EFFECT OF SPEECH SAMPLE SIZE ON THE FREQUENCY OF STUTTERING LIKE DISFLUENCIES (SLDs) IN ADULTS WHO STUTTER

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(Speech-Language Pathology)

University of Mysore

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May 2019

Certificate

This is to certify that this dissertation entitled "**Effect of speech sample size on the frequency of stuttering like disfluencies (SLDs) in adults who stutter"** is a bonafide work submitted in part fulfillment for degree of Master of Science (Speech Language Pathology) of the student Registration Number: 17SLP025. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree

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This is to certify that this dissertation entitled "**Effect of Speech Sample Size on the frequency of stuttering like disfluencies (SLDs) in adults who stutter"** has been prepared under my supervision and guidance. It is also being certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree

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Declaration

This is to certify that this dissertation entitled "**Effect of speech sample size on the frequency of stuttering like disfluencies (SLDs) in adults who stutter"** is the result of my own study under the guidance Dr. Santosh. M, Associate Professor, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree

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DEDICATED TO

MY DEAR FAMILY

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CHAPTER 1

INTRODUCTION

The purpose of assessment is to know the nature of a presenting disorder and related communication difficulties, based on that appropriate treatment goals may be followed. A diagnosis is the end result of assessment. Diagnosis is the identification of a particular condition. A classic diagnostic aim is to differentiate a patient's condition from other potential clinical problems. The general component of the assessment of stuttering involves collecting background and case history details, speech sample from many different speaking contexts, analysis of the collected sample of speech, assessing the stuttering severity of speech, evaluating further communication difficulties and detecting the factor which leads to that difficulty. Further, assessing the emotions associated with speaking and stuttering, and other elements affecting a person's personal, social, and career life are also done (Yairi & Seery, 2015).

Due to the multidimensionality of stuttering disorder, it is essential to broaden the assessment a far from the speech domain. Speech language clinicians should be ready to view the "etiologies, characteristics, anatomical/physiological, acoustic, psychological, developmental and linguistic and cultural correlates" of fluency disorders (ASHA, 2008b). During stuttering assessment and treatment, a multidimensional approach is required to be followed through which the qualitative factors can be measured. Research reports that self-esteem and emotional stability are reduced in adults who stutter (Klompas & Ross, 2004).

Despite the comprehensive and multilayered evaluation procedure, the stuttering assessment can be minimized to two basic principles. First, the person with stuttering who highly changes the choices and limit the available options in life, the more stuttering impact are likely to be. The objective of assessment is to determine the extent of such modified decision making in

all its form. The second principle of the assessment has to focus on many forms of effort and struggle behavior. If a person reacts more to his or her stuttering by attempting to prevent it from happening, that person will have a greater effect of the difficulty. In order to rule out anticipation of stuttering, a person follows many strategies of speaking like avoiding the speaking situation, reluctance to speak and replacement of words (Jackson, Yaruss, Quesal, Terranova, & Whalen, 2015). The surface features of stuttering which has to be determined are categorized into three basic categories; frequency, duration, and tension.

Frequency

The frequency of disfluencies is one of the apparent aspects of the difficulty and it also impacts the severity. The percentage of stuttered syllables or stuttered words is the most common way to compile the frequency of disfluency (Brundage, Bothe, Lengeling, & Evans 2006). Along with this, severity ratings (SR) are used most commonly to quantify stuttering severity (Wingate, 1977). The essential part of assessment and outcome quantification is a tabulation of the frequency of stuttering which is valid and reliable, many clinician and researchers agree to it (Brundage, Bothe, Lengeling, & Evans 2006). Depending on the speaking situation and the chosen material for reading, the percentage of stuttered syllables or stuttered words is going to vary. Persons with stuttering who try to avoid and substitute words perhaps have more stuttering frequency during reading aloud since the chances of substituting and avoiding the sounds and words are less (Manning, 2001).

Tension and duration

Stuttering in its most basic form described as "speech transformed by tension and fragmentation" (Bloodstein, 1993). There are also chances of a stuttering "block" when there is greater level of tension. During block the occlusion of vocal tract happens and cessation of both airflow and voicing takes place. Since the tension and duration are closely associated, simple duration measures can signal the occurrence of tension. The rate of speech in words or syllables per minute will also indicate about the degree of tension and disfluency duration (Manning, 2001). Factors that affect the accurate estimation of disfluencies include situational context (within clinic and outside of clinical setup), different tasks (reading, spontaneous speech, picture description, telephone conversation), language familiarity of the speaker (L1 and L2) and size of the audience.

Most common clinical observation is the variability in the frequency of stuttering which was reported from both clinicians and clients (Bloodstein & Ratner, 2008; Van Riper, 1971). Variability is one of the hallmarks of stuttering. Persons who stutter hardly make all possible stuttering behaviors, though few who stutterer perhaps not even show the usual characteristics (Barr, 1940). The event of stuttering varies both across and within person who stutters. The severity and types of stuttering event can change in different situations and time within the same individual. In children and adult who stutter to quantify day to day alteration in stuttering a speech sample size of 350 syllables is not enough (Maruthy & Sharma, 2018). The severity and types of stuttering event can change in different situation and time within the same individual. Therefore, it is useful to collect speech samples in a variety of situations in order to determine the variability range and the effect of a variety of context for a specific client are comprehended by the clinician (Yairi & Seery, 2015).

Speech sample size

There is a question as to what should be the sample size to make a reliable and valid data for stuttering analysis? Till now, only two studies (Logan & Haj-Tas, 2007; Roberts, Meltzer, & Wilding, 2009) are available on the sample size for stuttering assessment. Both these studies have compared disfluency data from different sample sizes and reported that there were no significant differences for the number of disfluencies more typical of stuttering within the speech samples covering from 300 to 1,800 syllables (Logan & Haj-Tas, 2007; Roberts, Meltzer, & Wilding, 2009). Few sources recommend a modest 200 syllables for every context of speaking: conversation and oral reading (Riley, 1994), collecting sample of 300 to 400 words (Shapiro, 1999). Some authors suggested 3 to 5 minutes of speaking time (Roberts, Meltzer, & Wilding, 2009; Ward, 2006), size of speech sample was not specified by many sources (Manning, 2001). The research done in preschoolers who stutterer indicate fluency variation within the sample (Sawyer and Yairi, 2006). In their study, they obtained conversational samples which contain 1,200 syllables and observed that compared to the first 300 syllables sample segment stuttering like disfluencies (SLD) were more in the last segment of 300 syllables. They finalized that when doing fluency evaluation in preschoolers, clinicians should collect long speech samples and recommended that analyzing a sample of 600 syllables may end in stuttering severity underestimation. In that study they concluded that longer speech samples, above 1,200 syllables, were essential to find all the appropriate disfluent speech behaviors and to differentiate borderline stuttering. For adolescents and adults, one cannot generalize these findings. During the oral reading situation, it is not necessary to have a longer speech sample to detect whether this state is varying from spontaneous speech samples. To reveal the stuttering severity in that context a paragraph of oral reading is frequently enough. A 200 syllables passage provides more representative data to obtain a frequency for baseline measurement (Yairi & Seery, 2015).

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During the collection of the adult speech sample, it requires a minimum of 300 syllables or words in conversation or monologue. The rational is that if the measure will be per 100 units, then 300 is 3 times more than the sampling unit basis. Minimum 3 data points are needed to make a trend during baseline measurement (Barlow, Hayes, & Nelson, 1984). In contrast, at least 600 syllables required for assessment recommended by Yairi and Ambrose (2005). They indicate that to sample certain disfluency types adequately larger speech sample size is essential. They assert that "it is advisable to have at least three tokens for any given type of disfluency". Just one could be random, two are insufficient to identify a pattern or obtain a mean, but three indicate that the behavior is more than a fluke, presenting some semblance of pattern or typicality". Though their research was done in young children, for adolescent and adult it may be even more crucial because to reduce their stuttering like disfluencies they may have established ways and in that case, chances of under detection of their speech difficulty is more.

Logan and Haj-Tas (2007) reported in adults who stutter, within the segments there were no significant difference in frequency of stuttering like disfluencies. They collected 1,800 syllables speech sample and divided into 6 segments which contain 300 syllables in each segment. They mentioned that by analyzing the group data, there was no significant group difference in stutter like disfluencies. There was fluctuating stuttering like disfluencies in the individual data evaluation, among the subjects the position of maximum and minimum segments of disfluencies differs

Need for the study

Overall, limited studies are done to examine the influence of size of the speech sample on the stuttering like disfluencies estimation. These details are essential to collect since it can influence the fluency evaluation's efficiency and validity. Hence, the present study is undertaken

to explore the effect of sample size on the quantification of stuttering like disfluencies in adults with stuttering.

Aim

The present study aims to investigate the effect of speech sample size on estimation of stuttering like disfluencies in adults who stutter.

Hypothesis

There is no significant difference across different speech sample sizes on stuttering like disfluencies in adults who stutter.

CHAPTER 2

REVIEW OF LITERATURE

Fluency is defined as the effortless production of long continuous utterances at a rapid rate (Starkweather, 1987). One of the most common disorders of fluency is stuttering. Stuttering refers to "disorders in rhythm of speech in which the individual precisely knows what he or she wishes to say but at the same time is unable to say it because of an involuntary repetition, prolongation or cessation of a sound" (WHO, 1977). Stuttering can arise at any age, although the onset of stuttering was reported to be between two and five years of age (Johnson, 1959; Yairi, 1983). Nearly 95% of children who stutter develop stuttering before 5 years of age (Yairi & Ambrose, 2005).

The characteristic of developmental stuttering is frequent interruptions in the continuity of speech and increased presence of disfluencies, specifically type of disfluency that creates repetition (part-word, mono syllable whole word, and syllable repetition), audible and inaudible prolongation of sound and broken words or blocks. The fundamental characteristics of stuttering are repetition, prolongations, and blocks (Guitar, 2013). In an attempt to avoid the stuttering moment, individuals with stuttering react through secondary behaviors (Silverman, 2004). During the event of stuttering, secondary behaviors occur simultaneously. They can be classified as escape behaviors and avoidance behaviors (Guitar, 2006). There is a striking distinction between stuttering in children and adults. The difference exists in the terms of type of disfluency, location of stuttering, cognitive and affective reactions towards the stuttering. Adaptation, consistency and adjacency are the three patterns that describe stuttering predictability, indicating some rules which explain that stuttering is not random like it frequently occurs to the listener. These three patterns have few clinical implications (Yairi & Seery, 2015).

Variability in stuttering

Stuttering is a disorder which is familiar for inter and intra individual variations in addition to within and across situational variations. Changes in the frequency may be associated with fluctuations in various cognitive, emotive, physical and communicative events, internal factors such as anxiety, fatigue etc., and external factors such as environmental demand for rapid, precise oral language, the reaction of others to the problem. These corresponding events interplay very rapidly as well as unpredictably. Thus it is not easy to estimate when, where and how much the frequency of stuttering increase or decrease. The frequency, type, severity, and duration of stuttering can vary. Variations also occur in related speech and non-speech behavior (Ainsworth & Fraser 1988; Conture & Caruso 1987). Stuttering also varies with respect to situations, particularly with places, language and people. Situational variability provides essential information with respect to an individual's speech outside the clinical setting (Conture & Wolk, 1990). It also gives information about social interaction that should be focused on management (Brutten & Shoemaker, 1967; Darley & Spriersterbach, 1978). Shulman (1955) mentioned that in an oral reading situation, there was reduction in the event of adaptation in stuttering, when social complexity increased with consecutive reading. He also specified about the phenomena of consistency, it was not affected by the social complexity variation in situation of oral reading and consistency phenomena. It was also found that lesser adaptation in oral reading under distributed practice conditions.

Loci and Linguistic factors in stuttering

Many research studies have been conducted to examine whether there is a constant pattern to stuttered episodes and which linguistic aspects decide if a word is more probably to be stuttered. In 1945, Brown found four basic factors that detected whether the presence of

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disfluency in a word spoken by adults with stuttering. The determinants were: (a) word class (content words are more likely to stutter than function words); (b) word length (longer words are more problematic than shorter words); (c) sentence position (initial position words are more susceptible to be stuttered); (d) initial phoneme of the word (stuttering occur more on the word starting with the consonant than those that start with vowels). Geetha (1979) investigated the linguistic variables in oral reading and conversation samples in Kannada. These results also supported Brown's earlier findings. In her study it was found that stuttering occurred more in content words than function words. Presence of stuttering in consonants was more compared to vowels. Repetition of syllables found most frequently followed by word repetition. Jayaram (1984) investigated the stuttering distribution in the sentence in terms of length of sentence and position of the clause and found that stuttering always occurred at the clause beginning regardless of length of sentence and clause position. It was mentioned that speech breakdown occurs due to speech motor planning demands, which arise specifically at the sentence beginning.

Various measures of Stuttering like disfluencies

Stuttering like disfluencies include syllable repetitions, blocks and prolongations (Yairi, 2007), whereas nonstuttered (typical) disfluencies include hesitation, interjections, multi-syllabi whole word repetition and phrase repetition or revisions (Ambrose &Yairi, 1999; Tumanova, Conture, Lambert, & Walden, 2014). Frequency of the stuttering like disfluencies is an important measure in stuttering. The frequency of stuttering is usually indicated as number or percentage of moments of stuttering or stuttered words or syllables. Bloodstein (1944) analyzed oral reading of stuttering individual and found that the occurrence of stuttering on a mean of 10.8% of the words and ranged from 0 to 47% of words stuttered. Another measure of the stuttering is the

mean duration of stuttering. There is variation in the duration of stuttering block which vary within a few seconds. For those with severe stuttering it may rarely be noticed to extend for longer than a minute. Johnson and Colley (1945) concluded that the total mean of the longest blocks was 0.41 seconds. Another objective measure in the estimation of fluency is the speech rate. Syllable per minute (SPM) is the measure which is used for measuring the rate of speech. When the severity of stuttering increases the rate of speech decreases (Andrade & Sassi, 2003). Person with stuttering reacts to their stuttering like disfluencies (repetitions, prolongation and blocks) by trying to concluding them rapidly if they cannot eliminate them. Such reactions may start as a random struggle but shortly convert into secondary and avoidance behaviors. Such reactions to stuttering shortly turn into secondary behavior (Guitar, 2006).

Size of speech sample

Speech sample contains an important source of information for the most assessment of fluency (ASHA, 1995). Person with fluency disorder mostly show variability in fluency between various contexts and tasks, and they may exhibit variability across time (Ingham & Riley, 1998; Yaruss, 1997). Even though speech sample may not be collected in a variety of situations outside the clinical setting, clinicians can get a situational anxiety hierarchy from clients in order to find out how the adult's fluency of speech was influenced by a variety of speaking situations (Silverman, 1996). The clinician must elicit a set of samples of speech to get an accurate fluency profile of the client. Speech sample can take many patterns: structured or unstructured, formal or informal; spontaneous or rehearsed; each method has its merits and demerits and subsequently, each has its position in the assessment of fluency. In fluency assessment clinicians regularly use conversation as a task for sampling of speech. The matter of how much utterance would be

adequate to enhance the recognition of disfluencies or to investigate its features, such as frequency and degree of stuttering, in a complete and appropriate way, is valuable.

Suggestions for eliciting speech samples in general have highlighted that samples must contain an adequate number of features decided for examination and that bigger speech samples with different context improve reliability (Lahey, 1988; Lund & Duchan, 1993). As van Riper (1982) recommended, "it is also necessary to obtain a speech sample adequate in length for frequency count". Conture (1990) mentioned that to adequately assess variations in stuttering, a 300-word sample was adequate for averaging around a sample of 100-words. Yaruss (1997b) advised examining 200-syllable speech sample elicited from four variety of situation. But the above mentioned three reports on sample size of speech were without any evidence to support the data.

Sawyer and Yairi (2006) did a study in preschoolers with stuttering to investigate the impact of sample size on the severity of stuttering. They have taken 20 preschool stuttering children (M = 43.9 months). Every child was made to interact with their parent and with the researcher, during this interaction audio and video recording was done. They elicited a speech sample with at least 1,200 syllables. Then in the collected speech sample initial 1,200 syllables were orthographically transcribed. Then the sample was segmented into 4 portions each containing 300 syllables. They used Systematic Analysis of Language Transcripts (SALT) to identify and note disfluencies. In this study, they have considered the following three stuttering like disfluencies: part word repetition, monosyllabic word repetition, and dysrhythmic phonation. For 20% of the speech samples interjudge reliability was done, and it obtained a .98 agreement coefficient. Similarly for type and location of disfluencies it was .89 interjudge reliability. They determined evidence of higher number of disfluencies in the last 300 syllables of sample than in

the initial 300 syllables of speech sample. They also recognized an upward shift in disfluency, in subgroups of subjects, when there was progression over its initial stages. The authors revealed in preschoolers that higher disfluency might have been associated with the utility of lengthy, higher complex expressions when there was progression in speech sample. They concluded the study by suggesting collecting relatively lengthy speech sample during stuttering assessment in preschoolers and they mentioned that underestimation or misdiagnosis of severity in stuttering may happen when using even 600-syllable speech sample with preschool children.

Gregg and Sawyer (2015) did a study in school going children to determine whether the frequency of stuttering like disfluency change with the length of speech sample increment and also checked if there is a significant difference in the number of disfluencies especially repetition in terms of size of sample. Subjects included for the study were 30 school aged children with stuttering in the age range from 7 to 12 years with mean age of 9 years, 9 months). They collected conversation sample when child interacting with parent and investigator. The conversation sample contains 1,200 syllables. It was transcribed and was divided into four segments. The stuttering like disfluencies was noted. They used the SALT program for analyses. The mean number of repetition units were also calculated which include part-word and monosyllabic repetition. Reliability was also checked for the data obtained. It was done by two experts who did know about the study hypotheses. For 20 % of the data interjudge reliability were obtained. It gave agreement coefficient as 0.93. The interjudge reliability for disfluencies type and location in the 20% analyzed segments was 0.89. They investigated by using the percentage-occurrence-agreement formula (Baird & Nelson-Gray, 1999). For part-word and single syllable repetition interjudge reliability was 0.90. 9 month later period they derived 0.91 values as intrajudge reliability. For the analyses of data they used one-way, repeated measure

ANOVA as a statistical measure. Results showed that when the speech sample length increases there was no significant difference in disfluencies and there was no significant change in repetition units across the samples. Finally, they conclude the study by recommending the speech language pathologist to collect speech sample from many different speech context while assessing school aged children who stutter. Through this kind of speech sample collection it gives the clinician details about the variability range and effect of various contexts on the client and also suggested for a child who stutter in the school age range, a 300 syllable sample of speech is similar to a 1,200 syllable sample

Logan and Haj-Tas (2007) studied the impact of sample size on stutter-like disfluencies in the adult population. They took ten stuttering adults with the mean age of 24 years. All the subjects were native English speakers. They used a 9-point rating scale (O' Brian, Packman, Onslow, & O'Brian, 2004). Totally in this study, there were 6 adults who had moderate stuttering, 2 adults with severe stuttering and 2 adults with mild stuttering. 4.9 is the mean rating and 1.9 is the standard deviation. The subjects were asked to speak about pleasant and unpleasant experiences and narrate about the recently seen movie or television plot. In all these topics they spoke for a minimum time of 5 minutes. If it seemed to be that they were terminating the topic early, the researcher presented an open ended prompt to speak more about it. Stuttering like disfluencies such as repetition, prolongation and block were marked on the transcripts. Number of syllables and frequency of stuttering like disfluencies were measured. Mean sample length for the subjects was 3,131 syllables and standard deviation was 780. The final speech samples were divided into portions of 300 syllables. 298.5 syllables was the mean segment of sample length across the subjects. They used one-way, repeated-measures analysis of variance (ANOVA) for analysis of group wide pattern in variation in disfluency. Single sample t-test was used to analyze

within-subject differences between sample segments with most and fewest disfluencies. Between the sample segments with the most and fewest disfluencies the criterion of more than 50% disfluency variation was regarded. The reason behind the consideration of 50% greater disfluency variation was that fluctuation of that magnitude would be more probably to have a significant effect upon the real world situation communication. Results of this study indicated that there was no significant variation in frequency of stuttering like disfluencies between the segments. Position of segments with the most and fewest disfluencies changes among the subjects. They concluded that by usually, collecting a long sample of speech was not commonly essential to identify highest disfluency level of an adult.

Overall, there are only few research studies done to investigate whether the size of speech sample is affecting the frequency of stuttering like disfluencies. This information is important because it can affect the efficiency and validity of fluency assessment. The few studies done in this issue were conducted in Western context. There is a dearth of studies in the Indian context, so there is a need for more research in Indian languages.

Kannada is a Dravidian language spoken in and around Karnataka state in south India. Like most other Dravidian languages, the phonological system comprises a number of significant contrasts that are not found in English. The most conspicuous differences are the existence of retroflex consonants and the contrasts between short and long vowels. Spoken Kannada tends to eliminate the aspirated consonants and the sibilant contrasts to some extent (Schiffman, 1979). Therefore, the current study was planned to study the effect of speech sample size on stuttering like disfluencies in adults with stuttering that had Kannada as their native language.

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CHAPTER 3

METHOD

Objective of the current study

To determine whether there is a change in the frequency of stuttering like disfluencies when there is an increase in length of speech sample

Participants

The participants for the study were twenty Kannada speaking adults with stuttering. The age range of participants was 16 to 30 years (Mean=21.83, SD= 2.77). Among the twenty participants, eighteen were males and two were females. Their severity of stuttering was assessed using Stuttering Severity Instrument for Children and Adults- fourth Edition (SSI-4) (Riley, 2009) by the examiner prior to the initiation of the study. Among the twenty participants, seven had mild degree of stuttering, seven had moderate stuttering, and six had severe stuttering. All participants were asked to complete a questionnaire providing their demographic details regarding their native language, age of onset of stuttering, and family and sibling history. Only those individuals without any other associated problems such as neurologic, psychological, or hearing problems were recruited. All the participants had childhood onset of stuttering and among them two participants had a history of stuttering in their family. The participants were explained about the purpose and procedure of the study and an informed written consent was obtained. The demographic details of the participants are provided in Table 1.

Table 1

Demographic details of participants

S.No	Age	Gender	Severity of stuttering	SSI score	Family history of stuttering
1	27	Male	mild	18	Absent
2	22	Male	severe	34	Absent
3	21	Male	moderate	29	Absent
4	18	Female	Moderate	25	Absent
5	19	Male	mild	20	Absent
6	27	Male	severe	32	Present
7	22	Male	moderate	25	Absent
8	20	Male	mild	20	Absent
9	22	Male	mild	21	Absent
10	19	female	moderate	28	Absent
11	21	Male	moderate	25	Absent
12	23	Male	mild	19	Absent
13	22	Male	severe	33	Absent
14	21	Male	severe	34	Absent
15	28	Male	severe	32	Absent
16	22	Male	moderate	31	Absent
17	19	Male	moderate	31	Absent
18	22	Male	severe	32	Present
19	23	Male	mild	24	Absent
20	19	Male	mild	23	Absent

Procedure

The participants were seated comfortably and the recording was conducted in a room with minimum external noise. To make the participant comfortable, the investigator made general conversation and built rapport with the participant prior to the recording. Instructions specific to the procedure were given in Kannada. For the purpose of eliciting a sample of 1,800 syllables, the investigator asked open-ended questions to the participants, (Logan & Haj-Tas, 2007)

The following were the open ended questions:

- Tell about your family, education, job, hobbies

- Tell about the famous places, festivals in your locality

- Tell about your favorite sport

- Tell me about the recently seen movie plot or television show

- Tell about the steps that can be taken to prevent pollution

The participants were asked to talk for at least 5 min in each of the above mentioned topics. Topic order was randomized across the participants. Whenever the experimenter felt that the participant concluded a topic prematurely, the experimenter presented another set of open-ended prompts like "say much more about it". All the participants' speech samples were audio and video recorded using video camera of a mobile phone with resolution of fifteen megapixels. The participants were aware of the recording procedure. The participants were seated at a level directly in front of the camera, in order to observe the facial movements while speaking. After recording, the sample files were transferred to a computer system and then the audio video sample files were opened with VLC media player software for further analysis of sample.

Syllable segmentation and Disfluency analysis

The investigator listened to the recordings of the speech sample and transcribed each participant's utterance verbatim orthographically. The investigator did syllabification of utterances that were orthographically transcribed for each of the participants. Then syllable counts of first 1,800 were done. The first 1,800 syllables speech sample were considered because to divide the speech sample into six segments with each segments containing 300 syllables (Logan & Haj-Tas, 2007)

Then in each 300 syllables segment, each moment of disfluency was identified. The disfluencies which were considered for the study included repetition (single-syllable repetition, part-word repetition) and dysrhythmic phonation (Yairi & Ambrose, 2005). This classification of disfluency was used because this classification system is widely used for categorizing the types of disfluencies and it was easy to compare with previous research studies. For each segment of a sample (300 syllables), the percentage of syllables stuttered (%SS) was calculated. The total number of disfluencies in one segment divided by the total number of syllables in that segment of the sample multiplied by 100 was used to indicate the percentage of syllables stuttered (%SS) in each segment of a sample.

Reliability

The Inter-judge agreement was established for 20% of the recorded samples. It was carried by another speech language pathologist who had completed masters in speech language pathology. The speech language pathologist was blind to the purpose of the study. Two randomly selected audio video samples were given. Instructions were given regarding orthographic transcription and marking the types of disfluencies using classification given by Yairi and

Ambrose (2005). For intra-judge reliability, 20 % of the recorded samples were reanalyzed by the investigator after a gap of one month.

Statistical Analysis

For investigating the group-wide pattern in variation of stuttering like disfluencies, repeated measures analysis of variance (ANOVA) was done. Single sample t-test was used to examine within-subject differences among the speech sample segments with most and least disfluencies. Logan and Haj-Tas (2007) used a more than 50 % disfluency criterion which was more conservative and they also specified the reason as variations of that magnitude would be further likely to have a significant influence upon situations of real-world communication. In the present study the same criterion was chosen, that was greater than 50% disfluency variations among the segments of the sample with most and least disfluencies would be regarded as significant.

CHAPTER 4

RESULTS

The mean number of stuttering like disfluencies (SLDs) that was produced by participants among the six segments of 300 syllables, within speech sample segments is shown in the Figure 1. The results suggested a minimal change in the frequency of SLDs across 6 segments. Further, the variation in the frequency of SLDs across the six segments was observed to be statistically not significant [$F (5.00, 95.00) = 0.33; P=0.894$].

The mean group increment in the frequency of SLDs between the most and least segments is shown in Table 2. In current study, it was fixed that 50% change as minimum criteria for clinically significant. Further analysis of stuttering like disfluencies was done to compare the speech segment between most and least segment of stuttering like disfluencies. Even though the group results suggested a statistically significant difference ($t(19)= 16.80$, $p=0.00$) but clinical significant difference was found only in three participants (S09, S12, S20). In the most and least stuttering like disfluencies, their position of segment broadly varied among the participants.

Table 3 depicts frequency of SLDs for the six cumulative speech sample segments (i.e. 0 to 300, 301 to 600, 601 to 900, 901 to 1200, 1201 to 1500, 1501 to 1800 syllables). Minimal variations were seen in most participants as the length of the sample segment increased. Sample segment that obtained the highest frequency of SLDs broadly varied among the participants. In eleven participants (S02, S03, S04, S08, S09, S11, S13, S14, S18, S19, S20) the frequency of SLDs in the final syllable segment (1500-1800) were lower than their first syllable segment (0-

300). When put together into a group data, the frequency of SLDs varied by a maximum of 0.5 SLDs per 100 syllables across the different lengths of the speech sample.
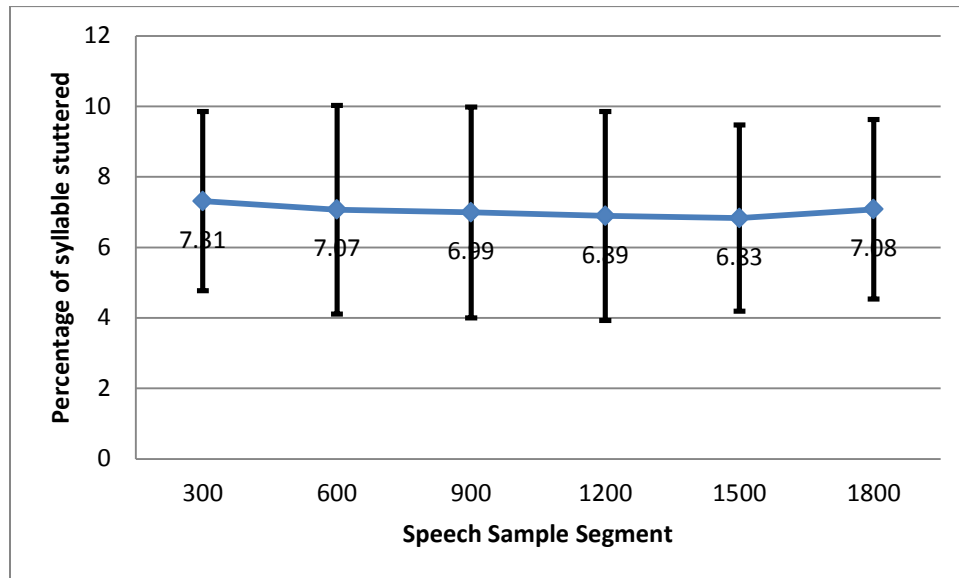

Figure 1: *Frequency of SLDs among the six 300 segments of syllables of 1800 syllable samples of speech.*

Table 2

Individual stuttering like disfluencies (SLDs) for the speech sample segments of 300 syllables providing the most and least SLDs, and also with the ratio of most by least segment SLD, as well as their location of the sample

Participant	Most		Least		Ratio (SLD$_{most}$/SLD$_{fewest}$)
	SLDs	Segment	SLDs	Segment	
S01	6	601-900	3.6	901-1200	1.66
S02	10.3	901-1200	5.6	1501-1800	1.83
S03	9	1-300	6	301-600	1.5
S04	7.3	1-300	4.3	901-1200	1.69
S05	4	1501-1800	2.3	301-600	1.73
S06	9.6	901-1200	5	601-900	1.92
S07	8.3	1501-1800	4.3	301-600	1.93
S08	7.6	601-900	4	1501-1800	1.9
S09	7	301-600	3	1201-1500	2.33
S10	11.3	901-1200	7.6	1-300	1.48
S11	8.6	901-1200	6	601-900	1.43
S12	7.6	301-600	3.6	1201-1500	2.11
S13	12.3	1-300	9.6	901-1200 1201-1500	1.28
S14	15.3	301-600	11	1501-1800	1.39
S15	12	601-900	9	1-300	1.33
S16	9	1201-1500 1501-1800	6	601-900	1.5
S17	10.3	901-1200 1501-1800	6	301-600	1.71
S18	10	301-600	7	1201-1500	1.42
S19	5.6	1-300	4	301-600 901-1200	1.4
S20	6.3	301-600	2.6	901-1200	2.42

Table 3

Frequency of stuttering like disfluencies (SLDs) by cumulative length of speech sample (given in syllables)

(**Bold phase** indicate most SLDs among other SLDs)

Participant	1-300	301-600	601-900	901-1200	1201-1500	1501-1800
S01	4.60	4.30	**6.00**	3.60	4.00	5.60
S02	9.00	6.60	7.00	**10.30**	6.60	5.60
S03	**9.00**	6.00	7.60	7.00	7.60	6.30
S04	**7.30**	5.30	5.00	4.30	6.30	5.00
S05	3.60	2.30	2.60	3.00	3.60	**4.00**
S06	6.60	6.00	5.00	**9.60**	9.00	7.30
S07	6.30	4.30	5.60	4.60	6.00	**8.30**
S08	5.00	5.30	**7.60**	5.00	4.60	4.00
S09	6.30	**7.00**	5.60	4.60	3.00	4.30
S10	7.60	9.00	8.60	**11.30**	9.00	10.30
S11	8.00	7.60	6.00	**8.60**	8.30	7.00
S12	5.00	**7.60**	4.30	5.30	3.60	5.00
S13	**12.30**	10.30	10.00	9.60	9.60	12.00
S14	13.60	**15.30**	14.30	12.30	13.00	11.00
S15	9.00	11.30	**12.00**	10.30	9.30	9.30
S16	6.30	7.00	6.00	6.60	**9.00**	**9.00**
S17	7.30	6.00	**10.30**	8.00	8.30	**10.30**
S18	9.30	**10.00**	9.00	7.30	7.00	8.00
S19	**5.60**	4.00	4.30	4.00	5.30	5.30
S20	4.60	**6.30**	3.00	2.60	3.60	4.00
Mean	7.315	7.075	6.99	6.895	6.835	7.08

RELIABILITY

Interjudge reliability and intrajudge reliability for 20% of the recorded sample indicated that interjudge and intrajudge disagreement was less than 1%.

CHAPTER 5

DISCUSSION

The objective of the present study was to determine whether there is any change in the frequency of stuttering like disfluencies (SLDs) when there is an increase in length of speech sample. Speech sample which was 1,800 syllables in length was recorded from each participant. From these recorded speech samples, orthographic transcription along with marking stuttering like disfluencies were done. Then the 1,800 syllables were divided into six segments each containing 300 syllables. In each segment percentage of syllable stuttered was determined. Results revealed several important findings.

First, there was no significant variation in the number of SLDs between the six segments in group-wide comparison. Results of the current study support the previous research studies which were done in adults (Logan & Haj-Tas, 2007) and school going children who stutter (Gregg & Sawyer, 2015). The current results were in contrast to the study done in preschool children. The findings of that study suggested that lengthier size of speech sample more than 1,200 syllables might be essential to know about the related disfluent characteristics in speech. The authors have also explained the factors which were influenced the disfluency production in children. Those factors include complexity, length of utterance, and rate of speech. In addition, they mentioned that a faster rate of speech was influenced by lengthier sentences, increased excitement and an increased speech rate led to a greater number of disfluencies in speech (Sawyer & Yairi, 2006). Second, when seen as a group data, when speech sample length increased from 300 syllables towards 1800 syllables, there was minimal variation in SLDs. Therefore, in general, collecting a longer sample of narrative speech was not regularly needed to detect maximum stuttering like disfluency in a given task (Logan & Haj-Tas, 2007). When

individual data was examined, it was observed that the frequency of stuttering like disfluency was fluctuating considerably over the sequence of 1800 syllables speech sample. The position of most and least segment of disfluency differed broadly among the subjects. This suggests that variation in fluency originate from elements other than ones related with the task of speaking. Those factors which are the foundations for variations are important to understand and to evoke during a task. There may be many intrinsic and extrinsic factors related to variation in fluency. Intrinsic factors may include speech rate, grammatical complexity and utterance length. Extrinsic factors may include patterns of interruption and contextual support (Ingham & Riley, 1998). A speech language pathologist could present those factors while collecting speech sample systematically in the probes of the scripted pattern. Through this way, during an assessment, a speech language pathologist can provoke many stuttering related behaviors and can get information regarding variability in the performance of a speaker for a specific task. It is considered that determination of highest and lowest degrees of stuttering like disfluencies as one of goal in the assessment of fluency. One more major goal is to get an appropriate record of what are the characteristics for a given speaker during fluency assessment. This goal may be met by examining many samples of speech, which were obtained during the time of assessment, by providing different tasks and in a variety of contexts (Conture, 2001; Yairi & Ambrose, 2005; Logan & Haj-Tas, 2007).

What should be the length of the speech samples? In accordance with narrative production, Logan & Haj-Tas (2007) suggested that the frequency of stuttering like disfluency can be found from 300 to 600 syllable segment like that can be determined from a 1,800 syllable segment of the speech sample. They also mentioned that probably some clients would not show all of the characteristics that should be known regarding their stuttering in speech sample segment containing 300 to 600 syllables. The severity of stuttering also plays an essential role in

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deciding the speech sample length. When the severity of stuttering is more, a speech sample which is shorter in length can be elicited. When there is milder degree of stuttering, a longer speech sample should be obtained (Yairi & Seery, 2015). Based on the severity of stuttering one can decide which measurement is meaningful whether time or number of syllables or words. Time measurement can be more appropriate when the stuttering severity is more (Yairi & Seery, 2015). In addition to this, they also stated that for the use of recording the specific stuttering disfluencies, the speech sample size issues are considered essential. However, it is not important for those clinicians who are concerned only in allocating the stuttering severity rating, even if stuttering severity can have an influence on the judgment about the speech sample size. Thus, in adults, the influence of stuttering severity and variability should be considered when they are doing an assessment for the adult population with disfluencies in speech. The efficacy of any sample of speech may be determined by making a client to comment about his outcomes of fluency while performing a specific task in comparison to usual performance (Logan & Haj-Tas, 2007). From the current study results, however in terms of SLDs, there is no significant variation between 300 syllables segment and 1,800 syllables segment in adults who stutter.

CHAPTER 6

SUMMARY AND CONCLUSION

In conclusion, the aim of the current study was to examine the influence of speech sample size on frequencies of stuttering like disfluencies in adults who stutter. Each participant was asked to speak about few topics, which were similar for everyone and it was recorded. Each speech sample containing 1,800 syllables were orthographically transcribed and divided into six segments, each of the segments containing 300 syllables. Stuttering like disfluencies were identified and marked. Results of the present study indicated that there was no statistically significant difference in frequency of SLDs between the six speech segments. It was also observed that among the six segments, the position of most and least stuttering like disfluencies varied widely. In most of the participants, it was seen that as length of speech sample size increased, there were minimal differences in SLDs.

Future indications

➢ Studies can be done in children in larger population

➢ Studies can be done across various tasks (reading, speaking)

➢ Studies can be done across various speaking situations (within clinic, beyond clinic)

➢ Studies can be done among different degrees severity of stuttering

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