Phonological changes and social determinants: cases seen at a speech therapy assessment clinic

Alterações fonológicas e determinantes sociais: casos atendidos em um ambulatório de avaliação fonoaudiológica

Cambios fonológicos y determinantes sociales: casos dela practica ambulatoria de evaluación en fonoaudiología

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Abstract

Objective: Identify and analyze the prevalence of phonological variations and the association with social health determinants in the children who were attended in a phonological evaluation and diagnostic clinic. The children were from four to ten years old. **Methods**: Analysis of medical records of 74 children who were phonologically evaluated from 2010 to 2014. Sociodemographic data such as age, sex, family income, per capita income, parents and patient education, living area, as well as final result of the Phonology Test of Children's Language Test – PTCLT - was collected. The records included were those from children from four to ten years old who took the test and had complete anamnesis and assessment reports. Medical records of children with evidence of intellectual disability, hearing impairment or visual impairment and neuropsychiatric disorders were excluded. The analysis of the data was done through frequency distribution and central tendency and dispersion measurements, and Pearson and

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Mann-Whitney chi-square tests were used for the associations. This study was approved by the Research Ethics Committee, as well as the request for exemption from the TCLE. **Results**: The association analysis allowed verifying the existence of statistical significance relation between the phonological evaluation result with mother's education as well as the father's education. The other associations did not reveal statistically relevant information. **Conclusions**: It should be stressed the importance of the speech and language pathology work in public schools and public health centers, due to the association between the phonological evaluation final result and the parents' education.

Keywords: Speech Language and Hearing Sciences; Social Determinants of Health;Speech Sound Disorder; Child; Association.

Resumo

Objetivo: Identificar e analisar a prevalência de alterações fonológicas e sua associação com os determinantes sociais em saúde em crianças de quatro a dez anos de idade atendidas em um ambulatório de avaliação e diagnóstico fonoaudiológicos. **Métodos:** Análise de prontuários de 74 crianças que passaram por avaliação fonoaudiológica entre 2010 e 2014. Coletaram-se dados sociodemográficos referentes à idade, gênero, renda familiar e *per capita*, escolaridade parental e do paciente, local de residência, além do resultado da prova de fonologia do Teste de Linguagem Infantil ABFW. Os prontuários incluídos foram os de crianças com idade entre quatro e dez anos, que foram submetidas à prova e que possuíam relatórios de anamnese e avaliação completos. Foram excluídos prontuários de crianças com evidências de deficiência intelectual, auditiva ou visual e distúrbios neuropsiquiátricos. Analisaram-se os dados por meio de distribuição de frequências e medidas de tendência central e dispersão, e para as associações foram utilizados os testes Qui-quadrado de Pearson e Mann-Whitney. Este estudo recebeu aprovação de Comitê de Ética em Pesquisa e dispensa de utilização do Termo de Consentimento Livre e Esclarecido. **Resultados:** Houve associação com significância estatística entre o resultado da avaliação fonológica e escolaridade materna e paterna. As demais associações não revelaram valores estatisticamente significativos. **Conclusões:** Destaca-se a importância da atuação fonoaudiológica na rede pública de ensino e saúde, haja vista a associação encontrada. Foi elevado o número de resultados da avaliação que mostraram alterações fonológicas nas crianças.

Palavras-chave: Fonoaudiologia; Determinantes Sociais da Saúde; Transtorno fonológico; Criança; Associação.

Resumen

Objetivo: Identificación y análisis de prevalencia de trastornos fonológicos y su asociación con determinantes sociales en salud, en niños de 4 a 10 años atendidos en una clínica de diagnóstico y evaluación ambulatoria. **Métodos**: Análisis de registros médicos de 74 niños evaluados por fonoaudiología entre 2010 y 2014. Se recogieron datos sociodemográficos sobre edad, sexo, ingresos familiares, ingreso per cápita, educación de los padres y de los pacientes, lugar de residencia, así como el resultado de la Prueba de Fonología del Test de Lenguaje Infantil - ABFW. Se incluyeron registros de niños de 4 a 10 años que se sometieron a la prueba y tenían informes completos de anamnesis y evaluación. Se excluyeron registros médicos de niños con evidencia de discapacidad intelectual, discapacidad auditiva o visual y trastornos neuro-psiquiátricos. Los datos fueron analizados por distribución de frecuencia y medidas de tendencia central y dispersión, utilizando para las asociaciones las pruebas de Chi-cuadrado de Pearson y Mann-Whitney. El estudio fue aprobado por el Comité de Ética en Investigación, al igual que la solicitud de exención de formulario de consentimiento. **Resultados**: El análisis de asociación verificó la existencia de significación estadística entre los resultados de la evaluación fonológica con la educación materna y también con la educación paterna. Otras asociaciones no revelaron valores estadísticamente significativos. **Conclusiones**: Se destaca la importancia de la actuación en fonoaudiología en la red pública de educación y salud, dada la asociación encontrada. Se encontró un alto número de resultados de evaluación que muestran alteraciones fonológicas en niños.

Palabras clave: Fonoaudiología; Determinantes Sociales de la Salud; Trastorno Fonológico; Niño; Associación.

Introduction

Phonological processes are innate, natural and commonly found in all talking children[1]. Because of a category or sequence of sounds that present a difficulty for the individual's speaking ability, the phonological process is a mental operation that applies to speech to replace an identical alternative category, but without the difficult property. More specifically, they are experiences that all children go through at some point in the process of learning and developing language[1]. It is clear that scientific advances in this area are of extreme importance for all those concerned with the acquisition of the child's phonology.

Phonological alterations are related to the mastery of the language sound system and its use. In this case, the child is not able to follow the rules of the phonological system. Causal factors related to auditory perception, speech sound production and organization, and knowledge of the phonological rules of language are pointed out[1,2]. Some scholars consider phonological system changes to be idiopathic or multi-user, but it can be said that, for some reason, the child does not use one or several phonological rules. This manifests itself as omission or substitution of syllabic sounds or structures[2]. Thus, children who do not overcome phonological processes at the expected age may acquire phonological alterations.

It is known that social factors can affect the biological conditions of individuals, as well as risk behaviors, environmental exposure and access to health promotion resources. Some social determinants, such as socioeconomic condition and parental education, may also be associated with phonological alterations found in children[3].

Social vulnerability has been pointed out as a risk factor for development, since children living in an environment of poverty are more susceptible to deprivation of stimuli, which can result in behavior and socialization problems and impair language learning and development[4]. Socio-economic and educational factors have been pointed out as influential in the parents' choice of educational strategies[5].

Knowing the social determinants of health is important to plan strategies to confront and improve the population's conditions. Therefore, they should be included as factors that can amplify the risk for phonological alterations[3,6].

The objective of this study is, therefore, to identify and analyze the prevalence of phonological disorders and their association with the social determinants of health in children between four and ten years of age seen in a phonoaudiological assessment and diagnosis clinic.

Methods

This study was approved by the Research Ethics Committee of the Federal University of Minas Gerais under the report number 1,174,646. Due to the use of secondary data, the waiver of the Free and Informed Consent (TCLE) was also approved.

This is an analytical, transversal and retrospective study of quantitative approach. The research was carried out through medical records of children from four to ten years of age seen in an outpatient clinic for speech evaluation and diagnosis. The ambulatory is part of a public and general university hospital of the health network of the city of Belo Horizonte, in Minas Gerais, which carries out teaching, research and assistance activities, being a reference in the municipal and state system in the care of patients who need the specialized or hospital components.

The collection covered the period 2010 to 2014, and the data were extracted from the anamnesis reports and evaluation of medical records, which were stored in the outpatient clinic and the medical and statistical archive service. The following socio-demographic data were collected in the anamnesis reports: age, gender, family income (in minimum wages), per capita income (income divided by the total number of people in the residence), parental and patient education, and place of residence (Belo Horizonte, metropolitan region and countryside of Minas Gerais). In the evaluation reports, the results of the phonology test of the ABFW7 Children's Language Test were collected.

The phonology test includes the evaluation of the phonetic inventory and 14 phonological processes that are analyzed qualitatively and quantitatively. Comparative parameters by age are provided for both traditional analysis and phonological processes[7]. Information on process analysis (productivity of each) and traditional analysis (most frequent types of occurrence: omission, substitution, distortion, and rightness) was also collected from this test.

Inclusion criteria included: having been served in the study's outpatient setting from 2010 to 2014, being between four and ten years old, having undergone the phonology test of the ABFW7 Children's Language Test, and having anamnesis and evaluation reports containing the necessary data. The exclusion criteria were: evidence of intellectual disability, hearing impairment or visual impairment and neuropsychiatric disorders.

For the present study, the response variable was the phonological assessment result, defined as altered or adequate. This classification was obtained considering only the age of the child and the productivity of the phonological process. The explanatory variables selected were: age, gender, education of the patient, family income in minimum wages, per capita income, parental education and place of residence.

The descriptive analysis of the data was carried out through the frequency distribution of all the cat-egorical variables and analysis of the measures of central tendency and dispersion of the continuous variables. For the association analyses, Pearson and Mann-Whitney Chi-square tests were used, being considered as statistically significant associations those with $p < 0.05$. For data input, processing and analysis the IBM SPSS Statistics software, version 21.0 was used.

Results

The sample consisted of medical records of 74 patients with an average age of 6.26 years. Most were between five and seven years and 11 months of age and were male. The average family income was 2.42 minimum wages and the per capita income presented an average of 0.63. The average of residents per residence was 3.99 people. (Tables 1 and 2).

Table 1. Frequency distribution of socio-demographic variables of the children evaluated

Variables	N	%
Sex		
Female	25	33,8
Male	49	66,2
Total	74	100,0
Age group		
0 to 4 years and 11 months	12	16,2
5 to 7 years and 11 months	42	56,8
8 to 10 years and 11 months	20	27,0
Total	74	100,0
Insertion in formal education		
Yes	70	94,6
No	4	5,4
Total	74	100,0
Education		
Early Childhood Education	27	36,4
Incomplete elementary	42	56,8
Not inserted	4	5,4
Data not collected	1	1,4
Total	74	100,0
Maternal education		
Incomplete elementary	16	21,6
Complete elementary	6	8,1
Incomplete high school	9	12,2
Complete High school	30	40,5

(continua)

Variables	N	%
Incomplete Higher/other	2	2,7
Complete Higher /other	8	10,8
Without insertion in formal education	1	1,4
Data not collected	2	2,7
Total	74	100,0
Paternal education		
Incomplete elementary	26	35,1
Complete elementary	8	10,8
Incomplete high school	7	9,5
Complete High school	18	24,3
Incomplete Higher/other	3	4,1
Complete Higher /other	5	6,8
Total	74	100,0
Place of residence		
Belo Horizonte	32	43,2
Metropolitan Region	41	55,4
Countryside Minas Gerais	1	1,4
Total	74	100,0

Legend: N = number of individuals.

Table 2. Description of the continuous variables age, income and number of people in the household

Variables	N	Mean	Median	S.D.	Minimum	1st Q	3r Q	Maximum
Age (years)	74	6,26	6,00	1,70	4,00	5,00	8,00	10,00
Income (m.w.)	67	2,42	2,00	1,51	1,00	2,00	3,00	11,00
Per capita income (m.w.)	66	0,63	0,60	0,34	0,17	0,38	0,75	2,20
People in residence	74	3,99	4,00	0,93	2,00	3,00	5,00	6,00

Legend: N= number of individuals; S.D.= standard deviation; Q= quartile; m.w.= minimum wages.

It was observed that most were inserted in formal education at the incomplete elementary level and lived in the metropolitan area of Belo Horizonte. There was a predominance of complete high school for maternal and incomplete elementary school for the paternal (Table 1).

The analysis of the nomination test indicated a higher average score when compared to the analysis of the imitation test. In contrast, the average of omissions, replacements, and distortions was higher in the nomination test (Table 3).

Table 3. Descriptive measures of the analysis of the proofs of appointment and imitation

Variables	N	Mean	Median	S.D.	Minimum	1st Q	3rd Q	Maximum
Proof of appointment								
Number of hits	67	30,57	33,00	10,81	8,00	27,00	39,00	39,00
Number of omissions	66	5,25	2,00	7,48	0,00	0,25	10,00	21,00
Number of replacements	66	3,50	1,50	5,45	0,00	0,00	4,75	16,00
Number of distortions	66	1,63	0,00	3,85	0,00	0,00	1,50	11,00
Proof of imitation								
Number of hits	66	27,13	29,50	14,62	3,00	14,75	34,00	50,00
Number of omissions	65	5,22	3,00	7,26	0,00	0,00	9,00	22,00
Number of replacements	65	1,78	1,00	2,82	0,00	0,00	3,00	8,00
Number of distortions	65	0,89	0,00	2,32	0,00	0,00	0,50	7,00

Legend: N = number of individuals; S.D. = standard deviation; Q = quartile.

The association analysis, using Pearson's Chi-square test, allowed to verify the existence of statistical significance between the result of the phonological evaluation with maternal (p=0.005) and paternal (p=0.047) education. The other associations did not reveal statistically significant values (Table 4).

For the continuous explanatory variables, the association analysis was performed using the Mann-Whitney test. There was no statistically significant association between these and the phonological evaluation result (Table 5).

Table 4. Analysis of association between phonological evaluation results and categorical explanatory variables

Variables	Phonological evaluation result			P* value
	Changed N (%)	Adequate N (%)	Total N (%)	
Sex				
Female	17 (23,6)	7 (9,7)	24 (33,3)	
Male	33 (45,8)	15 (20,8)	49 (66,7)	0,856
Total	50 (69,4)	22 (30,6)	72 (100,0)	
Age group				
0 to 4 years and 11 months	7 (9,7)	3 (4,2)	10 (13,9)	
5 to 7 years and 11 months	29 (40,3)	13 (18,1)	42 (58,3)	0,996
8 to 10 years and 11 months	14 (19,4)	6 (8,3)	20 (27,8)	
Total	50 (69,4)	22 (30,6)	72 (100,0)	
Education				
Early childhood education	17 (23,9)	8 (11,3)	25 (35,2)	
Incomplete elementary	29 (40,8)	13 (18,3)	42 (59,2)	0,961
Not inserted	3 (4,2)	1 (1,4)	4 (5,6)	
Total	49 (69,0)	22 (31,0)	71 (100,0)	
Maternal education				
Incomplete elementary	14 (20,3)	1 (1,4)	15 (21,7)	
Complete elementary	1 (1,4)	5 (7,2)	6 (8,7)	
Incomplete High school	8 (11,6)	1 (1,4)	9 (13,0)	
Complete High school	16 (23,2)	13 (18,8)	29 (42,0)	0,005**
Incomplete Higher/other	2 (2,9)	0 (0,0)	2 (2,9)	
Complete Higher/other	6 (8,7)	2 (2,9)	8 (11,6)	
Total	47 (68,1)	22 (31,9)	69 (100,0)	
Paternal education				
Incomplete elementary	22 (33,8)	3 (4,6)	25 (38,5)	
Complete elementary	5 (7,7)	3 (4,6)	8 (12,3)	
Incomplete High school	4 (6,2)	2 (3,1)	6 (9,2)	
Complete High school	8 (12,3)	10 (15,4)	18 (27,7)	0,047**
Incomplete Higher/other	1 (1,5)	2 (3,1)	3 (4,6)	
Complete Higher/other	4 (6,2)	1 (1,5)	5 (7,7)	
Total	44 (67,7)	21 (32,3)	65 (100,0)	
Place of residence				
Belo Horizonte	21 (28,8)	11 (15,1)	32 (43,8)	
Metropolitan Region	28 (38,4)	12 (16,4)	40 (54,8)	0,783
Countryside Minas Gerais	1 (1,4)	0 (0,0)	1 (1,4)	
Total	50 (68,5)	23 (31,5)	73 (100,0)	

Legend: *Test Pearson Chi-square; **value p < 0.05; N= number of individuals.

Table 5. Analysis of association between phonological evaluation results and continuous explanatory variables

Variables	Phonological evaluation result		P* value
	Modified	Adequate	
Age			
Mean	6,31	6,53	
Median	6,00	7,00	
Standard deviation	1,76	1,61	0,610
Minimum	4,00	4,00	
Maximum	10,00	9,00	
Income (n.m.)			
Mean	2,40	2,63	
Median	2,00	2,00	
Standard devitation	1,10	2,27	0,779
Minimum	1,00	1,00	
Maximum	6,00	11,00	
Per capita income (m.w.)			
Mean	0,59	0,74	
Median	0,50	0,67	
Standard devitation	0,27	0,47	0,290
Minimum	0,17	0,20	
Maximum	1,50	2,20	

Legend: *Test Mann-Whitney; m.w. = minimum wages.

Discussion

This work was performed using secondary data contained in medical records. Thus, it is clear the possibility of bias in filling out the information during the anamnesis and evaluation, being one of the limitations of the study. Another possible limitation may justify the absence of associations with statistical significance between the phonology test result and most of the explanatory variables: the sample size and homogeneity in terms of income and place of residence, since most families had an average of two minimum wages and lived in the metropolitan region of Belo Horizonte, Minas Gerais.

This study sought to verify the association between social determinants and the result of phonological evaluation of children from four to ten years old. The sample profile showed a higher proportion of male children, which corroborates the literature, which points to a higher prevalence of language alterations in individuals of this sex[6,7]. The authors justify this fact by the acquisition and development of language occurring differently between the sexes, or by the male brain presenting a slower maturation[6,7]. It is known that there are differences in the chronology of neuronal myelinization, being earlier in females in areas related to language, which may explain superiority in the development of language skills[8]. However, no studies were found that proved the predominance of phonological alterations in males.

Describing and classifying phonological disorders is fundamental to later diagnose the various subtypes of phonological disorders. The results found in this study showed the average of hits, omissions, replacements and distortions of the proofs of appointment and imitation of phonological evaluation. The children analyzed were more correct in the proof of appointment than in the proof of imitation. The dispersion of results was lower in the number of omissions, replacements and distortions, which was lower in the imitation test. A study that analyzed the nomination and imitation tests as diagnostic tools for phonological disorders, carried out in 2006, showed that there were no statistically significant differences between the two tests[9]. However, it is known that children with phonological disorders tend to improve speech under imitation, which diverges from the results found in this study, since children were worse in the imitation test.

The majority of the sample in this survey was in the age range between five and seven years and 11 months, and the association between the pho-

nological evaluation result and age was not statistically significant. The literature shows that there is no pattern of increased and decreased phonological changes according to age[10]. These findings are corroborated by the present study as we see that phonological system acquisition occurs gradually until its establishment, which can be practically complete at five years, but can also extend from four to seven years of age[11].

It was observed that the majority of the population studied was inserted in formal education, at the incomplete fundamental level. However, there was no association of education with the results of the phonology test. Some authors state that phonological awareness occurs in parallel with the development of the alphabetic principle of language. However, initially, there is no high degree of dependence between them. It is possible to consider the phonological consciousness as the individual's ability to think about word structures, segmenting and analyzing the sounds that compose them. This ability to work with phonemes brings benefits to children with normal development and to those considered at risk for the presence of difficulties in the development of reading, since phonological sensitivity can favor literacy. Likewise, the development of the phonological system, as far as speech is concerned, involves learning which sounds are used and how they are organized by their linguistic community. So, as literacy is improved, phonological awareness and the phonological system are also optimized and walk in consonance to help children improve their cognitive functions[11]. A study, conducted in publicly and privately funded schools in Recife (PE), investigated the relationship between phonological development and initial learning of writing in different socio-educational contexts and indicated that the more advanced the school year, the better the performance in the task of appointing the phonology test[12].

Socio-economic disadvantages have been pointed out as a risk factor to development, since children living in a socially vulnerable environment may be more susceptible to deprivation of stimuli, which may result in behavior and socialization problems and impair language learning and development[3,13]. Brazil has one of the most advanced laws in the world regarding the protection of childhood and adolescence. However, it is necessary to adopt public policies capable of expanding responsibilities in fighting and overcoming countless inequalities, especially with regard to ensuring access to quality health services, education, housing, food, sports, leisure and many other essential services[13]. A study revealed that children from families with higher socioeconomic level have performance considered adequate since literacy, while those with lower socioeconomic level have performance six times lower[14].

A study compared the occurrence of altered phonological processes and the phonological disorder severity index in samples of speech and writing from first to fifth grade students of publicly and privately funded educational institutions[15]. The results showed lower performance in the phonology tests of public-school children compared to private school children. This fact can be justified by the interference of the socioeconomic situation, since it plays a significant role in the use of different language codes[15]. In the present study, there was no association between income (family and per capita) and phonological alterations.

The place of residence of the children analyzed showed no statistically significant values when associated with phonological disorders. However, the only distribution carried out in this study referred to Belo Horizonte, a metropolitan and interior region, which is not capable of differentiating territorial specificities. In a previous study, which showed the lexical effects on the reduction of final nasal diphthongs in Brazilian Portuguese and sought to associate the geographic location with the studied sample, no statistically significant association was found[16]. Thus, it is essential that in future studies the intra-urban differentials in the search for associations between territory and phonological development be better investigated.

The association with statistical significance found in this study was between parental education and the result of phonology evaluation. Thus, it is possible to infer that this social determinant presented an association with the phonological system of the children analyzed. In a work carried out with children from four to six years and 11 months of age, enrolled in municipal schools of early childhood education in the city of Santa Maria (RS), it was found that 51.4% of the parents interviewed referred to elementary education, and the average paternal education (n=1,399) of 6.6 years of study, which indicates incomplete elementary level. As for maternal education, 52.67% indicated secondary education[3]. The present study corroborates find-

ings in the literature, as authors have shown that children with parents with a level of education up to elementary school are more vulnerable to language development impairments[6]. However, there is a previous study that showed different results: it was found, with children from four to five years and 11 months, from public and private schools in Belo Horizonte (MG), that those whose parents had a lower educational level (elementary school) performed better in the phonology test when compared to those with parents with secondary and higher education[6]. Another study, conducted in 2015, which assessed the phonological profile of children according to age, gender, parental education, educational institution and auditory processing, showed that the increase in years of maternal study allows greater knowledge and better perception of material aspects related to language. These factors are of great relevance to the development of language, both in the expressive and receptive parts of a child. Thus, it is believed that children who have mothers with high school or college degree have better communicative and cognitive development[17]. In this context, it is worth considering that parental schooling can influence the development of the child's phonological system and contribute to the planning of prevention strategies aimed at these families.

In view of the findings, it is worth pointing out that, in the development of the child's language, there are individual differences, both in the acquisition process and in speed and quality. It is noted that this development is complex and depends on a series of factors, ranging from neuropsychological maturation, affectivity and cognitive development to the social determination of health. The findings of this study are important to attest the need for new research in the area, which may generate proposals for future interventions both in the promotion and prevention of aspects related to language and in the development of public policies focused on health and education.

Conclusion

The study revealed an association between the result of the phonological evaluation and the parental education of children referred for evaluation in a speech therapy outpatient clinic, in the four to ten-year-old age group. This result evidenced the importance of phonoaudiological performance in the public education and health network, with the purpose of carrying out prevention and health promotion actions, as well as the need for public policies focused on education. It is worth mentioning that there was no statistically significant association between phonology assessment results and other social determinants studied, probably due to the homogeneity of the studied sample. There is, therefore, a need for new works with a larger number of subjects in order to increase the power of data analysis.

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