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Методика

SPEECH DISFLUENCIES OF PRESCHOOL-AGE CHILDREN WHO DO AND DO NOT STUTTER

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Abstract. The purpose of the present study was to determine (i) the frequency of normal disfluency (ND) and stuttered disfluency (SD) in young children who stutter (CWS) and who do not stutter (CWNS) and (ii) whether SD serves as a risk factor for stuttering in CWNS. Participants were 30 preschool-age CWS (n = 14) and CWNS (n = 16). The speech (dis)fluency of all participants was measured from 100 words selected from samples of each child's conversation and storytelling using the Vanderbilt University (Nashville, TN, USA) Disfluency Count Sheet. Results indicated that CWS, when compared to CWNS, significantly differed in stuttered but not in non-stuttered disfluencies. Within-group analysis indicated that CWS exhibited a significant relation between total speech disfluencies and an index of stuttering severity and that a relatively few CWNS (n = 4) exhibited a percentage of total and stuttered disfluencies within the lower ends of the distribution for CWS. Findings appear to suggest that inclusion of the Vanderbilt Disfluency Count Sheet as part of a comprehensive diagnostic assessment of childhood stuttering helps fine-tune such assessment through consideration of both ND and SD in a child's speech as well as the ratio between these measures of disfluency.

Keywords: speech disfluency; normal disfluency (ND); stuttered dysfluency (SD); disfluency measures; preschool children; childhood stuttering; stuttering severity

Introduction

The term "stuttering" may be used as a diagnostic label as well as a description of speaking behavior. As a diagnostic label, stuttering refers to a complex, multidimensional composite of behaviors, thoughts and feelings of persons who stutter (Yaruss and Quesal, 2004). As a descriptor of behavior, stuttering refers to disruptions in the forward flow of speech-language planning and production such as sound/syllable repetitions (e.g., "so-so-so-some") or sound prolongations (e.g., "ssssome)." Whether referring to the diagnostic label or descriptor of behavior, the onset of the disorder is typically during early childhood. Therefore, increasing our

knowledge of those factors that contribute to the onset of stuttering during early childhood is essential to better understanding, diagnosing and treating the problem.

Research to date strongly suggests that speech disfluencies are central features of stuttering or "stuttering moments" in childhood (e.g., Conture, 2001; Curlee, 2007) and such sound/syllable repetitions, monosyllabic word repetitions, sound prolongations, and tense pauses are often perceived to be associated with excessive muscle tension (e.g., Johnson, 1955; Gregory, 1986; Van Riper, 1982; Yairi, 1997). Furthermore, children's speech disfluencies have been considered not only from the standpoint of disorder, but as a stage of normal speech development (e.g., Filatova, 2003; Colbrun, 1985; Myers, 1998; Starkweather, 2002; Yaruss, Newman, & Flora, 1999).

In the Russian literature, Levina (1981) was the first to consider speech disfluency a normal part of speech maturation in children. More recently, Belyakova and colleagues have reported age-specific changes in speech disfluency during early childhood—changes commensurate with normal speech development (Belyakova & D'yakova, 2003; Belyakova & Filatova, 2008). In children between the ages of 1½ and 2½ years, they identified only a small number of speech disfluencies, mainly associated with repetitions of isolated sounds or their combinations, and prolonged pauses between words. In children between the ages of 2½ and 3½, they observed a substantial increase, not only in the number of speech disfluencies, but also in the type disfluency. Beside sound/syllable repetitions, prolonged pauses, and breathing iterations, the children began to produce whole-word repetitions and revisions. Finally, for children between 3½ and 5 years of age, there was a reduction in the number of types of speech disfluencies, with whole-word repetitions, between-word pauses, revisions, and interjections remaining the most common. This apparent trajectory of changes of speech disfluencies has been taken to suggest that for children aged 2½ to 3½ years, the functional system of oral speech is being intensively developed. This may render the functional speech system "hypersensitive" to various endogenous and exogenous factors for children of this age (Belyakova & Filatova, 2008, 2018; Belyakova, Goncharova, Filatova, & Xatnukova-Shishkova, 2017) as, for example, when they are repeatedly interrupted by others.

The measurement of stuttering behavior has a long history in the literature (e.g., Johnson et al., 1959; Conture & Kelly, 1991; Yaruss et al., 1997; Curlee, 2007; Tumanova, Conture, Warren, & Walden, 2017). Among others, Pellowski and Conture (2002), and Yairi and Ambrose (2005) differentiate the various types of speech disfluency into: 1) normal disfluencies (ND) that include phrase repetitions, fillers or interjections, revisions, and tense pauses occurring *between* words; and 2) stuttered dysfluencies (SD) that include sound/syllable repetitions, monosyllabic whole-word repetitions, sound prolongations, and "blocks" *within* words.

In Europe, Great Britain, and United States, various assessment instruments have been employed, including Systematic Disfluency Analysis (Campbell & Hill, 1987), the Assessment of Child's Fluency (Rustin, Botterill, & Kelman, 1997), the Stuttering Severity Instrument (SSI) for Children and Adults (Riley, 1994, 2009), the Computerized

Scoring of Stuttering Severity (Bakker, 2009) and the Test of Childhood Stuttering (TOCS; Gilliam, Logan, & Pearson, 2009). Of these tests, the SSI is most widely used internationally, and seemingly is a valid as well as reliable index of stuttering.

Given the importance of test accuracy, reliability and validity, Bulgarian researchers have selected those stuttering assessment instruments that appear to be most valid as well as reliable for measuring outcomes before, during and after treatment (Georgieva, 2010). Likewise, Russian researchers (e.g., Belyakova & D'yakova, 2003; Vlasova & Bekker, 1983) have employed a methodology that permitted them to develop a relatively comprehensive measure of childhood stuttering. Nonetheless, at present, there is no universally accepted method for assessing the severity of stuttering. This may account for the fact that quantitative assessment of the frequency of "stuttering moments" may not correspond to the more qualitative assessment of stuttering severity.

There also remains a lack of clarity regarding the differential diagnosis of speech disfluency in children who stutter (CWS) versus children who do not stutter (CWNS) (Tumanova, Conture, Warren, & Walden, 2014). There is no commonly agreed upon or unified means for assessment of the various types of speech disfluency. The heterogeneity of disruptions in the tempo, rhythm, and fluency of speech and the differing methods used to measure them only serve to compound the problem further. Hence, there is a need to develop more consistent means for determining children's stuttering severity.

Aim of the study

The aim of the present investigation was to determine (1) the frequency of ND and SD in young CWS and CWNS and (2) whether SD serves as a risk factor for stuttering in CWNS.

Participants

Thirty preschool-age children served as participants. The participants' ages ranged between 4½ to 6½ years (mean age = 5 years, 8 months). Inferential analysis indicated no significant between-group (i.e., CWNS vs. CWS) difference in chronological age ($U = 73.0$, $p < 0{,}109$). All participants exhibited no hearing or visual impairment and had no cognitive impairment based on their medical history and an interview with a speech-language therapist.

Of the 30 participants, sixteen were CWNS (with the Male to Female ratio = 1:1) and fourteen were CWS (with the Male to Female ratio = 4:1). All 16 CWNS attended two kindergartens in Moscow and all 14 CWS attended special groups for children with speech and language disorders associated with the same kindergartens from two Moscow districts.

The severity of each CWS's stuttering (i.e., mild, moderate or severe) was determined using a scale of stuttering severity (Belyakova & D'yakova, 2003). *Mild*

severity of stuttering was determined when "stuttering moments" were observed only in spontaneous speech; *moderate* severity of stuttering was determined when the "stuttering moment" are presented during both dialogue and monologue; and severe stuttering was determined when the "stuttering moments" are observes in all types of speech including speaking in unison and modeled speech. Using the Belyakova and D'yakova (2003) scale of stuttering severity, three of the CWS were classified as mild, ten as moderate, and one as severe.

Method

Using an IPhone 7 voice recorder, each participant was audio recorded during a 20-to-30-minute session. Each spoke during conversation and while storytelling (i.e., describing a set of pictures). Subsequent to recording, a 100-word sample was obtained for each participant from both the conversational dialogue and the storytelling monologue. This resulted in a total of at least 200 words spoken for each of the 30 participants.

The qualitative analysis of speech disfluencies was conducted in 3 stages:

Stage 1: *Counting Total Disfluencies*. Based on listening to the audio recording of each subject's two speech samples (conversation and storytelling), the total number of spoken words, number of disfluent words and the determination of the total percentage of disfluency (TD, %).

The percentage of *TD* was calculated by the formula:

$$\frac{\text{Total Disfluent Words}}{\text{Total Words Spoken}} \times 100\ \% = \text{TD}\ (\%)$$

Stage 2: *Counting Total SD and ND.* Based on listening to the audio recordings of each subject's two speech samples the total percentage of SD (%, total SD) and total percentage of ND (%, total ND).

The percentage of *SD* was calculated by the formula:

$$\frac{\text{SD}}{\text{TD}} \times 100\% = \text{Total SD}\ (\%)$$

The percentage of *ND* was calculated by the formula:

$$\frac{\text{ND}}{\text{TD}} \times 100\% = \text{Total ND}\ (\%)$$

Stage 3: *Counting Disfluency Types in Speech Samples*. Determination of types of SDs and NDs in speech samples and counting the percentage of each type of disfluency (DT) for the predominant DT identification.

The percentage of each type of disfluency was calculated by the formula:

$$\frac{\text{Frequency of type of disfluency}}{\text{TD}} \times 100\ \% = \text{DT}$$

The audio recordings for each participant were transcribed on the Vanderbilt University Disfluency Count Sheet (Conture, 2001) to derive the % of total dysfluencies (TD), the % of SD (sound repetitions, SoR; syllable repetitions, SyR; whole word repetitions, WWR; sound prolongations, SP; stuttering moments, SM); and % of ND (phrase repetitions, PR; interjections, INTJ; revisions, REV, and others).

Data analysis

A Mann-Whitney *U*-Test was used for inferential analysis between-group difference in chronological age. A criterion Yates corrected Chi-square was used to determine: i) between-group (CWS vs. CWNS) differences in TD, SD and ND; and ii) within-group (mild, moderate, severe stuttering) differences in TD, SD and ND. The statistical analysis was made using Statistica 10.0.

Results and discussion

Between-group analysis

Between-group differences in TD. Findings indicated that CWNS exhibited significantly lower *TD* (8.8%) than CWS (29.5%) ($\chi^2 = 301.03$, $p < .0001$).

Between-group differences in ND and SD. As shown in Figure 1, there was no significant between group difference in normal disfluencies between CWNS (6.5%) and CWS (7.8%; $\chi^2 = 0{,}6$, $p = .8075$). However, CWNS exhibited significantly lower *SD* (2.3%) than CWS (21.7%) ($\chi^2 = 459.53$, $p < .0001$) (See Figure 1).

Within-group analysis

Relation of TD to stuttering severity. In general, the number of speech disfluencies observed in CWS was closely related to their severity of stuttering. Specifically, for CWS there were significant relations between TD and severity level: TD for those with a mild degree of stuttering was 22% (mild/moderate – $\chi^2 = 5.15$, $p < .00232$), those with a moderate degree 25% (mild/severe – $\chi^2 = 17.26$, $p < .0001$, and those with severe stuttering degree 34% (moderate/severe – $\chi^2 = 9.90$, $p < .0017$).

Results and analysis of types of dysfluencies

Within the group of CWS, the most commonly observed speech disfluences were SD (21.7%) like: (i) syllable repetitions, SyR (29%), (ii) sound repetitions, SoR (21%), and (iii) prolongations, SP (15%) (Figure 2).

Within the group of CWNS, the most commonly observed speech disfluencies were revisions, REV (28%), pauses (25%), and interjections, INTJ (15%) (Figure 3). In a same group of CWNS, SD manifestations were represented in small quantities in the form of sound repetitions (10%), syllable repetitions (8%), prolongations (6%), and whole word repetitions (5%). It was not observed any 'stuttering moments' in this group of children. Even though the authors did not judge the CWNS to exhibit a 'stuttering moments' a relatively large number of SDs were observed in four CWNS (Table 1). The four participants were identified as risk cases for possible stuttering development.

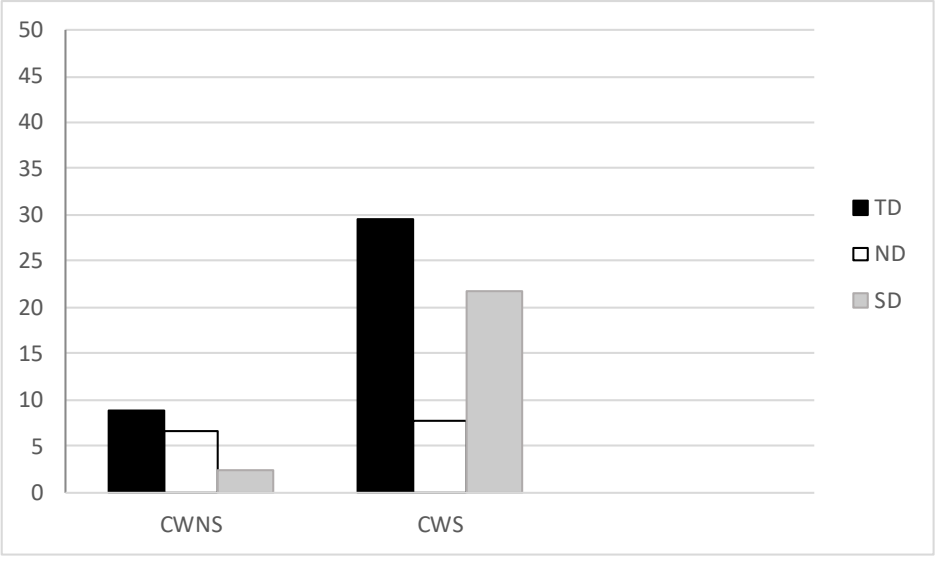

Figure 1. Total % disfluencies (*TD*), normal % disfluencies (*ND*), and % stuttered dysfluencies (*SD*) for children who do not stutter (n = 16; CWNS) and children who stutter (n = 14; CWS)

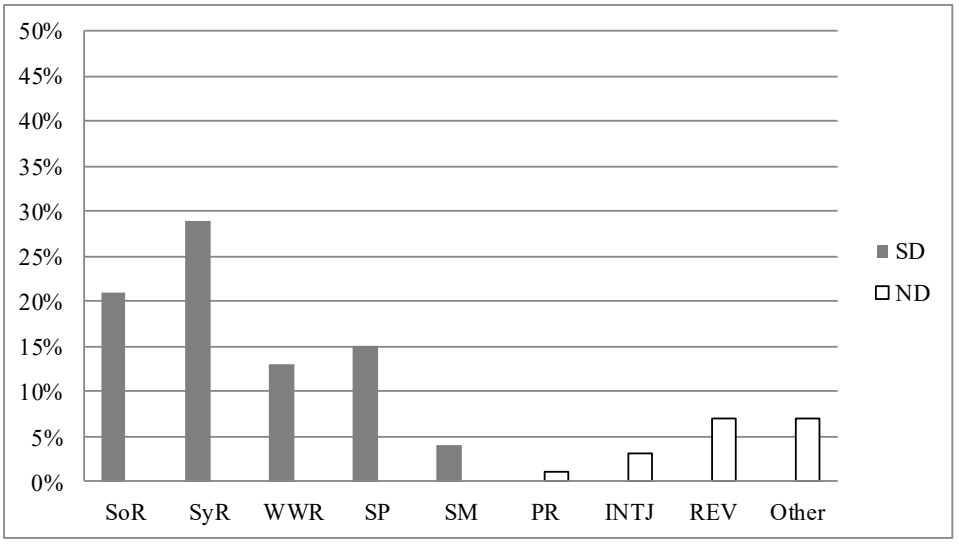

Figure 2. Percent (%) CWS's different types of disfluencies (SD and ND)

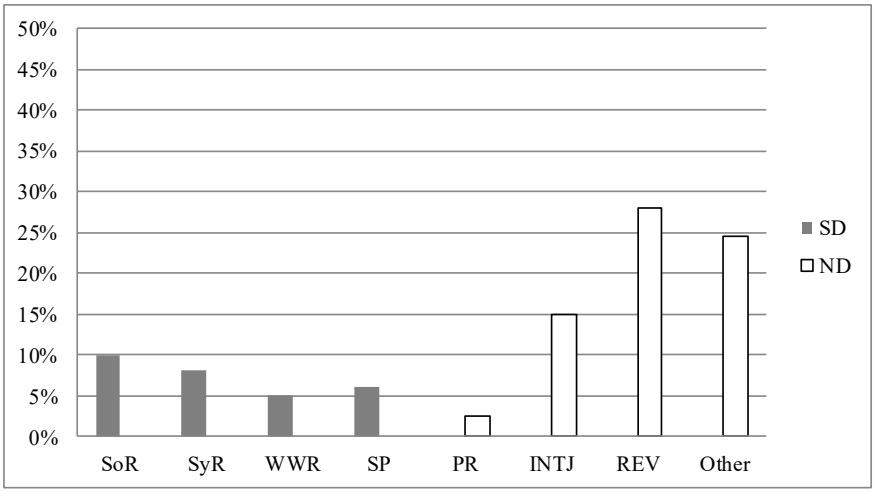

Figure 3. Percent (%) CWNS's different types of disfluencies (SD and ND)

Table 1. Individualized results of TD, ND, and SD of children of four CWNS with some apparent risk of stuttering

Participants, CWNS	Age (yrs.)	TD (%)	ND (%)	SD (%)
1	5,5	16	5	11
2	5,7	13	6.5	6.5
3	4,8	15.5	7	8.5
4	5,6	14	5	9

Data indicated that CWS demonstrated mostly SDs in the form of sound and syllable repetitions, and prolongations (within-word atypical stuttered dysfluencies, Conture, 2001), whereas CWNS mostly demonstrated ND such as revisions, pauses and interjections which are presented in small quantities. According to Conture (2001), these types of disfluencies are between-word typical non-stuttered speech disfluencies. In our experience, these types of disfluencies are a part of the process of language acquisition (Filatova, 2012, 2018). Regarding the 4 CWS whose SD represented a relatively large percentage of their TD, one might suggest that these children are at some risk to develop stuttering. The identification of such types of disfluencies, with reference to their TD, would appear to be quite important in terms of the process of stuttering prevention.

Conclusion

The following three conclusions may be derived from the present findings:

Between groups: Stuttered speech disfluencies were significantly different between CWS and their normally fluent peers, as is consistent with clinical

experience and various criteria used to distinguish the two talker groups. It also is consistent with the notion that listeners, when they judge a person as stuttering, are reacting to instances of speech disfluency that are outside the region of normal speech disfluency. There were no significant group differences in non-stuttered speech disfluencies.

Within the CWS group: There was a significant relationship between total speech disfluencies and an index of stuttering severity in CWS. Not only SDs distinguished between CWS and CWNS. However, this second implication refers more to *within-group* distinctions in stuttering severity rather than *between-group* distinctions in stuttered disfluencies. Using both measures, that is, stuttered disfluencies and total disfluencies during a diagnostic assessment would appear to make such an assessment more comprehensive as well as differential.

Within the CWNS group: A relatively small number of CWNS (n = 4) exhibited a percentage of total and stuttered disfluencies that place them within the lower end of the distribution for CWS. It is not immediately apparent how to interpret this, but further study, using other measures of speech (dis)fluency (such as the sound prolongation index [i.e., the percentage of stuttered disfluencies consisting of sound prolongations; Schwartz & Conture, 1988]) may help better distinguish this small group of CWNS from their CWS peers.

It is important to note that several categorization models of children's speech disfluencies have been developed over the years (e.g., Johnson, 1959; Yairi & Ambrose, 2005; Conture, 2001; Yaruss, LaSalle, & Conture, 1998). Such models consider the types of speech disfluency known to be most apt to be associated with instances of stuttering (e.g., sound/syllable repetitions, revisions) in order to assist discerning the differences between CWS and CWNS. The present findings suggest including the Vanderbilt University Disfluency Count Sheet as part of a comprehensive diagnostic assessment of childhood stuttering may help fine-tune such assessment through the consideration of both ND and SD in a child's speech as well as the ratio between these measures of disfluency.

By determining the ratio of ND to SD in CWNS, it may be possible to identify children at risk for developing stuttering. The specific nature and frequency of speech disfluency in young children can contribute important diagnostic information about (ab)normal development of speech fluency. Further, application of the SD/TD ratio for CWNS may contribute to determining whether a child is at greater or lesser risk for developing stuttering, which may create an opportunity to provide preventive support for the occurrence of stuttering in these young children.

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