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ORIGINAL RESEARCH

# LANGUAGE DISORDERS ASSOCIATED WITH DEAFNESS

**Letícia Neves de Oliveira[1], Bárbara Niegia Garcia de Goulart[2], Brasilia Maria Chiari[3]**

**Abstract**

**Objective:** to assess the association between speech-language disorders related to hearing loss and to describe it regarding gender, chief complaint, and type and degree of hearing loss. **Methods:** retrospective study of 482 archives of patients with speech-language disorders between July 1998 and July 2008. Information on age, gender, area of residence, chief complaint / manifestation of language impairment, etiologic diagnosis, and speech-language and hearing impairment was collected. **results:** Most were male patients (56%) aged three to five (32,8%) and six to 11 years (32,8%). Their chief complaints included oral language impairment (57%); sensorineural hearing loss (66,3%); profound hearing loss bilateral (32,8%); and an organic etiology (41,7%). A correlation between language disorder with the level of hearing loss and complaint of language was statistically significant ($p < 0,001$). **Conclusion:** the study found an association between language disorder and degree of hearing loss and language complaint.

**Key words:** speech pathology; epidemiology; deafness; hearing loss; language.

## INTRODUCTION

Hearing enables one of the greatest higher brain functions in human beings— communication. Sensory limitations due to hearing impairment may favor the co-occurrence of language disorders and thus impact effective communication[1, 2].

Human communication is a predominantly sensory-dependent process carried out through auditory perception and decoding of perceived stimuli opening up the possibility of understanding, which are inherent aspects of human language[1, 3].

The impact of hearing loss on the development of speech-language skills can be complex and diverse. Although individuals with hearing loss may show a wide variety of disturbances, the higher the degree of hearing loss and the earlier its onset, the greater the negative impact on development. Thus, diagnosis and intervention as early as possible is required to minimize these impacts[4, 5].

In addition to affecting language and communication hearing loss can have an impact on the different biopsychosocial interfaces individuals are exposed to[6-8]. It is thus crucial to fully understand the many variables involved in language and hearing disorders so that more effective management and treatment actions can be taken to minimize their effects[6].

There are few studies in the literature on the prevalence and characteristics of speech-language disorders associated with hearing loss[6]. The objective of this study was describing the characteristics of patients with speech-language disorders related to hearing loss and to assess their association with gender, chief complaint, and type and degree of hearing loss.

## METHODS

Retrospective study conducted in a sample of 536 patients attending an outpatient public clinic in the city of São Paulo, Brazil. Data was collected from archives of patients seen between July 1998 and July 2008.

1 Speech-Language Pathologist, Research Technician, Universidade Federal de São Paulo (UNIFESP).
2 Research Associate, Universidade Federal de São Paulo. Assistant Professor, Universidade Federal do Rio Grande do Sul (UFRGS).
3 Speech-Language Pathologist, Principal Investigator; Full Professor, Human Communication Disorders, Universidade Federal de São Paulo (UNIFESP).
**Corresponding author:** leticianeoli@gmail.com

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Patients with archives with information on any language disorder were included in the study. There were excluded archives with more than 20% missing data. There were collected information on age, gender, area of residence, chief complaint (manifestation of language impairment), etiologic diagnosis, and language and hearing impairment.

The variable age was divided by age groups (zero to two; three to five; six to 11; 12 to 19; 20 to 39; 40 to 64; and 65 or more)[9]. Gender was categorized as male or female. The areas of residence in the city of São Paulo were divided as follows: downtown, North, East, South, West, and other (residents from outside the city of São Paulo).

Data on the chief complaint were categorized based on type of manifestation of language impairment (oral, written, or both). The etiologic diagnosis was divided into organic, functional, and organic and functional.

Language impairment was categorized based on time of disruption of the language process: language acquisition / maturation; development / learning; or encompass / individuation[10].

A hearing examination was performed in both ears separately. Any changes were classified according to type of hearing loss (sensorineural; conductive; mixed; or normal), degree (mild, moderate, severe, and profound); and involvement (unilateral or bilateral).

In the event of missing information or hard to identify data were recorded as "unknown." This study was reviewed and approved by the institutional review board of the Universidade Federal de São Paulo (UNIFESP) (protocol no. 0915/09).

Data were tabulated and then analyzed using the Statistical Package for Social Sciences (SPSS) v. 16.0, Minitab Statistical Software v. 15 and Microsoft Office Excel 2007. The following statistical tests were performed in the analyses: test for equality of two proportions, chi-square test for independence, means and 95% confidence intervals and p-values. The level of significance was set at 5% ($p < 0.05$).

## RESULTS

A total of 536 archives were reviewed but 53 were excluded due to missing data and no reporting of a language disorder. The final sample consisted of data collected from 482 archives.

Tables 1, 2 and 3 show the relative frequency distribution (percentages) of all study variables, taking Reference (Ref.) p-values of comparisons of each level of response compared to the most prevalent.

The analysis of the association between the variables type and degree of hearing loss, chief complaint and gender and language impairment is presented in Table 4. A correlation between language impairment and bilateral hearing loss was statistically significant ($p < 0.001$). In addition, we found a statistically significant association between language impairment and chief complaint ($p < 0.001$).

## DISCUSSION

An intact peripheral and central auditory system is required for the acquisition and development of normal language. It is also crucial for an individual's adequate psychosocial development allowing them to express their thoughts, feelings and desires and acquire life experiences and knowledge[11, 12].

It was observed predominance of male patients with language impairment and hearing loss that is in agreement with that reported by other authors[13-15]. However, this find might be connected with the demand by the service. This study considered that predominance is not associated straightly with the language impairment.

Studies have questioned the association between gender and higher risk of language disorders[6, 16] showing that gender is unlikely to affect the type of language disorder. It is a major evidence refuting gender as a risk factor for the occurrence of language disorders, especially when associated with hearing impairment.

The sample studied consisted primarily of residents living in the health service coverage area, which was expected. People tend to seek care within their own area residence[17], and only go to seek care elsewhere when have no choice or care services are not available[18].

Although age range was wide in this study (1 to 57 years old), there was a greater proportion of preschool and school age patients (3 to 12 years old). At school these children are faced with increased *linguistic demands* and linguistic differences become more evident[19]. This finding is corroborated by other studies[18, 19].

Language complaints reported by the patients and their family were mostly a of oral language disorder, which is consistent with findings of an earlier study[19, 20]. These complaints are a manifestation of symptoms and a professional can establish a relationship between the impairment and environmental, social and family factors that can potentially affect their condition[6].

The language learning process occurs through biological maturation and interaction within the environment. These two factors are prerequisites for acquisition, development and encompass for satisfactory process of adequate language. Bearing in mind that hearing loss greatly affects one's interaction with the environment, this study found a higher proportion of language disorders observed in encompass stage in the language's process[10,21] because we evaluated patients with delayed diagnosis, the same occurs with wearing hearing aids and intervention.

Early diagnosis of hearing loss in children should be made through Universal Newborn Hearing

**Table 1:** Descriptive statistics from chi-square tests for the categorical variables gender, area of residence, and age

| | | N | % | p-value |
|---|---|---|---|---|
| GENDER | Male | 271 | 56.2% | p<0.001 |
| | Female | 211 | 43.8% | |
| AREA OF RESIDENCE | Downtown | 6 | 1.2% | p<0.001 |
| | North | 24 | 5.0% | p<0.001 |
| | East | 95 | 19.7% | p<0.001 |
| | South | 220 | 45.6% | p<0.001 |
| | West | 22 | 4.6% | ref. |
| | Other | 112 | 23.2% | p<0.001 |
| | Unknown | 3 | 0.6% | p<0.001 |
| AGE GROUP (years) | 0–2 | 77 | 16.0% | p<0.001 |
| | 3–5 | 158 | 32.8% | ref. |
| | 6–11 | 158 | 32.8% | ref. |
| | 12–19 | 58 | 12.0% | p<0.001 |
| | 20–39 | 27 | 5.6% | p<0.001 |
| | 40–64 | 4 | 0.8% | p<0.001 |

**Table 2:** Descriptive statistics from chi-square tests for the categorical variables chief complaint and language disorder

| | | N | % | p-value |
|---|---|---|---|---|
| CHIEF COMPLAINT / MANIFESTATION OF LANGUAGE IMPAIRMENT | Oral | 276 | 57.3% | ref. |
| | Written | 13 | 2.7% | p<0.001 |
| | Oral and written | 19 | 3.9% | p<0.001 |
| | Other | 166 | 34.4% | p<0.001 |
| | Unknown | 8 | 1.7% | p<0.001 |
| LANGUAGE DISORDER | Acquisition | 76 | 15.8% | p<0.001 |
| | Development | 159 | 33.0% | p<0.001 |
| | Encompass | 247 | 51.2% | ref. |

**Table 3:** Descriptive statistics from chi-square tests for the categorical type and degree of hearing loss, ear involvement and etiology

| | | N | % | p-value |
|---|---|---|---|---|
| TYPE OF HEARING LOSS | Conductive | 17 | 3.5% | p<0.001 |
| | Sensorineural | 320 | 66.3% | ref. |
| | Mixed | 6 | 1.2% | p<0.001 |
| | Normal | 68 | 14.1% | p<0.001 |
| | Unknown | 71 | 14.8% | p<0.001 |
| TYPE OF HEARING LOSS | Conductive | 17 | 3.5% | p<0.001 |
| | Sensorineural | 320 | 66.3% | ref. |
| | Mixed | 6 | 1.2% | p<0.001 |
| | Normal | 68 | 14.1% | p<0.001 |
| | Unknown | 71 | 14.8% | p<0.001 |
| DEGREE OF HEARING LOSS | Mild | 22 | 4.6% | p<0.001 |
| | Moderate | 64 | 13.3% | p<0.001 |
| | Severe | 99 | 20.5% | p<0.001 |
| | Profound | 158 | 32.8% | ref. |
| | Normal | 68 | 14.1% | p<0.001 |
| | Unknown | 71 | 14.7% | p<0.001 |
| DEGREE OF HEARING LOSS | Mild | 29 | 6.0% | p<0.001 |
| | Moderate | 55 | 11.4% | p<0.001 |
| | Severe | 102 | 21.2% | p<0.001 |
| | Profound | 157 | 32.6% | ref. |
| | Normal | 68 | 14.1% | p<0.001 |
| | Unknown | 71 | 14.7% | p<0.001 |
| INVOLVEMENT | Unilateral | 24 | 5.0% | p<0.001 |
| | Bilateral | 331 | 68.7% | ref. |
| | Normal | 56 | 11.6% | p<0.001 |
| | Unknown | 71 | 14.7% | p<0.001 |
| ETIOLOGY | Organic | 253 | 52.5% | ref. |
| | Functional | 21 | 4.4% | p<0.001 |
| | Organic-Functional | 201 | 41.7% | p<0.001 |
| | Unknown | 7 | 1.5% | p<0.001 |

**Table 4:** Association between speech-language disorder and type and degree of hearing loss according to ear involvement, chief complaint and gender

| Speech-language disorder | | Acquisition | | Development | | Encompass | | Total | | p-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | |
| Degree of hearing loss (right ear) | Mild | 1 | 2% | 6 | 5% | 15 | 7% | 22 | 5% | p<0.001 |
| | Moderate | 7 | 12% | 8 | 6% | 49 | 21% | 64 | 16% | |
| | Severe | 15 | 26% | 26 | 21% | 58 | 25% | 99 | 24% | |
| | Profound | 25 | 44% | 69 | 55% | 64 | 28% | 158 | 38% | |
| | Normal | 9 | 16% | 17 | 13% | 42 | 18% | 68 | 17% | |
| Type of hearing loss (right ear) | Conductive | 4 | 7% | 6 | 5% | 7 | 3% | 17 | 4% | 0.396 |
| | Sensorineural | 42 | 75% | 103 | 82% | 175 | 76% | 320 | 78% | |
| | Mixed | 1 | 2% | 0 | 0% | 5 | 2% | 6 | 1% | |
| | Normal | 9 | 16% | 17 | 13% | 42 | 18% | 68 | 17% | |
| Degree of hearing loss (left ear) | Mild | 1 | 2% | 9 | 7% | 19 | 8% | 29 | 7% | p<0.001 |
| | Moderate | 4 | 7% | 10 | 8% | 41 | 18% | 55 | 13% | |
| | Severe | 17 | 30% | 21 | 17% | 64 | 28% | 102 | 25% | |
| | Profound | 25 | 44% | 69 | 55% | 63 | 28% | 157 | 38% | |
| | Normal | 10 | 18% | 17 | 13% | 41 | 18% | 68 | 17% | |
| Type of hearing loss (left ear) | Conductive | 3 | 5% | 7 | 6% | 7 | 3% | 17 | 4% | 0.487 |
| | Sensorineural | 42 | 75% | 102 | 81% | 176 | 77% | 320 | 78% | |
| | Mixed | 1 | 2% | 0 | 0% | 5 | 2% | 6 | 1% | |
| | Normal | 10 | 18% | 17 | 13% | 41 | 18% | 68 | 17% | |
| Chief complaint / manifestation of language impairment | Oral | 42 | 56% | 114 | 73% | 120 | 49% | 276 | 58% | p<0.001 |
| | Written | 1 | 1% | 1 | 1% | 11 | 5% | 13 | 3% | |
| | Oral and written | 0 | 0% | 1 | 1% | 18 | 7% | 19 | 4% | |
| | Other | 32 | 43% | 40 | 26% | 94 | 39% | 166 | 35% | |
| Gender | Male | 40 | 53% | 90 | 57% | 141 | 57% | 271 | 56% | 0.786 |
| | Female | 36 | 47% | 69 | 43% | 106 | 43% | 211 | 44% | |

Screening (UNHS) programs but also later hearing screenings of school-aged children because children with hearing loss risk, although with normal hearing at birth, may develop a hearing loss later in life and/or mild hearing loss that is present at birth may progress to more severe forms[4, 22].

Complaints of oral language disorders were also seen during the three stages of the language process (acquisition, development and encompass). This is because hearing loss becomes evident when its consequences arise as impaired oral language[23]. In addition, complaints of oral language disorders may have a greater impact on daily activities regardless of age and are more easily detected even by lay people.

When a language disorder occurs with hearing loss a thorough multidisciplinary evaluation is crucial to accurately determine the type of communication disorder and any impairments associated [2].

The most common type of hearing loss found in this study was profound sensorineural loss bilateral of organic origin, which is corroborated by other studies[1, 14]. Organic changes may be caused by meningitis, congenital rubella, ototoxic drugs, hyperbilirubinemia, among others[24], which can lead to hearing loss with similar characteristics as described in the present study.

Hearing and language are correlated interdependent functions, and this study showed a statistically significant association between degree of hearing loss and language impairment. It was found a greater prevalence of profound hearing loss during the stages of language acquisition, development and encompass. A direct impact of profound hearing loss on language was reported in a previous study that found more significant language impairment with profound than mild, moderate and severe loss[2, 23].

However, the type of hearing loss was not associated with language impairment. Changes in the auditory pathway directly affect language acquisition, development, and encompass[4]. Conductive abnormalities result in a reduction of the *sound intensity* that *reaches the cochlea, and* sounds are perceived as low and muffled lacking in depth, richness, and dimension. All these factors show that this condition may also have a great impact on language acquisition and development[11].

In conclusion, our results show that language impairment is directly associated with the degree of hearing loss and language complaints. The profile of patients with language impairment related to hearing loss includes profound sensorineural hearing loss bilateral by organic origin; chief complaint of an oral language disorder; and higher prevalence among male children aged three to five and six to 11 years, corresponding to the stages of language development and linguistic ability.

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