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## Relationship between speech rate and speech disruption in cluttering

### *Relação entre taxa de elocução e descontinuidade da fala na taquifemia*

### ABSTRACT

**Purpose:** To correlate speech rate and speech disruptions in individuals who clutter, and to compare with individuals who do not clutter. **Methods:** Participants were 14 individuals with ages between 8 and 40 years and 11 months, of both genders, divided into two groups paired by age and gender. GI was composed by seven individuals who clutter, and GII by seven individuals who do not clutter. The Speech Fluency Assessment Protocol was used to gather and analyze the speech samples, considering the frequency of speech disruptions and the speech rate. **Results:** Data indicated that the greater the rate of syllables and words per minute, the greater the number of speech disruptions, both for individuals who do and do not clutter. In the comparison between groups, there was correlation both for syllables and words per minute only in the group of individuals who not clutter. **Conclusion:** The individuals who clutter in this study presented a higher speech rate and frequency of common disfluencies. In both analyzed groups there was a tendency to greater frequency of common disfluencies as speech rate increased. However, in the comparative analysis between individuals who do and do not clutter, the correlation was significant only in the group of individuals who do not clutter.

### RESUMO

**Objetivo:** Correlacionar a taxa de elocução com as rupturas da fluência em pessoas com taquifemia e comparar com pessoas sem taquifemia. **Métodos:** Participaram dessa investigação 14 indivíduos na faixa etária de 8 a 40 anos e 11 meses de idade, de ambos os gêneros, divididos em dois grupos pareados por idade e gênero. O GI foi composto por sete pessoas com taquifemia e o GII por sete pessoas sem taquifemia. Um protocolo de avaliação da fluência da fala foi utilizado para obter e analisar a amostra de fala, que considera a frequência das disfluências e a taxa de elocução. **Resultados:** Os dados indicaram que quanto maiores os fluxos de sílabas e de palavras por minuto, maior o número de rupturas na fala, tanto nas pessoas com taquifemia como nas pessoas sem taquifemia. Quanto à comparação entre os grupos, houve correlação tanto para sílabas por minuto como para palavras por minuto apenas no grupo de pessoas sem taquifemia. **Conclusão:** O grupo de taquifêmicos apresentou aumento na taxa de elocução e disfluências comuns excessivas. Nos dois grupos analisados ocorreu uma tendência em se obter maiores valores de disfluências comuns à medida que a taxa de elocução aumentava. Porém, na análise comparativa entre o grupo de pessoas com e sem taquifemia, a correlação foi significativa apenas no grupo de pessoas sem taquifemia.

Study conducted at the Fluency Studies Laboratory, Department of Speech-Language Pathology and Audiology, Faculty of Philosophy and Sciences, Universidade Estadual Paulista “Júlio de Mesquita Filho” – UNESP – Marília (SP), Brazil.

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**Conflict of interests:** None

## INTRODUCTION

Cluttering and stuttering represent the main disorders that show disruptions in the ongoingness or flow of a message. Nevertheless, while stuttering is widely investigated, research involving cluttering is rarer. A possible explanation for this is the difficulty in making the diagnosis of this disorder, as well as the fact of lower prevalence of cluttering in relation to stuttering<sup>(1)</sup>.

Fluency is an aspect of speech production with respect to continuity, smoothness, speech rate and/or effort in which phonological, lexical, morphological and/or syntactic language units are expressed<sup>(2)</sup>. It has also been described as a multifaceted phenomenon, composed of various elements, such as disfluencies, effort/strain, speech rate and silent pauses<sup>(3)</sup>.

Therefore, cluttering as a fluency disorder presents the main manifestation of excessive disfluencies in speech<sup>(4,5)</sup>. Rapid and/or irregular speaking rate is another symptom often associated with this clinical disorder<sup>(2,4,6-10)</sup>. Another characteristic described by experts is reduced speech intelligibility due to exaggerated coarticulation or indistinct articulation<sup>(4,7)</sup>. It is also known that the temporal aspect of speech, or speech rate, interferes on the intelligibility of speech.

Clinically, cluttering is the presence of normal disfluencies in a quantity that draws the listener's attention<sup>(2)</sup>. In a study that investigated the disfluencies of two youths clutterers, the authors reported that the most common disfluencies were interjections and revisions<sup>(11)</sup>. These disfluencies seem to highlight questions related to the linguistic formulation of phrases or pronunciation of words. Some experts believe that these disfluencies occur when the person who clutter (PWC) speaks too rapidly, rendering an insufficient amount of time for the individual to organize and formulate utterances<sup>(9)</sup>.

The manifestations of cluttering are more likely to be perceived during the speaking task that is more spontaneous, informal, less structured, more linguistically complex, involving more emotion and more depth<sup>(12)</sup>.

Therefore, cluttering is a complex disorder with a broad spectrum of manifestations. In addition to the changes in speech, the language can be confusing<sup>(2,6,7)</sup>. The person who clutter (PWC) often has little or lack of self-awareness of the disorder<sup>(2,4)</sup> and can also have manifestations in writing language and difficulties in prosody, among other characteristics.

Thus, the literature<sup>(2,6,8-10)</sup> presents information on the manifestations of cluttering, but few studies investigating the relationship between these manifestations. Therefore, this study aims to correlate the speech rate with the speech disruptions in a group of persons who clutter (GI), comparing them with a group of persons who not clutter (GII).

## METHODS

This study was approved by the Research Ethics Committee of Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP), Marília (SP), Brazil, under protocol number 0529/2010. Before participating in the study, all participants (as adults) or guardians (if under 18 years) signed a consent

form in compliance with Resolution 196/96 of the National Health Council/Brazilian Ministry of Health.

The sample consisted of 14 individuals, eight female and six male, aged between 8 years and 40 years and 11 months (mean=34.5 years), divided into two groups, paired by age and gender.

GI was composed of seven persons who clutter (PWC), without any other associated communicative, cognitive or neurological deficit, who sought speech-language therapy at the Fluency Studies Laboratory (LAEF) of the Department of Speech-Language Pathology and Audiology of UNESP/Marília.

The inclusion criteria for GI were: (a) speech disorder complaint, rapid speech rate, by parents (in cases of children or adolescents) or by the individuals themselves (adults); (b) present speech disfluency, with an excess of normal disfluencies (above 10%); (c) present less than 3% of stuttering-like disfluency (SLD) to eliminate the possibility of concomitant stuttering; (d) present little or no concomitant physical effort or tension in speaking; (e) speech rate outside the references values for age and gender<sup>(13)</sup>, and; (f) score above 120 on the Predictive Cluttering Inventory<sup>(12)</sup>, because according to the author, preliminary data above this score suggests a diagnosis of cluttering.

GII was composed of seven persons who not clutter (PWNC) or fluent persons with no disfluency complaints (current and prior) by family members, teachers and/or the individuals themselves and without any communicative, neurological or cognitive deficit according to collected data. The inclusions criteria for GII were: (a) present less than 10% of normal disfluencies and 3% stuttering-like disfluency (SLD), and; (b) no family history for cluttering and/or stuttering.

A speech sample of each participant containing at least 200 fluent syllables was obtained from a visual stimulus of picture. The individual speech could only be interrupted (with questions and comments) when there was a need to encourage production to achieve the required number of syllables for analysis. Each conversational sample was recorded for analysis and comparison of the findings, using a Sony® Digital Handycam and tripod. After the speech sample of the participants was collected, a transcript was made considering both fluent and non-fluent syllables.

To characterize the typology, frequency of disfluencies and speech rate, the Speech Fluency Assessment Protocol<sup>(14)</sup> was used in accordance with the following description:

- Common or normal disfluencies: hesitations, interjections, revisions, unfinished words, word repetitions, segment repetitions and phrase repetitions;
- Stuttering-like disfluencies (SLD): syllables repetition, sounds repetitions, prolongations, blocks, pauses and intrusions of sounds or segments.

The frequency of speech disruptions or the percentage of speech discontinuity was calculated from the count of all disfluencies. The speech rate was measured according to the protocol used, characterizing the flow of syllables and words per minute<sup>(14)</sup>.

Individuals were diagnosed as clutterers according to

**Table 1.** Intergroup comparison in relation to speech discontinuity and the flow of syllables and words per minute

Variable	Group	n	Mean	SD	Minimum	Maximum	Median	p-value
Speech intelligibility	GI	7	13.50	1.58	11.00	15.50	13.50	0.002*
	GII	7	6.36	0.80	5.00	7.50	6.50	
SPM	GI	7	295.28	53.16	213.00	375.10	273.00	0.034*
	GII	7	247.62	48.51	153.85	255.79	220.43	
WPM	GI	7	179.43	26.30	150.00	257.14	175.70	0.001*
	GII	7	141.35	27.57	99.23	180.00	123.50	

\* Significant values ( $p \leq 0.05$ ) – Mann-Whitney U test

**Note:** GI = group of persons who clutter; GII = group of persons who not clutter; N = number of individuals; SD = standard deviation; SPM = syllables per minute; WPM = words per minute

manifestations of the disorder considered mandatory by leading authors on the subject, which are rapid speech rate and an excessive normal disfluencies obtained in the fluency assessment<sup>(2,7,9,10)</sup>.

### Data analysis

The collected data were statistically analyzed by applying the Mann-Whitney Test, in order to verify possible differences between groups for the variables of interest. The correlation between speech rate and speech disruption frequency was performed using the Spearman correlation coefficient ( $r$ ), which measures the degree of association between two quantitative variables of interest. The coefficient ranges from -1 to +1, considering the closer these two extremes, the greater the linear association between variables. The significance level adopted in this study was  $p=0.05$ .

### RESULTS

The results obtained by comparing the three measures analyzed (percentage of speech discontinuity, and flow of syllables and words per minute) showed difference between groups. GI showed approximately twice as many disfluencies and a greater flow of syllables and words per minute than GII (Table 1).

Table 2 shows the correlation between speech rate (syllables and words per minute) and the speech discontinuity of individuals in GI and GII. Note in the table that the correlation coefficients ( $r$ ) were positive for both groups, showing that the

**Table 2.** Correlations between speech discontinuity and speech rate (syllables and words per minute)

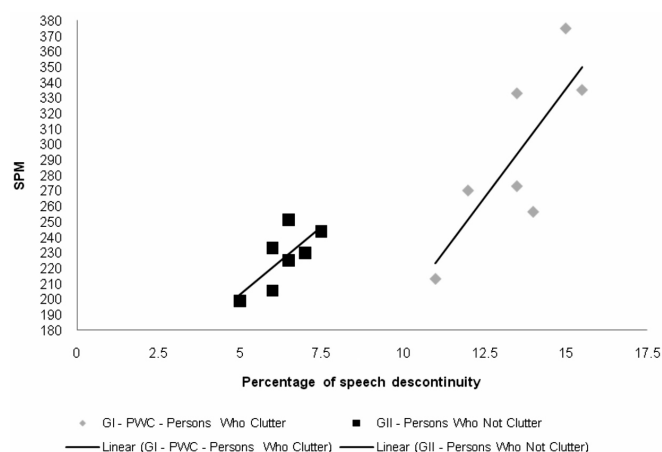
Groups	Variable pairs	Correlation coefficient ( $r$ )	p-value
GI	Speech discontinuity x SPM	+0.739	0.058
	Speech discontinuity x WPM	+0.541	0.210
GII	Speech discontinuity x SPM	+0.927	0.003*
	Speech discontinuity x WPM	+0.782	0.038*

\* Significant values ( $p \leq 0.05$ ) – Spearman's correlation coefficient

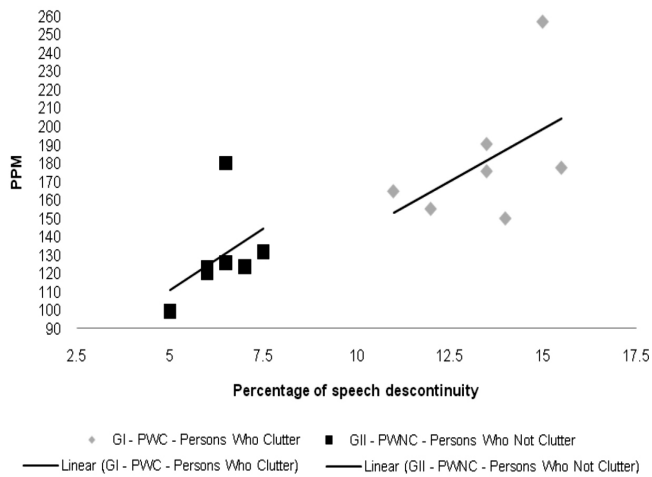
**Note:** GI = group of persons who clutter; GII = group of persons who not clutter; SPM = syllables per minute; WPM = words per minute

two opposing variables, the speech rate and speech discontinuity, present “parallel” behavior, or in other words, the higher the rate of speech, the greater frequency of disruptions. Thus, in both the persons who or not clutter there appears to be a correlation between the increase in speech rate and increased disfluencies. However, the correlation was only significant in the group of persons who clutter (GII).

Figure 1 shows that the greater the flow of syllables per minute (SPM), or otherwise known as articulation rate, the greater the number of speech disruptions, both in persons who or not clutter. For example, a person who not clutter with a flow rate of 243.8 SPM showed 7.5% of disfluencies whereas another person who not clutter with a flow rate of 198.7 SPM showed 5% of disfluencies. Nevertheless, the correlation was significant only for the group of persons who not clutter.

**Figure 1.** Correlation between the values of speech discontinuity and syllables per minute (SPM)

Regarding the flow of words per minute (WPM), which indicates the rate of information produced by the speaker, statistical analysis indicated that the more words produced per minute, the more speech disfluencies occurred in persons who or not clutter (Figure 2). For example, a person who clutter with a flow rate of 190.5 WPM, showed a total of 13.5% of disfluencies, while another person who clutter with a flow rate of 155.2 WPM had a total of 12% of disfluencies. However, the correlation was significant only for the group of persons who not clutter.



**Figure 2.** Correlation between the values of speech discontinuity and words per minute (WPM)

## DISCUSSION

This study examined the correlation between the main clinical manifestations of cluttering: speech disruptions and rapid speech rate. To conduct this analysis, measures were initially taken of the frequency of speech disruptions and the flow of syllables and words per minute. In accord with previous studies, persons who clutter showed a higher occurrence of speech disruptions, mainly characterized by normal disfluencies<sup>(2,4,5,7,8,10)</sup>.

The results found in this study agree with findings in the literature<sup>(2,4,8-10)</sup>, which reveal that persons who clutter present a rapid speech rate. Both SPM and WPM were higher in the group of persons who clutter, compared to the group of persons who not clutter. In other words, both the articulatory rate (SPM) and the production of information (WPM) were increased in the group of persons who clutter.

A review of the literature highlights, in addition to the importance of objective measures of disfluencies and speech rate for completing the diagnosis of cluttering, the need to prioritize a reduction and control of speech rate in therapy<sup>(7)</sup>. It is believed that the decrease in speech rate will result in the promotion of fluency, as well as the improvement in speech intelligibility. However, the literature also points to the lack of a correlation between speech rate and frequency of speech disruptions of persons who clutter.

In this respect, the development of this study allowed us to state that there is a positive correlation between speech rate and speech disruption frequency, both for persons who or not clutter, showing “parallel” behavior for these variables<sup>(15)</sup>. This finding has an important clinical implication, since it reinforces the need to prioritize the therapy of persons who clutter the reducing the speech rate. On a review of the literature, we found no studies to compare these results with.

The reduction of speech rate provide more time for the brain to process the speech, which provide for the person who clutter more time to organize thoughts, for the lexical access, to improve articulatory accuracy and amplitude, thus facilitating the reduction of normal disfluencies and increasing speech intelligibility.

Another important note refers to the fact that correlation was significant only in the group of persons who not clutter. In the group of persons who clutter, other variables likely act together so that they have excessive normal disfluencies. Researchers have stressed that cluttering presents other dimensions changed beyond speech, such as language, articulation and prosody<sup>(12)</sup>, which are possibly interrelated and determine the fluency or disfluency in the speech of persons who clutter.

Thus, the results of this study reinforce the need for a broad look into cluttering, directed to the various dimensions of communication, whether oral language, writing language or listening skills in the diagnostic process, thereby providing more effective therapy.

We believe that this study is extremely relevant in the area of fluency disorders, since little is specifically written in the literature on this topic, signaling that the findings described here may contribute to the scientific knowledge in speech-language pathology and related areas.

## CONCLUSION

Through this research we can conclude that persons who clutter present a rapid speech rate and excessive normal disfluencies as well as it occur a tendency of the greater frequency of normal disfluencies as the higher the speech rate. However, in the comparative analysis between the group of persons who clutter and persons who not clutter, the results show that the correlation was significant only in the group of persons who not clutter.

It is important to stress that to determine the objective values of the frequency of speech disruptions and speech rate, as well as understand the correlation that exists between these variables are important aspects of the diagnosis of cluttering. The assessment of language, articulation and prosody is also fundamental to aid in the diagnosis and treatment planning for persons who clutter, considering that the disorder is complex.

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