considered within the normal range, while scores below this value indicated LI.

In addition, each examiner asked teachers to respond in writing to two standardized questions: "Which student do you think does not understand what you are saying?" and "Who understands what you are saying but cannot answer you well?" Teachers' responses were compared with each child's overall language ability composite score to improve classification accuracy. In cases where teachers' observations were inconsistent with the TOLD-P3 composite scores, additional steps were taken, including reviewing individual subtest performance and/or re-administering the TOLD-P3 by a second examiner who was blinded to the child's class and school.

To assess scoring reliability, 10% of participants from each examiner's caseload were rescored by another SLT who was blinded to the study. Raw scores, standard scores, and percentile conversions were reviewed to evaluate intra-rater reliability.

Statistical Analysis

The collected data were analyzed using SPSS software (version 24). The Kolmogorov–Smirnov test was applied to assess the distribution of the data. Descriptive analyses were conducted to obtain measures of central tendency and variability, including means and standard deviations. For inferential analyses ($p < 0.05$), nonparametric statistical tests (Mann–Whitney U test) were used to compare groups based on gender, maternal education, and fathers' occupations. Intra-rater reliability was assessed using the intra-class correlation coefficient (ICC).

Results

In this study, 340 students were evaluated (mean age: 63 ± 3 months), of whom 179 were boys (52.64%). Among the fathers, 142 (41.8%) were private employees and 198 (58.2%) were government employees. Maternal education was categorized into two groups: ≤ high school diploma and > high school diploma; 75 mothers (22.1%) had an education level at or below a high school diploma.

Table 1 presents the proportion of students with and without language impairment (LI) based on children's standard scores in the subtests of the Test of Language Development—Primary, Third Edition (TOLD-P3). Table 2 shows the mean language age of students in both groups across the TOLD-P3 subtests.

Comparison of language age between the two groups revealed significant differences ($p \leq 0.001$) for all subtests except the Word Articulation subtest.

Table 3 presents the proportions of students with and without language impairment (LI) by composite score. These composite scores represent different linguistic domains and were calculated by summing the standard scores of all or selected main subtests.

The ratio of male to female students with LI is presented in Table 4 by subtest and in Table 5 by composite scores. It is noteworthy that none of the scores obtained from participants were normally distributed ($p < 0.05$); therefore, the use of the Mann–Whitney test was appropriate. Girls had significantly higher composite scores than boys ($p < 0.05$) (Appendices 1 & 2).

Table 1: Proportion of students with and without language impairment (LI) based on the Test of Language Development—Primary, Third Edition (TOLD-P3)

Standard score	Description	Vocabulary			Grammatical Understanding	Sentence Imitation	Grammatical Completion	Word Discrimination	Phonemic Analysis	Word Articulation
		Picture	Relational	Oral						
0-6.25	With LI	9.7	23.8	11.5	13.5	16.8	24.1	23.2	8.8	7.4
≥ 6.25	Without LI	90.3	76.2	88.5	86.5	83.2	75.9	76.8	91.2	92.6

Table 2: Mean language age (in years) of children with and without language impairment (LI) based on the Test of Language Development—Primary, Third Edition (TOLD-P3)

Standard score	Description	vocabulary			Grammatical Understanding	Sentence Imitation	Grammatical Completion	Word Discrimination	Phonemic Analysis	Word Articulation
		Picture	Relational	Oral						
0-6.25	With LI*	4.02	3.29	3.22	3.71	3.25	3.13	3.96	3.41	6.73
≥ 6.25	Without LI	5.94	6.26	6.04	5.66	6.04	5.39	5.32	4.98	6.95

* language impairment (LI)

Table 3: Proportion of students with and without language impairment (LI) based on composite scores of the Test of Language Development—Primary, Third Edition (TOLD-P3)

Standard score	Description	Overall language ability	Listening	Organizing	Speaking	Semantics	Grammar
0-81.25	With LI*	14.7	10.00	17.6	17.1	12.6	15.6
≥ 81.25	Without LI	85.3	90.00	82.4	82.9	87.4	84.4

* language impairment (LI)

Table 4: Distribution of students with language impairment (LI) based on subtests of the Test of Language Development—Primary, Third Edition (TOLD-P3), by gender

Gender	vocabulary			Grammatical Understanding	Sentence Imitation	Grammatical Completion	Word Discrimination	Phonemic Analysis	Word Articulation
	Picture	Relational	Oral						
girls	10.2	22.0	8.1	17.2	14.5	19.4	21.0	6.5	9.1
boys	9.1	26.0	15.6	9.1	19.5	29.5	26.0	11.7	5.2

Table 5: Proportion of students with language impairment (LI) based on composite scores of the Test of Language Development—Primary, Third Edition (TOLD-P3), by gender

Gender	Overall language ability	Listening	Organizing	Speaking	Semantics	Grammar
girls	12.4	11.8	15.6	12.9	9.7	13.4
boys	17.5	7.8	20.1	22.1	16.2	18.2

The other two factors that the Ministry of Education allowed the research team to investigate were maternal education and fathers' occupation. Comparisons between children based on maternal education and fathers' occupation are presented in Appendices 3–6. Both factors had a significant effect on children's subtest and composite scores ($p < 0.05$).

Students identified by teachers in response to the SLTs' questions were confirmed to have LI during assessment using the TOLD-P3. Agreement among SLTs was confirmed using the intra-class correlation coefficient (ICC) for absolute agreement (average measure = 0.958).

Discussion

This study aimed to evaluate the prevalence of language impairment (LI) in second-grade preschool children immediately following the end of the COVID-19 pandemic. The results were both striking and concerning, as the LI rate was higher than anticipated. A previous study in Semnan reported a prevalence of approximately 3.5% based on parental reports and general language indices [14]. Differences between these two studies may have several explanations.

First, the assessment tools differed. In the present study, teachers were interviewed, and a standardized test was administered, whereas the previous study relied on parental interviews and general language indices. Gender may also have contributed: both

studies found a higher percentage of boys with LI, but Mohammadi and colleagues did not compare groups to quantify the effect of gender. Additionally, this study analyzed children's language outcomes by socioeconomic status (SES), a factor not considered in prior research. Both maternal education and paternal occupation have been shown to significantly influence children's language outcomes in other studies [23]. In the current study, children whose mothers had lower levels of education and whose fathers were private employees obtained significantly lower scores than peers from more affluent backgrounds.

Finally, the use of a standardized test may have contributed to the higher observed prevalence. One potential limitation of standardized tests is the risk of over-reliance on quantitative data, which may amplify the detection of language deficits.

Therefore, the research team may not have fully captured the qualitative aspects of language, and some important features of a child's language skills may have been overlooked. To mitigate the limitations of the standardized test, we supplemented it with teachers' comments via a simple questionnaire—an informal assessment method designed to capture real-world relevance and consider children's abilities when they were not under test-related pressure. Importantly, we observed strong agreement between the standardized test outcomes and teachers' observations, which helps address concerns about the study's reliance on the standardized test.

Comparisons with international studies further contextualize our findings. Studies from Australia [21], using a conservative cutoff (1.25 SD below the mean), and the USA [24], using a less conservative cutoff (one or two SDs below the mean) with standardized tests and consideration of social determinants of health, reported substantially higher prevalence rates of LI than those observed in our study.

A fourth potential factor influencing our findings is the impact of COVID-19 on the participants. A study in Israel reported similar results, demonstrating that COVID-19 had negative developmental effects on children's language skills even after controlling for other factors, including SES [25]. Additionally, Erbay et al. reported, based on interviews with 21 second-grade preschool teachers in Turkey, that COVID-19 had detrimental effects on the language development of preschool children, with teachers observing noticeable language delays [26].

In this study, the rate of LI was significantly higher in boys than in girls across all language systems. This finding is consistent with previous studies examining factors affecting LI prevalence, which have shown that boys are more likely than girls to exhibit language impairments [15,27,28]. In an epidemiological survey, Tomblin et al. reported the prevalence of SLI in 7,218 English-speaking kindergarten children across rural, urban, and suburban areas. The screening failure rate was approximately 26.2%, with 8% of boys and 6% of girls classified as having SLI, yielding an overall LI prevalence of 7.4% across genders. The proportions observed in the present study for boys and girls, as well as the overall LI rate, were roughly twice those reported by Tomblin et al.

We also found that children from lower-SES families scored significantly lower than those from higher-SES families. This observation aligns with findings from previous studies investigating the impact of social determinants on health [21,24,29]. The adverse effects on children from low SES families during the COVID-19 pandemic may reflect limited resources to cope with the challenges imposed by the pandemic.

Araújo et al. conducted a systematic review of the impact of the COVID-19 pandemic and quarantine measures on parents, children, and adolescents in Brazil. Epidemics such as COVID-19 and SARS can cause severe depression or anxiety among parents, and post-traumatic stress, anxiety disorders, and depression among children [30]. These findings highlight the negative experiences children may endure during critical developmental periods, increasing their vulnerability to stress. Such adverse experiences can contribute to developmental delays and long-term health problems in adulthood, including cognitive impairments, substance abuse, depression, and non-communicable diseases. In children, language and cognitive skills may also be affected.

Studies conducted in different populations in Iran corroborate the findings of Araújo and colleagues, indicating an increased risk of mental disorders during pandemics [31–34]. Extensive research in Iran during and after COVID-19 has demonstrated the psychological and mental health consequences of the pandemic across various groups, including older people and children with special needs, such as those with autism [34–36]. Although the present study did not directly investigate the causes of the observed LI prevalence, the documented physical, psychological, and social complications associated with pandemics can be reasonably generalized to this context.

Moreover, as previously discussed, there is a vicious cycle linking low SES, increased parental stress, and the likelihood of LIs in children [9–11,23,37–39]. This framework provides an additional explanation for the elevated prevalence of LI observed in this study. Importantly, evidence suggests that providing parents with information on language development and encouraging positive interactions with their children (e.g., shared book reading) may help mitigate this cycle during lockdowns [40].

In summary, the present study revealed that SLTs are likely to encounter a substantial number of clients with complex and intertwined language issues. Policymakers could support low-SES families during crises by allocating additional crisis-oriented resources to help families maintain a sense of control over their lives. Long-term support, even after the COVID-19 pandemic, is also necessary to mitigate pandemic-related consequences.

This study examined only monolingual children due to limited resources; therefore, the results cannot be generalized to multicultural or multilingual populations. Additionally, the TOLD-P3 is an older instrument that has not been regularly updated and may not fully reflect current best practices in language impairment assessment. The number of examiners in

this study was seven, which may have introduced variability, as each examiner may interact differently with children; limited familiarity with examiners could potentially reduce test performance. Other factors related to the children themselves—such as differences in overall intelligence, undisclosed medical history, attention and concentration, mood, and diet—may have also influenced the outcomes.

Future studies should focus on mitigating the long-term consequences of the COVID-19 pandemic. Crisis management policies should include measures to prevent such high rates of LI in similar situations. Updating standardized tests, developing new assessment tools, and implementing a combination of formal and informal language assessments may provide researchers with more reliable and valid perspectives on the prevalence or incidence of LI. Furthermore, introducing diverse speech and language therapy service delivery models for post-pandemic societies, supported by both clinical and basic research, is warranted.

Conclusion

This study demonstrated that the rate of language impairment (LI) in the Persian monolingual population increased significantly following the COVID-19 pandemic. This increase may be a consequence of COVID-19-related circumstances or the pandemic's broader effects on family life.

Authors' Contribution

MS contributed to conceptualization, data collection, data analysis, manuscript writing, editing, and proofreading. MZ, MM, FEM, SS, MA, and RF all contributed equally to data collection, data entry, manuscript writing, and proofreading.

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