



## Association between audiological profile and primary language impairment in children



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### ABSTRACT

**Objectives:** The aim of the present study was to characterize the Brazilian Portuguese speaking children seen at the Speech-Language Pathology Service of a Health Center, between 1985 and 2009, diagnosed with primary language impairments (PLI): language development impairment (LDI), phonological disorder (PD) and reading and writing impairment (RWI) regarding demographic and audiological profile; as well as investigate the association between PLI and demographic variables, and the association between PLI and hearing disorders.

**Methods:** A survey of medical records was carried out, collecting audiological and language impairment diagnostic data, totaling 2424 individuals in the study group. In addition, audiological evaluation data of 186 children without language disorders complaints were collected so that they constituted the control group.

**Results:** From the study group, 1524 children (62.87%) had PLI. Considering the PLIs, the following occurrences were observed: PD = 58.84%, LDI = 30.75% and RWI = 10.41%, with a predominance of males (64.19%) and age range up to 6 years (67.15%). For the audiological profile, there was a predominance of normal hearing thresholds (81.34%), followed by conductive hearing loss (15.47%). Tympanogram type A was more prevalent (56.24%), followed by B and C types (21.84% and 18.16%). Acoustic reflexes were present in the majority of subjects (51.7%). There was a significant association between belonging to the 7–12 years-old group and presenting with PD, belonging to the group up to 6 years and having LDI, and belonging to the older group and presenting with RWI. There was a significant association between males and presenting with LDI. There was statistically significant association between PLI and abnormal audiological profile. Individuals with abnormal audiological profile were 63% more likely to have PLI than those who had normal audiological profile.

**Conclusions:** It is suggested that having an abnormal audiological profile would be a risk factor for PLI. Hence, these findings can serve as a basis for children hearing and speech–language monitoring, and as an important tool for the planning of health promotion and prevention actions, as well as the development and implementation of intervention programs.

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### 1. Introduction

Primary speech–language disorders result from primary deficits, do not occur due to obvious organic underpinnings and do not have complex physical manifestations. However, they have great impact on children development. They include fluency disorders, voice disorders, oral myofunctional disorders and primary language impairments (PLIs). PLIs are language development deviations that do not happen due to other impairments (e.g. permanent hearing loss, neurological, behavioral or emotional disorders) [1].

Speech and language impairments are very common in children; their prevalence is estimated between 2% and 19% worldwide [1,2]. Some authors have highlighted issues concerning economic disadvantages of individuals with communication impairments and the cost they represent for the economy, characterizing a public health matter [2].

Regarding hearing, the middle ear disorder is the most frequent pediatric diagnosis in children. Its prevalence ranges from 1% to 46% around the world, being higher in developing countries. Thus, it is also considered, by the World Health Organization, a public health problem, with substantial social and economic costs [3].

Middle ear disorders can cause temporary conductive hearing loss. However, the association between such disorders with language impairment is still questioned; there is no agreement

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in literature about the real impact of conductive hearing loss on language [4].

Therefore, the present study objective was to characterize the Brazilian Portuguese speaking children seen at the Speech-Language Pathology Service of a Health Center in relation to PLI, demographic and audiological profile. Furthermore, the existence of association between PLI and demographic variables was investigated, as well as the existence of association between PLI and hearing disorders.

## 2. Material and methods

This study was approved by the Ethics Committee in Research of the School of Medicine of the University of São Paulo, under the protocol no. 257/11.

A retrospective observational study was conducted, through the analysis of the records of the Speech-Language Pathology and Audiology Service and Pediatrics Service of a Health Center, located in the district of Butantã, west area of the city of São Paulo, SP, Brazil.

The data of speech–language and audiological diagnosis of all patients who have undergone complete speech–language evaluation at this Health Center between the years 1985 and 2009 were collected. All subjects were native speakers of Brazilian Portuguese. In some cases, it was not possible to obtain all the records concerning the audiological or speech–language diagnosis due to lack of registration, inconclusive or incomplete data. Thus, the number of records of children with primary speech–language disorders analyzed in this study is specified in Fig. 1.

In addition to these 2424 children of the study group, audiological evaluation data of 186 children, which served as a control group, were analyzed. The control group age had the same range as the study group; the children went to the same health center, did not have any language disorder complaints or history, according to the medical records and did not use the Speech-Language Pathology Service.

Regarding the speech–language evaluation for the study group, the following variables were considered: gender, age, speech–language primary diagnosis of primary language impairment (PLI), including language development impairment (LDI), phonological disorder (PD) and reading and writing impairment (RWI). The primary diagnosis, in case of co-morbidities, was determined considering the most severe, obvious and dominant diagnosis, according to the initial assessment of the child in the service.

For the audiological evaluation, the variables considered were: immittance audiometry (tympanogram and acoustic reflexes), and

pure tone audiometry. These variables were classified according to the following criteria:

- Pure tone audiometry within the normal range (pure tone thresholds  $\leq 15$  dB HL), conductive hearing loss, mixed hearing loss, isolated hearing loss (in one or two frequencies) or not tested. It should be emphasized that sensorineural hearing loss was excluded because this kind of hearing diagnosis did not fit within the cases of PLI, since the language impairment would be considered secondary, therefore, classified as 'other diagnoses'.
- Immittance audiometry:
  - Tympanogram—Type A curve (normal), type C curve (peak shifted to pressures lower than  $-100$  daPa, indicative of tubal dysfunction), type B curve (flat, indicative of middle ear disorder), type As curve (indicative of rigidity of the tympanic-ossicular system), type Ad curve (indicative of hyper mobility of the tympanic-ossicular system); double peak curve or not tested.
  - Acoustic reflex—Presence in all tested frequencies (500, 1, 2 and 4 kHz), absence in all tested frequencies, absence in one or two of the tested frequencies, and not tested.

The diagnostic data were collected from the records of the service, which consider the criteria specified above, used by all professionals who work in this teaching health center.

Initially, results obtained by each variable studied were submitted to descriptive analysis.

To verify the existence of association between hearing and language impairment, a variable that represents the audiological profile, formed by the sum of the variables that were included in the audiological evaluation (pure tone audiometry and immittance audiometry) was created. This variable was dichotomized into two categories: normal or abnormal audiological profile. For the classification 'normal audiological profile', both immittance audiometry and pure tone audiometry should be normal in both ears; for the classification 'abnormal audiological profile', it was considered the presence of abnormal results in one or both assessments, in one or both ears.

The test of comparison between groups, the Pearson's chi-square test ( $\chi^2$ ) and measures of association (to calculate the rates and risk ratios) were used in the analysis of the variables. A significance level of 5% was adopted.

## 3. Results

Considering the total analyzed study group records ( $n = 2424$ ), a high occurrence of PLI (62.87%) was observed in

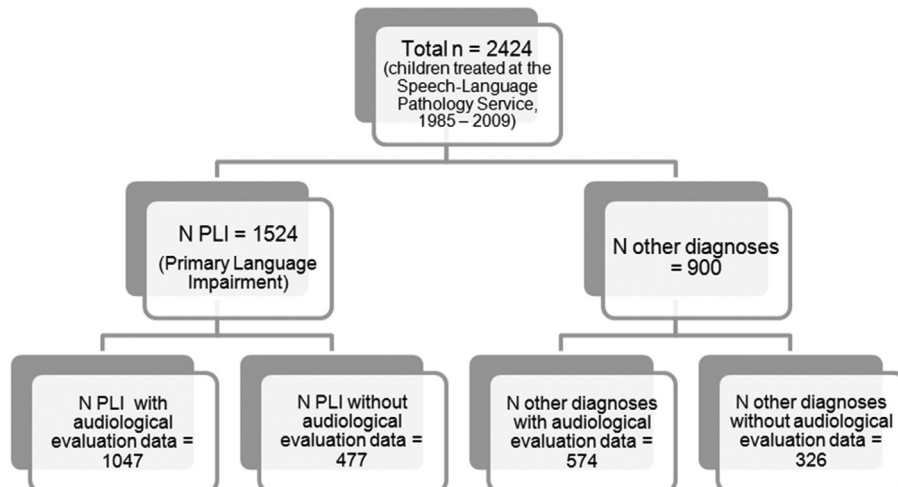


Fig. 1. Flowchart of speech–language pathology and audiology records analyzed in this study.

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