

# Risk factors for stuttering in disfluent children with familial recurrence

## Fatores de risco para gagueira em crianças disfluentes com recorrência familiar

Cristiane Moço Canhetti de Oliveira<sup>1</sup>, Denise Cunha<sup>2</sup>, Ana Cláudia dos Santos<sup>3</sup>

### ABSTRACT

**Purpose:** To characterize the factors gender, age, duration and typology of the disfluencies; physical and emotional stresses in children with high risk for stuttering and with familial recurrence of the disorder. **Methods:** Sixty-five children with high risk for developmental familial stuttering of both genders, with ages between 3 and 11 years and 11 months. The data were gathered through the Protocol of Risk for the Developmental Stuttering. **Results:** In our findings the ratio male:female was 2.8:1, and the majority of the children were aged 3 years old. Significantly more children presented more than 12 months' duration of the disfluencies when compared to children that presented 6 to 12 months' duration. The majority showed some emotional stress and didn't show any physical stress. **Conclusion:** The results of this study suggest that children with familial recurrence of stuttering, male, with 3 years old, with stuttering-like disfluencies (SLD) lasting for more than 12 months and with the occurrence of emotional stresses are the children that present the higher risk for the development of the persistent stuttering.

**Keywords:** Stuttering; Risk factors; Genetics; Speech, language and hearing sciences; Speech disorders

### RESUMO

**Objetivo:** Caracterizar os fatores gênero, idade, tempo de duração e tipologia das disfluências, fatores estressantes físicos e emocionais em crianças com alto risco para a gagueira e com recorrência familiar do distúrbio. **Métodos:** Participaram 65 crianças com alto risco para a gagueira desenvolvimental familiar, de ambos os gêneros, na faixa etária de três a 11 anos. A coleta de dados foi realizada por meio do Protocolo de Risco para a Gagueira do Desenvolvimento (PRGD). **Resultados:** A razão masculino/feminino de crianças disfluentes encontrada foi de 2,8:1, com predominância do grupo na faixa etária de três anos. Os resultados revelaram diferença significativa quanto ao tempo de duração: mais crianças apresentaram um período maior de 12 meses de duração das disfluências em relação às crianças que apresentaram de seis a 12 meses de duração. A maioria apresentou algum fator estressante emocional e não apresentou fator estressante físico. **Conclusão:** Os resultados sugerem que crianças com recorrência familiar da gagueira no gênero masculino, na faixa etária de três anos, com presença de disfluências gagas por mais de 12 meses e com ocorrência de fatores estressantes emocionais são as que apresentam maior risco para o desenvolvimento da gagueira persistente.

**Descritores:** Gagueira; Fatores de risco; Genética; Fonoaudiologia, Distúrbios da fala

Study conducted at the Department of Speech-Language Pathology and Audiology, Faculdade de Filosofia e Ciências, Universidade Estadual Paulista "Júlio de Mesquita Filho" – UNESP – Marília (SP), Brazil.

(1) Department of Speech-Language Pathology and Audiology and Pos-Graduation in Speech-Pathologist, Faculdade de Filosofia e Ciências, Universidade Estadual Paulista "Júlio de Mesquita Filho" – UNESP – Marília (SP), Brazil.

(2) Graduate Program (Masters degree) in Speech-Pathologist, Faculdade de Filosofia e Ciências, Universidade Estadual Paulista "Júlio de Mesquita Filho" – UNESP – Marília (SP), Brazil.

(3) Speech-Pathologist of Santa Casa de Misericórdia de Mococa, Mococa (SP), Brazil.

**Conflict of interests:** None

**Authors' contributions:** CMCO conducted the orientation of research, the accuracy of the data, wrote the scientific paper, ACS and DC performed the collection and analysis of data, as well wrote the scientific paper.

**Correspondence address:** Cristiane Moço Canhetti de Oliveira. Av. Higyno Muzzi Filho, 737, Câmpus Universitário, Marília (SP), Brazil, CEP: 17525-900.

E-mail: cmcoliveira@marilia.unesp.br

**Received:** 5/14/2012; **Accepted:** 1/8/2013

## INTRODUCTION

Stuttering is a chronic condition characterized mainly by involuntary disruptions in speech fluency<sup>(1)</sup>. The disorder that emerges in childhood is called developmental stuttering. Stuttering affects 5% of children, with the mean prevalence rate of 1% for general population<sup>(2,3)</sup>.

Disfluencies are all the disruptions that can occur in the flow of speech of any speaker, and can be classified as other disfluencies (OD) and stuttering-like disfluencies (SLD). It is known that the main manifestation of stuttering is the presence of excessive SLD.

The etiology of stuttering is multifactorial, as the result of a dynamic interaction between a wide and nonlinear spectrum of risk factors caused during child development<sup>(4,5)</sup>. Understanding these risk factors is essential to diagnose it early and correctly and so, to provide a more effective intervention for children who stutter.

The relevance of researches on risk factors for developmental stuttering is highlighted in the literature<sup>(6,7)</sup> because they may guide the cases that need to be prioritized in treatment. Children before six years of age respond better to therapy, preventing the disorder progresses to a more chronic and worse prognosis<sup>(8,9)</sup>. Therefore, it becomes necessary to know what are the most relevant risk factors to identify stuttering earlier.

Thus, in the study of the clinical history of stuttering, it seems to be essential to investigate the factors considered as risk for chronicity of the disorder. Among these factors, it is important to highlight the age, gender, duration and typology of disfluency prenatal, natal, or neonatal morbid history, family history and physical and emotional stresses that occurred near the onset of the disorder<sup>(10)</sup>.

The disfluencies generally begin between the ages of two and five years old<sup>(11-15)</sup>, with a mean age of 30 months<sup>(15)</sup>. Furthermore, the literature<sup>(16)</sup> indicates that most children who stutter manifest the disorder when they are around four years old.

Gender also influences the prevalence of stuttering, because the greatest risk for developing this disorder occurs in male, and this proportion increases with age<sup>(17)</sup>. A study also showed that the risk of stuttering in males increases when there are any other communication disorder associated, regardless of family history<sup>(18)</sup>. The reason for the higher chronicity of the disorder for male sample than female can be explained according to the literature<sup>(4,19,20)</sup>, by the findings that females have a greater tendency for recovering than males.

Concerning the duration of disfluencies, this is variable, however it is important to note that a period exceeding 12 months duration is indicative of a chronic disorder. It is known that spontaneous recovery from stuttering occurs mainly in the first years of life, and many recovered within the first 12 months after initiation<sup>(20)</sup>.

The symptoms of stuttering is characterized by excessive

sound repetition, monosyllabic word repetition, prolongation and block<sup>(12,21,22)</sup>, whereas these disfluencies are described as stuttering-like disfluencies (SLD), and are essential for the diagnosis of the disorder.

It is known that some children may exhibit disfluencies in the period of language development, but these ruptures may also represent the beginning of a stuttering. A consistent finding in this regard is that children who stutter since the early onset of the disorder present more within-word disfluencies, as sound repetition or part of the word repetition and prolongation of sound, than children who do not stutter<sup>(23)</sup>.

Concerning the physical stress factors or the prenatal, natal, or neonatal morbid history, the literature reported that the patients with no family history of stuttering can be associated with some form of early brain damage, as traumas or diseases that occurred at the birth or in the development<sup>(24)</sup>.

The genetic factors involved in the transmission of stuttering occur in about half the cases of developmental stuttering<sup>(25,26)</sup>, and this subgroup is called familial developmental stuttering<sup>(26)</sup>. Therefore, the children who have a history of stuttering in the family, a factor that represents a high risk for the stuttering<sup>(6,20,27)</sup>.

The emotional stresses that may occur near the onset of disfluency can also interact with the other factors above and contribute to the onset of the disorder<sup>(10)</sup>.

Considering the importance of understanding the risk factors for developmental persistent stuttering, the aim of this study was to characterize the factors gender, age, duration and typology of disfluencies, physical and emotional stresses in children at high risk of stuttering and familial recurrence of the disorder.

## METHOD

This research has received Research ethics approval from the local institutional human research ethics committee of Universidade Estadual Paulista (UNESP) (protocol number 665/2009). The participants were select from Centro de Estudos da Educação e da Saúde (CEES) of the UNESP, Marília. The children were on waiting lists for care in Supervised Speech Therapy: Fluency Disorders with complaining of stuttering. The families of the children who were in the age group defined by the study were recruited to implement the Protocol Risk for Developmental Stuttering (PRGD)<sup>(10)</sup> and the survey of family history. After verification of inclusion and exclusion criteria, those responsible for selected cases consented to participation of children in the research, according to Resolution 196/96 of CONEP.

The research group was composed by 65 children with high risk of stuttering (disfluent), between three years and 11 years and 11 month years old (mean age of 6.09 years, SD=2.52), of both gender (48 male and 17 female). All children were included regardless to gender, education level or socio-economic-cultural.

The inclusion criteria of the participants were: age between three years and 11 years and 11 month years old, be a native speaker of Brazilian Portuguese, stuttering complaint by the parents, have a higher score in the column at high risk for chronic stuttering in PRGD<sup>(10)</sup>, and present positive familial history for the disorder.

The exclusion criteria were to present any: neurological disorder or condition genetic or not, as like dystonia, extra-pyramidal diseases, mental retardation, disorder and attention deficit hyperactivity; psychiatric symptoms or conditions; communication disorders besides the stuttering; conductive or sensorineural hearing loss; and others conditions that could mistake the diagnosis.

The procedures used for the selection of participants were: anamnesis, otoscopy, threshold tonal audiometry, logoaudiometry, immittance measures and contralateral acoustic reflexes. After the selection of individuals, all participants underwent assessment as described below.

The data were gathered through the Protocol of Risk for the Developmental Stuttering - PRGD<sup>(10)</sup>, held with parents or relatives of children, in order to detect risk factors for chronicity of stuttering, such as age, gender, duration of chronicity of disfluency, typology of disfluency, physical and/or emotional stresses occurring near the onset of disfluencies and genetic factors. The application time of the procedure was approximately one session of 50 minutes.

Data from family history to accomplish the pedigree were collected in the family history of PRGD<sup>(10)</sup>. The adult first-degree relatives (father or mother) were asked about the standard of fluency and their relatives about the existence of a family member with stuttering. To enable them to answer these questions, the interviewer had a standard definition of stuttering offering examples that could illustrate them. Stuttering was defined as "interruption in the continuity of the flow of speech characterized as repetitions, prolongations, or blocks of sounds, syllables or short words"<sup>(19)</sup>. Examples of repetitions of sounds

or syllables, monosyllabic word repetitions, prolongations of sounds, blocks and intrusions were offered. In order to obtain accurate information, family members were encouraged to check and confirm with other relatives, information and histories of stuttering.

Statistical analysis was performed using the Likelihood Ratio Test to check if there were differences for the variables of interest. The adopted level of significance was 5%.

## RESULTS

The information concerning age, duration and typology of disfluency, the physical and emotional stresses by gender of the participants were organized in Table 1. Note that regardless of gender, most children had aged three years and three years and 11 months. The male-to-female sex ratio was 2.82:1.

By analyzing the duration of disfluencies, it was found that most of the children had more than 12 months duration of disfluency, which this difference was significant ( $p=0.019$ ). Most parents or relatives of children characterized the disfluencies showed by the children like as stuttering-like disfluencies (SLD). There were no physical stresses in most children of male and female. Over 50% of females showed no emotional stresses, whereas more than 50% of male presented emotional stresses.

In relation to age, gender and duration of disfluency it is showed in Table 2 that the majority of participants were characterized as children aged 3 years, with more than 12 months duration of disfluencies, regardless of gender. In relation to age, gender and typology of disfluency, it appears that most participants were characterized as children aged 3 years, with the presence of SLD, regardless of gender.

Table 3 shows the results related to physical and emotional stresses of participants, divided according to gender and age. It is observed that in both genders, most children showed no physical stresses. In relation to emotional stresses, in females

**Table 1.** Distribution of participants by gender according to age, duration and typology of disfluencies

	Age (years)				Disfluencies					Stress			
					Duration		Typology			Physical		Emotional	
	≥3 and <4	≥4 and <7	≥7 and <10	≥10 and <12	6-12m	+12m	OD	Mixed	SLD	Absent	Present	Absent	Present
Male (n=48)	20 41.7%	12 25%	9 18.7%	7 14.6%	0 0%	48 100%	1 2.1%	11 22.9%	36 75%	38 79.2%	10 20.8%	22 45.8%	26 54.2%
Female (n=17)	8 47%	2 11.8%	3 17.6%	4 23.6%	2 11.8%	15 88.2%	0 0%	3 17.6%	14 82.4%	13 76.5%	4 23.5%	9 52.9%	8 47.1%
Total (n=65)	28 43.1%	14 21.5%	12 18.5%	11 16.9%	2 3.01%	63 96.9%	1 1.5%	14 21.5%	50 76.9%	51 78.5%	14 21.5%	31 47.7%	34 52.3%
p-value	0.947				0.019*		0.650			0.817		0.614	

\* Statistical significance ( $p \leq 0.05$ ) – Likelihood Ratio Test

Note: m = months; OD = other disfluencies; SLD = stuttering-like disfluencies

**Table 2.** Distribution of participants by gender and age according to the duration and typology of disfluency

		Age (years)				Total	p-value
		≥3 and <4	≥4 and <7	≥7 and <10	≥10 and ≤12		
Duration of disfluencies							
6 to 12 months	Male	0	0	0	0	0	It isn't possible to apply test
	Female	0	1	0	1	2	
	Total (n=2)	0	1	0	1	2	
+12 months	Male	22	13	7	6	48	0.944
	Female	8	3	2	2	15	
	Total (n=63)	30	16	9	8	63	
Typology of disfluencies							
OD	Male	0	0	0	1	1	It isn't possible to apply test
	Female	0	0	0	0	0	
	Total (n=1)	0	0	0	1	1	
Mixed	Male	4	5	2	0	11	0.472
	Female	2	1	0	0	3	
	Total (n=14)	6	6	2	0	14	
SLD	Male	18	8	5	5	36	0.929
	Female	6	3	2	3	14	
	Total (n=50)	24	11	7	8	50	

Likelihood Ratio Test ( $p \leq 0.05$ )**Note:** OD = other disfluency; SLD = stuttering-like disfluency

the majority of children did not have any associated factor, and most males had some emotional stress.

Regarding age, most parents or relatives did not report the presence of physical stress, regardless of age. However, analysis of the emotional stress showed that most parents or relatives reported the presence of some factor, except the group of children over the age of 10, however, this difference was not significant.

Table 4 shows the physical stress in relation to emotional stress by gender. Note that in the majority of male participants, who showed no physical stress, showed the presence of emotional stress. For female children, most who showed no physical stress, also showed no emotional stress. However, this relationship was not significant for either gender.

In relation to age and physical stress factors, it is showed

**Table 3.** Distribution of participants by gender and age according to the physical and emotional stresses

		Age (years)				Total (%)	p-value
		≥3 and <4 (%)	≥4 and <7 (%)	≥7 and <10 (%)	≥10 and <12 (%)		
Physical stresses							
Absent	Male	14 (36.80)	12 (31.60)	6 (15.80)	6 (15.80)	38 (100)	0.928
	Female	6 (46.20)	3 (23.10)	2 (15.40)	2 (15.40)	13 (100)	
	Total (n=51)	20 (39.20)	15 (29.40)	8 (15.70)	8 (15.70)	51 (100)	
Present	Male	8 (80.00)	1 (10.00)	1 (10.00)	0 (0.00)	10 (100)	0.265
	Female	2 (50.00)	1 (25.00)	0 (0.00)	1 (25.00)	4 (100)	
	Total (n=14)	10 (71.40)	2 (14.30)	1 (7.10)	1 (7.10)	14 (100)	
Emotional stresses							
Absent	Male	9 (40.90)	6 (27.30)	3 (13.60)	4 (18.20)	22 (100)	0.896
	Female	5 (55.60)	2 (22.20)	1 (11.10)	1 (11.10)	9 (100)	
	Total (n=31)	14 (45.20)	8 (25.80)	4 (12.90)	5 (16.10)	31 (100)	
Present	Male	13 (50.00)	7 (26.90)	4 (15.40)	2 (7.70)	26 (100)	0.665
	Female	3 (37.50)	2 (25.00)	1 (12.50)	2 (25.00)	8 (100)	
	Total (n=34)	16 (47.10)	9 (26.50)	5 (14.70)	4 (11.60)	34 (100)	

Likelihood Ratio Test ( $p \leq 0.05$ )

**Table 4.** Relation between physical and emotional stresses, by gender

Physical stresses		Emotional stresses			p-value
		Absent (%)	Present (%)	Total (%)	
Absent	Male	18 (47.40)	20 (52.60)	38 (100)	0.896
	Female	7 (53.80)	6 (46.20)	13 (100)	
	Total (n=51)	25 (49.00)	26 (51.00)	51 (100)	
Present	Male	4 (40.00)	6 (60.00)	10 (100)	0.665
	Female	2 (50.00)	2 (50.00)	4 (100)	
	Total (n=14)	6 (42.90)	8 (57.10)	14 (100)	

Likelihood Ratio Test ( $p \leq 0.05$ )**Table 5.** Distribution of participants by to age according to the physical and emotional stresses that occurred near the onset of the disorder

Age	Physical stresses			Emotional stresses		
	Absent (%)	Present (%)	Total (%)	Absent (%)	Present (%)	Total (%)
$\geq 3$ and $< 4$	20 (66.70)	10 (33.30)	30 (100)	14 (46.70)	16 (53.30)	30 (100)
$\geq 4$ and $< 7$	15 (88.20)	2 (11.80)	17 (100)	8 (47.10)	9 (52.90)	17 (100)
$\geq 7$ and $< 10$	8 (88.90)	1 (11.10)	9 (100)	4 (44.40)	5 (55.60)	9 (100)
$\geq 10$ and $< 12$	8 (88.90)	1 (11.10)	9 (100)	5 (55.60)	4 (44.40)	9 (100)
Total	51 (78.50)	14 (21.50)	65 (100)	31 (47.70)	34 (52.30)	65 (100)
p-value	0.198			0.964		

Likelihood Ratio Test ( $p \leq 0.05$ )

in Table 5 that the majority of participants was characterized by the absence of these factors, and by children by aged 3 to 4 years. As to emotional stress and age, most participants were characterized as children aged 3 years, with the presence of these factors.

## DISCUSSION

Currently there is a tendency to delineate possible subtypes of stuttering<sup>(18,28,29)</sup>. In this direction, this research that characterized the risk factors in a group of disfluent children with familial recurrence of the stuttering, presents relevant data that may help to understand the different subtypes of stuttering.

A major challenge for clinicians and researchers in the area of childhood disfluency is to determine the risk that a child presents for developmental persistent stuttering, since this will guide the therapeutic approach to be applied. Besides knowing about what are the risk factors that should be investigated, the professional must understand that these factors interact with each other, and should not be analyzed separately. A comparative study of the risk factors in a group of children with familial and sporadic developmental stuttering was performed and the results suggest that the risk factors studied in two groups of children who stutter are similar, independent of family history<sup>(29)</sup>. The only significant difference between the groups was in relation to emotional stress that happened close

to the onset of disfluency, that occurred more frequently in the group of sporadic developmental stuttering<sup>(29)</sup>.

In this study it was found that the risk of familial developmental stuttering is higher in males, in agreement with previous studies<sup>(2,17-20)</sup>. According to the findings, most children, regardless of gender, were aged three years. This data is consistent with the literature that developmental stuttering often emerges before four years old<sup>(16)</sup>.

In this respect, it is important to note that children arrived late for speech therapy because most participants, regardless of gender, had more than 12 months duration of disfluencies. This finding is typical of persistent stuttering, regardless of their nature<sup>(29)</sup>, and has an important clinical implication because parents should seek speech therapy earlier. Therefore, speech therapists should develop actions in order to clarify the general population, parents, educators and health professionals about stuttering and its risk factors to which referrals were made as soon as the manifestations arise.

The results showed that most disfluencies was characterized as SLD, regardless of gender and age, this data was expected, since the occurrence of disfluency is the main manifestation of stuttering<sup>(1,12,21,22)</sup>. In relation to age, gender and typology of disfluencies, most participants were characterized as children aged three years, with the presence of SLD and male.

In our sample, consisting of cases of familial origin, most children showed no physical stress, regardless of gender. In

relation to emotional stress in male most children had some associated factor, and in females did not show any emotional stress. This finding emphasizes the multifactorial aspect of stuttering<sup>(4)</sup> because, despite this group of children presenting genetic predisposition for stuttering, also often presented emotional stress.

Data from this study indicate that multiple factors together may contribute to the onset and persistence of developmental stuttering, emphasizing the multidimensional nature of the disorder<sup>(4)</sup>. The genetic factors appear to act together with other factors, which in a complex and dynamic interaction, can justify the emergence of the disorder, as described in the literature<sup>(4)</sup>. The data highlight, therefore, the complexity of the source of stuttering and the necessity of investigate many factors considered at risk for the disorder in order to understand the clinic case and develop a better treatment.

The crossing between the data from this study and literature<sup>(4,5,18,20,29)</sup> relevant to the theme shows that the risk factors for developmental persistent stuttering must be contextualized in a multidimensional analysis that integrates multiple domains.

## CONCLUSION

The results of this study suggest that children with familial recurrence of stuttering, males, aged three years, with the presence of stuttering-like disfluencies for more than 12 months and with the occurrence of emotional stress are at greatest risk for developing persistent stuttering.

## ACKNOWLEDGEMENTS

This research was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) (process number 2009/09631-8), in the form of scientific initiation scholarship.

## REFERENCES

- Tran Y, Blumgart E, Craig A. Subjective distress associated with chronic stuttering. *J Fluency Disord.* 2011Mar;36(1):17-26.
- Craig A, Hancock K, Tran Y, Craig M, Peters K. Epidemiology of stuttering in the community across the entire life span. *J Speech Lang Hear Res.* 2002Dec;45(6):1097-05.
- Felsenfeld S. Finding susceptibility genes for developmental disorders of speech: the long and winding road. *J Commun Disord.* 2002Jul-Aug;35(4):329-45.
- Smith A, Kelly E. Stuttering: A dynamic, multifactorial model. In: Curlee RF, Siegel GM. *Nature and treatment of stuttering: New directions.* 2nd ed. Needham Heights: Allyn & Bacon; 1997. p. 204-17.
- Ajdacic-Gross V, Vetter S, Müller M, Kawohl W, Frey F, Lupi G et al. Risk factor for stuttering: a secondary analysis of a large data base. *Eur Arch Psychiatry Clin Neurosci.* 2010;260(4):279-86.
- Dworzynski K, Remington A, Rijdsdijk F, Howell P, Plomin R. Genetic etiology in cases of recovered and persistent stuttering in an unselected longitudinal sample of young twins. *Am J Speech Lang Pathol.* 2007May;16(2):169-78.
- Brosch S, Winkler S. Diagnostics and therapy of stuttering children. *Laryngorhinootologie.* 2008Jul;87(7):519-23.
- Bothe AK, Davidow JH, Bramlett RE, Ingham RJ. Stuttering treatment research, 1970-2005. I. Systematic review incorporating trial quality assessment of behavioral, cognitive, and related approaches. *Am J Speech Lang Pathol.* 2006Nov;15(4):321-41.
- Einarsdóttir J, Ingham RJ. The effect of stuttering measurement training on judging stuttering occurrence in preschool children who stutter. *J Fluency Disord.* 2008Sep;33(3):167-79.
- Andrade CRF. *Gagueira infantil: risco, diagnóstico e programas terapêuticos.* Barueri: Pro Fono; 2006.
- Bloodstein O. Some empirical observations about early stuttering: a possibly link to language development. *J Commun Disord.* 2006May-Jun;39(3):185-91.
- Wittke-Thompson JK, Ambrose N, Yairi E, Roe C, Cook EH, Ober C, et al. Genetics studies of stuttering in a founder population. *J Fluency Disord.* 2007;32(1):33-50.
- Wagovich SA, Hall NE, Clifford BA. Speech disruptions in relation to language growth in children who stutter: an exploratory study. *J Fluency Disord.* 2009Dec;34(4):242-56.
- Logan KJ, Mullins MS, Jones KM. The depiction of stuttering in contemporary juvenile fiction: implications for clinical practice. *Psychol Sch.* 2008Aug;45(7):609-26.
- Reilly S, Onslow M, Packman A, Wake M, Bavin EL, Prior M, et al. Predicting stuttering onset by age of 3 years: a prospective, community cohort study. *Pediatrics.* 2009Jan;123(1):270-7.
- Venkatagiri HS. Recent advances in the treatment of stuttering: a theoretical perspective. *J Commun Disord.* 2005Sep-Oct;38(5):375-93.
- Yairi E, Ambrose NG. *Early childhood stuttering: for clinicians by clinicians.* Austin: Pro-Ed; 2005.
- Oliveira CMC, Souza HA, Santos AC, Cunha DS. Análise dos fatores de risco para gagueira em crianças disfluentes sem recorrência familiar. *Rev CEFAC.* 2012Dec;14(6):1028-35.
- Ambrose NG, Cox NJ, Yairi E. The genetic basis of persistence and recovery in stuttering. *J Speech Lang Hear Res.* 1997Jun;40:567-80.
- Yairi E, Ambrose NG, Paden EP, Throneburg RN. Predictive factors of persistence and recovery: pathways of childhood stuttering. *J Commun Disord.* 1996Jan-Feb;29(1):51-77.
- Sawyer J, Yairi E. The effect of sample size on the assessment of stuttering severity. *Am J Speech Lang Pathol.* 2006Feb;15(1):36-44.
- Suresh R, Ambrose N, Roe C, Pluzhnikov A, Wittke-Thompson JK, Ng MC, et al. New complexities in the genetics of stuttering: significant sex-specific linkage signals. *Am J Hum Genet.* 2006Apr;78(4):554-63.
- Buchel C, Sommer M. What causes stuttering? *PLoS Biol.* 2004;2(2):e46.
- Poulos MG, Webster WG. Family history as a basis for subgrouping people who stutter. *J Speech Hear Res.* 1991Feb;34(1):5-10.
- Yairi E, Ambrose NG, Cox N. Genetics of stuttering: a critical review. *J Speech Hear Res.* 1996Aug;39(4):771-84.

26. Drayna D, Kilshaw J, Kelly J. The sex ratio in familial persistent stuttering. *Am J Hum Genet.* 1999Nov;65(5):1473-5.
27. Craig A, Tran Y. The epidemiology of stuttering: the need for reliable estimates of prevalence and anxiety levels over the lifespan. *Adv Speech Lang Pathol.* 2005Mar;7(1):41-6.
28. Yairi E. Subtyping stuttering I: a review. *J Fluency Disord.* 2007Apr;32(3):165-96.
29. Oliveira CMC, Souza HA, Santos AC, Cunha D, Giacheti CM. Fatores de risco na gagueira desenvolvimental familiar e isolada. *Rev CEFAC.* 2011Apr;13(2):203-13.