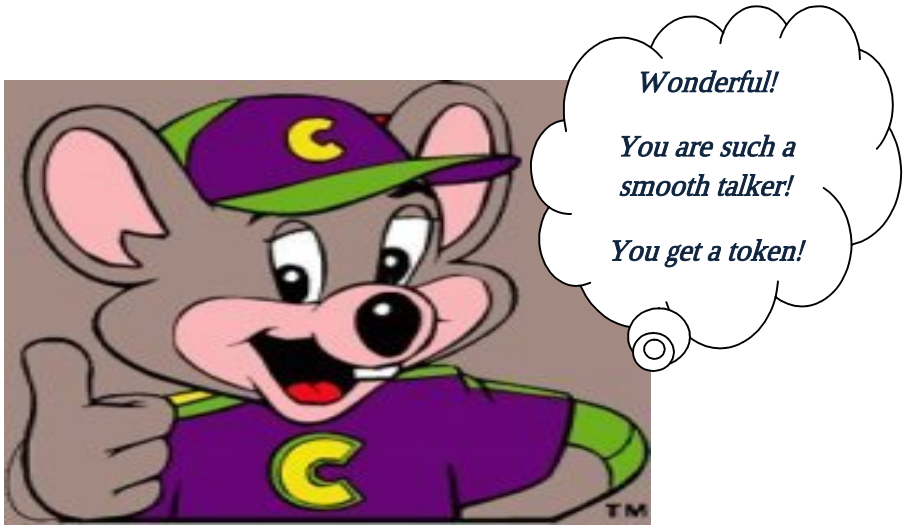
TREATMENT EFFICACY USING RESPONSE COST IN CHILDREN WITH STUTTERING



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All India Institute of Speech and Hearing

Manasagangothri, Mysore-570006

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PROJECT REPORT

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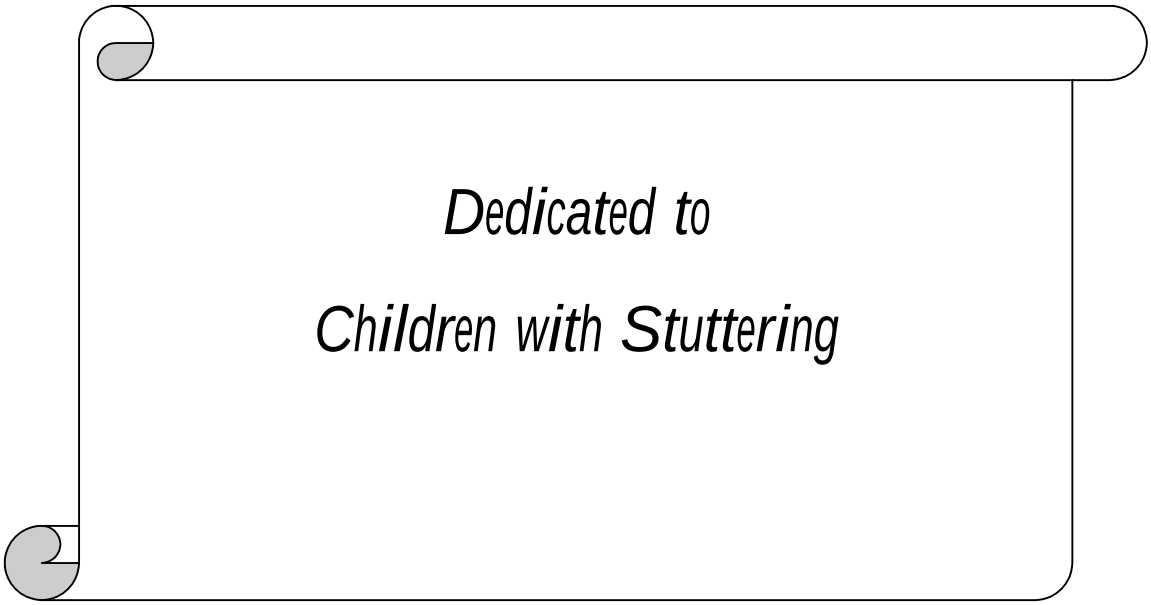
Dedicated to
Children with Stuttering

ACKNOWLEDGEMENTS

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INTRODUCTION

Speech, like many other human behaviors, is occasionally produced by speakers with hesitations, interruptions, prolongations and repetitions. These disruptions in ongoing speech behavior are termed dysfluency and the frequency, duration, type, severity and so forth of these speech dysfluencies vary greatly from person to person and across speaking situations. Some of the speech dysfluencies, particularly those which involve within-word disruptions (such as sound or syllable repetitions, are most apt to be classified or judged by listeners as stuttering (Conture, 1990a).

The World Health Organization (WHO) defines stuttering as "disorders in the rhythm of speech in which the individual knows precisely what he wishes to say, but at the same time is unable to say it due to involuntary, repetitive prolongation or cessation of sound" (WHO, 1992).

Onslow (1997) says that descriptions can be given of verbal features (what you hear) and non-verbal features (physical movements, negative emotions and avoidance) but that a *definition* which is used to distinguish between stuttered and non-stuttered speech is much more complex.

Guitar (1998) draws attention to the accepted fact that stuttering usually comprises:

- Core behaviors - involuntary repetitions, prolongations and blocks
- Secondary behaviors - learned reactions to core behaviors (escape and avoidance)
- Feelings and attitudes - can be as much a part of stuttering as the behaviors.

Stuttering can be defined as involuntary dysfluency in verbal expression. Usually, stuttering manifests as repetitions of sounds, syllables, or words or as speech blocks or prolonged pauses between sounds and words. Secondary behaviors are associated with stuttering include eye blinking, jaw jerking, and head or other involuntary movements. These behaviors are learned approaches to minimize the increasing severity of stuttering and can add to the person's embarrassment and fear of speaking (Wingate, 1964).

Speech dysfluency (stuttering) is common in children. Although stuttering often resolves before adulthood, it can cause significant anxiety for children and their families. Stuttering speech patterns are often easily identifiable; when a child is learning to talk, repetition of sounds or words, prolonged pauses, or excessively long sounds in words usually occur. Secondary behaviors (e.g., eye blinking, jaw jerking, involuntary head or other movements) that accompany stuttering can further embarrass the child, leading to a fear of speaking. The etiology of stuttering is controversial, but contributing factors may include cognitive abilities, genetics, gender of the child, and environmental influences. Research has shown that more than 80 percent of stuttering are classified as developmental problems, although stuttering can also be classified as a neurologic or, less commonly, psychogenic problem (Yairi & Ambrose, 2005).

Speech dysfluency occurs in approximately 3-5% in preschool aged children and 0.7 to 1% of the general population (Cooper, 1987). Stuttering occurs in persons of all ages, but it is most common in young children who are developing and learning language and speech. Stuttering resolves by adulthood in nearly 80 percent of children with developmental stuttering.

Although a child's chronological age is a factor influencing the behavioral features and severity of the stuttering syndrome, age is not as meaningful as the length of time

stuttering has been taking place. As Conture (1982) puts it, the age of the stuttering is usually more meaningful than the age of the child. Children as young as two or three years old can present with strikingly complex stuttering behaviors and exhibit high levels of tension, struggle, and fear. Furthermore, the longer the children have been stuttering, the more likely it is that the problem will become chronic. Chronicity may be especially likely if the child continues to stutter throughout ages of five to seven, which may become habituated.

According to Bloodstein (1995), the prevalence of stuttering remains consistent through grade 9 and begins to decline during grades 10 through 12. Thus, by far the largest numbers of potential persons with fluency disorders are to be found among children in their preschool and early school years (Conture, 1990). Researchers in the field of fluency disorders have suggested that clinicians will have the greatest impact of providing service to preschool children (Van Riper, 1982).

Stuttering can often have the significant effects on the academic, social, and vocational achievements and status of individuals who stutter. However, as will be shown, when treated properly and in a timely fashion, much can be done to improve the communication abilities of people who stutter. Such improvements meaningfully contribute to all facets of the person's personal and professional life. Available evidence makes it apparent that individuals who stutter benefit from treatment, but it is also apparent that determining the outcome of stuttering treatment is neither easy nor simple (Conture, 1996).

The process of conducting efficacy research, and the results obtained can contribute to the discipline of communication sciences and disorders in critical ways. By examining how manipulations of the environment (i.e., treatment) alter communication behaviors in individuals with disorders we have much to gain in our understanding about communication itself and about the nature of disorders. Treatment efficacy research is an investigatory tool

for examining the effects of environmental variables (treatment) on organismic variables (communication and related behaviors). The beauty of efficacy research truly is that it naturally addresses both theoretical and clinical questions. Basic and applied researchers need to appreciate this perspective and appreciate the findings that such research generates. The gains in theory will ultimately advance our efforts to demonstrate accountability; similarly the gains in accountability should ultimately advance our knowledge in theory (Olswang, 1990).

Researchers suggest number of approaches to treat young child with stuttering. Response cost is one among them with an attractive alternative to fluency shaping. It is effective with young children for whom fluency shaping is not a good option. It does not affect the speech rate and speech naturalness and is easy to administer. Parents accept it and therefore it has high social validity. Early research studies in the late 60s and 70s, demonstrated the effectiveness of Response cost. But those studies are limited as well as experimental, with few participants and little or no follow up. There is a need to explore the immediate and long term effects of this procedure. Hence, the present study was planned.

Need for the study

The fact that some treatments are frequently recommended in the absence of unequivocal demonstration that they are effective in helping children who stutter poses serious problems at times. Therefore, the present study was aimed at investigating the effectiveness of Response cost in children with stuttering (CWS). The studies pertaining to the treatment efficacy are also lacking with regard to CWS especially in the Indian context. Hence, the present study was planned with the following objectives.

Objectives of the study

The primary aim of this project was to investigate the treatment efficacy using Response cost in CWS. The specific aims included:

1. To determine the treatment efficacy using Response cost during pre and post treatment period (Initial therapy)
2. To determine the treatment efficacy using Response cost after a one month follow up period
3. To determine the treatment efficacy after reinstatement of Response cost
4. To determine the individual child's performance for treatment using Response cost

REVIEW OF LITERATURE

The dawn of a behavioral orientation to stuttering treatment in the 1960s introduced a set of principles and practices for determining treatment efficacy. This model was based primarily upon the quantification of target treatments, plus the systematic evaluation of relevant behaviors across clinically important settings and meaningful periods of time (Ingham & Andrews, 1973; Kazdin, 1978) and did, to an extent; transcend theoretical orientations (Bloodstein, 1987).

The available evidence makes it apparent that individuals who stutter benefit from the services of speech language pathologists, but it is also apparent that determining the outcome of stuttering treatment is neither easy nor simple. Although considerable research has documented the positive influence of treatment on stuttering frequency and behavior, far less attention has been paid to the effects of treatment on the daily life activities of the people who stutter and their families (Baer, 1990).

An evidence based framework can be described as an empirically driven measurement based on client sensitive approach for selecting treatments. It is believed that using such a framework is more likely to result in a clinically significant outcome. A clinically significant outcome was defined as a meaningful treatment change. It was suggested that there are at least three groups for whom a treatment's outcome is meaningful. These groups include clinicians/clinical researchers, the clients, and the relevant others who have some interest in the outcome (Finn, 2003).

Treatment efficacy

Efficacy has been defined as the extent to which a specific intervention, procedure, regimen or service produces a beneficial result under ideally controlled conditions when administered or monitored by experts. It is distinguished from effectiveness, which is the extent to which the intervention or treatment, when deployed in the field, does what it is intended to do for a specific population (Last, 1983).

According to Olswang, (1998) the treatment efficacy research evaluates treatment effectiveness (whether or not the treatment works), treatment efficiency (whether one treatment works better than another or whether all components are necessary in a treatment), and treatment effects (which aspects of treatment differentially influence which behaviors). As suggested by Olswang, treatment outcome and treatment efficacy more accurately exist on a continuum, but in their purest forms, represent different approaches to evaluating the influence of treatment. Every client is a potential participant in the long-term outcome investigations. It requires a standardized and sufficiently rigorous protocol for collecting data pre- and post treatment.

Olswang (1990) has observed that treatment efficacy is a broad term that can address several questions related to the treatment effectiveness (Does treatment work?), treatment efficiency (Does one treatment work better than other?), and treatment effects (In what ways does treatment alter behavior?). Treatment efficacy studies have used either group or single-subject experimental designs to answer these questions.

In other words, to describe the “effectiveness” of treatment for stuttering, there is need to define what is “effective”. The effectiveness is defined as the “ability to produce a

specific result or to exert a specific measurable influence" (Dorland, 1990). This definition is not sufficient, however, because discussions of effectiveness frequently involves descriptions of whether a treatment was successful; and judgments of success are highly dependent on who is making the judgment.

With regard to judging effectiveness or success to treatment of stuttering, we could discuss subject- independent measures of stuttering (e.g., frequency and duration of instances of stuttering) as well as subject- dependent measures of effectiveness (e.g., the client's belief that he or she can talk to anyone at any time (Conture & Wolk, 1990). And, as Conture and Wolk have stated, it is simply unclear which of these measures is more important in judging the effectiveness of stuttering treatment.

Treatment efficacy research: what is it?

A definition of treatment efficacy research must begin with its super-ordinate, clinical research. Clinical research (or applied research) is that type of research that follows guidelines and principles of science to provide an understanding of human experience and behavior change. In the discipline of communication sciences and disorders, clinical research is designed to yield a better understanding of the nature of communication and related disorders and the clinical process of assessment and treatment associated with disorders. The essence of clinical research is that it brings together scientific/methodological rigor and ecological validity; that is, it is clinical relevant science (Ingham, 1993).

In recent years accountability, health care, and education reform have forced practice to become more rigorous and structured. Although clinicians may scrupulously and conscientiously collect data to make informed clinical decisions and to demonstrate accountable service delivery, they are not conducting clinical research. Collection of data does not mean research. A controlled therapeutic condition does not mean research. Research

entails using valid scientific methodology to document trends via data collection; accountable clinical work is about making informed clinical decisions via data collection. The two are different (Frattalli, 1998a).

During the past several years research regarding treatment has gone in two directions, one documenting efficacy and the other, outcomes. More accurately, they exist on a continuum where at some point in the middle, they overlap. At their extreme purest forms, they represent different approaches to examining the influence of treatment on individuals with communication and related disorders. To be simply stated, treatment efficacy research proves treatment benefits; treatment outcome research identifies treatment benefits (Olswang, 1998).

As Purser (1987) notes, the evaluation of treatment efficacy involves treatment process research (e.g., study of the methods of conducting treatment) and treatment outcome research (e.g., study of effects of treatment). A challenge of treatment outcome research is determining the most relevant aspects of a stuttering disability to measure (Curlee, 1993), because many different aspects of stuttering can be measured (e.g., frequency of occurrence, duration, severity, type of stuttering, and associated behaviors). For this as well as for other reasons, St. Louis and Westbrook (1987) note that "Determining the outcome of stuttering therapy is not a simple task". Perhaps, as Baer (1990) suggests, treatment research would be improved if researchers were better able to discern what client's main complaints or concerns actually are. To date, most published studies of the efficacy of stuttering treatment have relied on measure of stuttering or stuttered speech (e.g., frequency of stuttering).

Efficacy versus Outcome research

Efficacy research provides evidence that treatment works by ruling out possible alternative explanations for client change. It also examines various ways that treatment alters

behavior. “Efficacy research documents that changes in performance are directly attributable to the treatment administered” (Campbell, 1995). The proof comes about via well-controlled conditions and data collection beyond standard clinical practice. Recent efficacy research has expanded its emphasis, primarily because of the demands of health care and education reform. Treatment outcome research, on the other hand, identifies treatment benefits. It demonstrates that treatment made a difference to a client by examining changes related to clinical variables.

Recent interest in health care reform has pushed health-related professionals to demonstrate their worth. Demands for data showing significant, cost effective changes in client behavior following intervention have resulted in an increase in out-come research. The interest is less on exploring how a treatment alters behavior, but rather that treatment is associated with important changes in client’s life. The essence of the difference between efficacy and outcome research is “proof”; the former attempts to prove a relationship between treatment and client change, and the latter attempts to identify and document a relationship. Both contribute to accountability; both constitute research; both advance the profession (Langevin & Kully, 2003).

Role of Speech Language Pathologists

Speech language pathologists, who work in various employment venues- for example, public and private schools, public and private hospitals and clinics, university and college clinics, and private practice- routinely diagnose and treat people who stutter. Although some manage a variety of communication disorders, a number of speech- language pathologists- with appropriate graduate level degrees, certification, and state licensure have specialized experience, interest, and training in stuttering. For stuttering as for all communication disorders, diagnosis is the gateway to the treatment and may consist of initial screenings, full scale evaluations, and subsequent reevaluations, when needed. Treatment for stuttering can

be intensive (i.e., many hours every day for relatively few weeks) or extensive (i.e., one or two hours per week for several months to over a year) and can involve both individual as well as group treatment sessions (St. Louis & Westbrook, 1987).

Treatment approaches used may be determined by such factors as available resources at the place of employment, age of the person who stutters, possible exacerbation of stuttering because of inappropriate parent-child communicative interactions, nature and or severity of the person's stuttering as well as clinician's training and experience in treating stuttering. There is both scientific and clinical evidence that individuals who stutter benefit from the services of speech-language pathologists. The evidence is documented by experimental research, program evaluation data, and case studies (Conture, 1996).

Major research focus has been treatment outcome evaluation driven by the desire to: (a) investigate long term maintenance of treatment gains (Boberg, 1981; Boberg, Howie, & Woods, 1979; Boberg & Kully, 1994), a long held concern of clinicians and researchers (Bloodstein, 1995; Ingham, 1993); and (b) advance theoretical knowledge. Another long held concern of our profession is that of accountability (e.g., Caccmo, 1973; Frattali, 1998a; Mowrer, 1972; Siegel, 1975) which, according to Frattali (1998b), has been more recently spurred by "flaws in current research activities, accreditation agency outcomes initiatives, managed care and regulatory agency demands for data, and consumer choice". As suggested by Seigel in 1975, this public demand for accountability can serve as a call for critical and reasoned self- evaluation. It is also a means to advance theoretical knowledge about stuttering and stuttering treatment. As Olswang (1998) stated, "Our gains in theory will ultimately advance our efforts to demonstrate accountability; similarly our gains in accountability should ultimately advance our knowledge in theory." Like Wambaugh and Bain (2002), we believe that practice results from the interface of clinical practice and research.

Fluency is often variable with young children, a fact that makes both assessment and therapeutic progress somewhat more difficult to track for this age group. There is always the question of how much behavioral change is due to treatment and how much is due to the natural variability of the behavior. According to Manning, (2001), other important differences that the SLPs should consider when working with younger clients are:

1. Children are functioning with neurophysiological systems that are far from adult- like and are still in the process of maturation.
2. Depending on the child's level of awareness and reaction to the stuttering experience, the clinician may select treatment techniques that are less direct than used with adults.
3. Parents and a variety of other professionals, and particularly the child's classroom teacher, play essential roles in the treatment process.
4. The clinicians will more likely place greater emphasis on the evaluation and possible treatment of the child's other communication abilities, including language, phonological, and voice problems. On occasion, some children will also present with a variety of other learning or behavioral problems (e.g., Obsessive Compulsive Disorder (OCD) or Tourette's syndrome).
5. The likelihood of achieving spontaneous or automatic fluency is much greater for young children than for adults.
6. There tends to be somewhat less effort needed for helping the child to transfer and maintain treatment gains into extra- treatment environments.
7. Relapse following formal treatment is not usually a serious problem, as it is with adult clients.

According to St. Louis and Westbrook (1987) "Achieving healthy client attitudes or feelings, or a reduction of avoidance or anxiety, is viewed as essential ingredients in therapies". Indeed treatment outcome measures, although currently focused on changes in

disability features (e.g., frequency of stuttering), should, in an ideal world, also assess changes in the degree of handicap (e.g., extent to which an individual, after treatment, enters and engages in previously avoided speaking situations).

Approach to evidence –based practice

An approach to clinical work is grounded in the tenets of evidence- based practice as described by Sackett, Rosenberg, Gray, Haynes, and Richardson (1996). Specifically, that makes every attempt to conscientiously, explicitly, and judiciously use current best evidence in developing treatment programs for individual clients and also to integrate clinical expertise with systematic research and client choice. In the daily work arise the two broad questions. They are, (1) From a treatment development perspective, "Is the treatment program effective across clients in the short and long term?" and (2) From an individual client perspective, "Is the treatment program selected or designed for this client effective in the short term and long term?" To answer these questions data is collected and therefore used to inform and evaluate the effectiveness of treatment. The summaries of guidelines for documentation of treatment efficacy for young children who stutter (Ingham & Riley, 1998) are as follows:

Guideline I: Conditions of documentation

1. Speech samples should be obtained from non-treatment conditions.
2. Speech samples should be obtained under multiple conditions and on multiple occasions
3. Some speech samples should be obtained from the natural environment.

Guideline II*:* Dependent variables

1. Stuttering frequency
2. Stuttering severity
3. Speech rate

4. Speech naturalness
5. Reliability

Guideline III*:* Treatment integrity

1. Adequate description of treatment procedures
2. Adequate application of treatment procedures

Guideline IV*:* Verification of the relationship between treatment and outcome

1. Confirmation of the role of treatment – common research designs include: single subject time series with replication; group comparison, and single group, and single group pre-/post –designs
2. Selection of subjects- controlling for unaided remission; reporting individual client characteristics that may have linkages to treatment outcome, if such linkages exist
3. Confirmation of the role of hypothetically mediating child behaviors in treatment (e.g., obtaining measures of voice onset/reaction time as a result of using easy onsets).

Research designs in measurement outcomes

Questions that ask how a particular manipulation (i.e., treatment) alters behavior over time are best addressed through within subject/time series designs. This approach to research attempts to explore treatment efficacy (effects, effectiveness, and efficiency) by studying one individual at a time and documenting the ways in which a treatment changes performance. At the heart of within subject methodology is applied behavioral analysis; the environment is manipulated by the experimenter in systematic, predetermined ways (i.e., treatment) and critical behaviors are measured repeatedly over time. Proof is demonstrated by systematic change in subject's performance as treatment is introduced, altered and/or withdrawn. At the

heart of proof is replication, either within or across subject, particularly replications that are yoked in time, provide increased experimental control and allow for greater generalizability of results. Case studies are ones in which a single subject is observed independently from other subjects; they can employ within subject/time series design features to increase their validity, but a case study by itself has little generalizability to a larger sample, and has limited experimental control. The highlight of time series research is the opportunity to examine the unfolding nature of change. The approach allows the researcher to document how treatment changes an individual over time. The power of this observation is that it yields extraordinary insight into the therapeutic process, by revealing how treatment interfaces with particular disorders and subject/client characteristics (Frattalli, 1998a).

The independent variable is most often thought in terms of the treatment itself, and the manipulation of it. Treatments can be manipulated in many ways, including its strength and integrity (Yeaton & Sechrest, 1981). Strength refers to how often a treatment is given and the intensity of the treatment (length of session, number of exposures to teaching items, etc). Integrity refers to identifying and manipulating the various components of the treatment, including the steps/phases, the instructions (i.e., prompts, cues, consequences, and reinforcements), the person implementing the treatment, the setting, the activities, and materials. All aspects of treatment that are important to the research questions must be identified and controlled. Some questions address the efficacy of the treatment packages; others examine treatment components. Some questions will explore how much change a client exhibits in a set of time and exposure to treatment; others will ask how much treatment is necessary to bring about a particular change in performance.

Kazdin and Kendell (1998) have proposed that clinical significance for selecting effective treatments is based on “the extent to which changes on various outcome measures translate to palpable benefits or meaningful change.” The first palpable benefit means that the

treatment change is easily perceived. This, however, raises an obvious question: easily perceived by whom? The second characteristic is “meaningful change” which means that treatment change is important, but again this raises the question: important to whom? In considering these questions, Hayes and Haas (1998) have argued that something is meaningful because somebody thinks it is meaningful and, ultimately, what is meaningful will be a matter of value and how much of a change is meaningful will also be a matter of value.

In other words defining what is a meaningful change and how much change is meaningful really depends on who the stakeholders are in the treatment’s outcome. In terms of clinical significance, there are at least three of the following:

(1) Clinicians and clinical researchers who are trying to administer and develop the most effective treatment approach,

(2) Clients who are seeking help for their problem,

(3) Relevant others who have some interest in the treatment’s outcome, such as parents, teachers, third-party payers, and employers (e.g., Craig & Claver, 1991)

Kazdin (1999) suggested the methods for evaluating amount of change within an evidence-based framework are typically based on two well-known concepts. The first is statistical significance, which is used for evaluating differences in the context of group designs and the second is non- statistical criteria, which are used for evaluating differences in the context of single subject designs. Clinicians and clinical researchers value both amount and meaningfulness of treatment change. But equally importantly it reveals the scientific underpinnings of an evidence-based framework.

Management of children with stuttering

Stuttering can be challenging to treat because there is a lack of evidence-based consensus about therapy. Although several pharmacologic interventions to control or alleviate stuttering events have been studied, all have proved ineffective or have had adverse effect. In addition, no large-scale trials on pharmacologic therapy have been published, and there are no trials including children. A comprehensive review of pharmacologic interventions for stuttering showed that no agent leads to valid improvement in stuttering (i.e., decrease to less than one half of its prior frequency or with less than 5% of words) or in secondary social and emotional consequences (Ludlow, 2006).

Recently, treatment of stuttering has focused on non-pharmacologic approaches, such as self-monitoring of speech to manage stuttering events and symptom reduction instead of elimination. The focus of treatment in children is to prevent the progression of confirmed stuttering (Guitar, 1998).

In the non-pharmacological treatment approaches families play an important role in the management of stuttering in children. An environment that encourages slow speech, affording time for the child to talk, and modeling slowed and relaxed speech can help reduce stuttering events. Gentle, nonjudgmental acknowledgment of stuttering does not worsen the problem and may comfort a frustrated child (Johnson, 1984).

There are some of the most effective preschool intervention programs which call for direct acknowledgment of stuttering in the form of contingencies such as “That was bumpy” or “That was smooth.” Fluency-shaping mechanisms, such as delayed auditory feedback (Lee, 1950) devices, may improve fluency. Using the device, the speaker must slow the rate of speech to prevent distortions in the speech that they hear through the device. Contemporary stuttering devices alter the frequency of a speaker’s voice to mimic the “choral

effect" (i.e., a phenomenon that significantly decreases or ceases stuttering when the person is speaking with a group of others) or slow the rate of speech through delayed auditory feedback. Long-term outcome studies on these devices have not been published (Bakker, 2006).

The treatment of early, mild stuttering (generally in children younger than six years) focuses on the prevention or elimination of stuttering behaviors. Therapy is usually characterized by parental involvement and direct treatment. The Lidcombe approach (Onslow, Packman, & Harrison, 2003), which has become prominent in recent years, involves parental praise for fluent speech in the child's daily speaking and occasional correction of stuttering. The likelihood of eliminating stuttering behaviors decreases if they persist beyond eight years of age.

For those children who have more advanced forms of stuttering and secondary behaviors, therapy is generally a variation or combination of two approaches: (Conture, 2001)

1. The first approach is a fluency-shaping technique that replaces stuttering with controlled fluency (a speaking style requiring careful self monitoring).
2. The second approach focuses on reducing the severity of stuttering so that speaking is performed without struggle by controlling primary symptoms, eliminating secondary behaviors, and reducing the fear of overt stuttering; this approach is typically referred to as stuttering modification or traditional stuttering therapy.

Speech measures that are routinely collected in individual and group treatment programs for school –age children include percentage of syllables stuttered (% SS), Speaking per minute (SPM), and parent ratings of the typicality and severity of stuttering exhibited in the samples. Speech samples routinely obtained on three occasions pre-treatment and immediately post treatment. They include (a) a pretreatment video-taped home sample of the

child talking with a parent or parents, and (b) a set of audio-taped or video taped conversation, storytelling or explanation, and reading samples obtained during the assessment and immediately pre and post treatment. Again, to minimize clinic and clinician cues, in-clinic pre- and post treatment samples are obtained in a room not associated with therapy and with unfamiliar adult conversation partners. Follow up samples are obtained for children who return to the clinic for refresher work and for groups or individuals who are randomly selected for follow up because of their involvement in novel programs (e.g., tele health- delivered treatment; Kully, 2002).

Teacher observations of (a) the frequency and severity of stuttering, (b) difficulties in speaking in various talking situations within the classroom, and (c) whether or not the child is being teased are also obtained by way of a questionnaire. To answer the broad question "Is children's therapy program effective?" an outcome investigation was undertaken (Langevin, 2003). In this program speech was modified using prolongation and fluency enhancing skills, and there were attitude and parental involvement objectives. The dependent variables reported were % SS and SPM in 3- min video-taped in-clinic conversations obtained (a)pre therapy, (b) post therapy, (c) 2 months follow up (for a subset), and (d) 8-18 months follow up. The results of this preliminary investigation were encouraging, indicating that 9 of 10 children made marked improvements in fluency at the end of transfer and 8 of 10 children were judged to have maintained their gains (mean= 0.54% SS, 2-18 months post treatment).

Indirect and direct treatment strategies

Young children can benefit from a variety of forms of indirect and direct intervention (e.g., Bloodstein, 1995; Conture, 1996; Conture & Guitar, 1993; Conture & Wolk, 1990; Gottwald & Starkweather, 1995). The literature indicates that a number of different approaches appear to help the younger child become more fluent. These approaches typically

make use of combinations of techniques that help the child to make slower and easier movements for voicing and articulation, decrease sensitivity to the stuttering event, increase self confidence and problem solving as it relates to speech and communication, and promote an enjoyment of speaking.

During the first seven or eight decades of this century in the United States, the treatment used with young children who stuttered was indirect. That is, the children themselves were not the recipients of the intervention activities, and no specific instructions were given to the child. Rather, the significant adults in the child's environment – the parents, family members, grandparents, and teachers were advised concerning procedures for altering the child's environment (Johnson, 1984).

The choice of this general approach was due to many cautions from authorities who strongly recommended that the clinician should not do anything to make the child aware of the problems he/she seemed to be having with his/her speech. Clinicians were extorted not to bring the child's attention to his/her disrupted speech or to respond in any way that might associate speech with negative emotion. This view was especially popular during the decades of the 1940's through the 1960's and coincided with the prominence of the Diagnosogenci theory of stuttering onset and development.

Blumel in 1932, explained that primary stuttering is seen as a transient phenomenon during which the child does not yet show awareness of his problem or demonstrate special effort during speaking. Finally**,** Van Riper, in the first edition (1939) of his popular text, Speech Correction: Principles and Methods, wrote, "The way to treat a young stutterer in the primary stage is to let him alone and treat his parents and teachers.' With such cautions, few clinicians and parents were likely to intervene directly and assist a young child with his communication problems. The fear was that direct intervention could make the stuttering

more severe, a fear that permitted the decision-making process for clinicians. Doubtless there are many clinicians who continue to hold such views and are overly cautious when deciding whether treatment is appropriate for young children.

With indirect intervention the clinician takes no direct action to modify specific features of the child's speech. Parents and significant others are counseled and provided with information concerning the developmental nature of language and fluency. The clinician will likely spend as much or more time working with the parents as with the child. The major focus of an indirect strategy is to make speech enjoyable for the child and to adjust those environmental factors that tend to disrupt his fluency. By decreasing demands, desensitizing the child to fluency- disrupting stimuli and giving rewards for open, easy, and forward-moving speech, the child is guided step-by-step toward increased fluency (Halvorson, 1971).

Treatment is likely to be more direct if the child is experiencing tension and struggle behavior or fragmenting multisyllabic or, especially, monosyllabic words. In addition, the child may be exhibiting the nonverbal characteristics of more developed stuttering such as breaking eye contact with the listener (Conture, 1990). For these children, the clinician will be more straightforward in demonstrating specific activities for enhancing fluency and modifying moments of stuttering. A number of authors (Gregory, 1995; Healey & Scottt, 1995; Peters & Guitar, 1991) have indicated that fluency modification techniques are more likely to be used at the outset of treatment.

Depending on the child and the degree of struggle behavior that is present, clinicians also use stuttering modification procedures such as voluntary stuttering, cancellations, and pull-out techniques (Guitar, 1998). Stuttering modification techniques may also be employed depending on the success of the techniques. A more direct approach to modifying stuttering consists of identifying stuttering events, contrasting both fluent and stuttered speech, and

having the child intentionally produce both forms. The clinician will select the most appropriate activities along a continuum of directness according to the needs of the child and his response to treatment. Regardless of how directly the clinician works to alter the child's speech, treatment for young children who stutter should be characterized by a high degree of reassurance and encouragement by the clinician. The treatment environment must be highly supportive as the child is guided into the exploration of his speech and himself. The primary targets of communication by the clinician and parents can be such concepts as (1) stuttering is not the child's fault, (2) stuttering is not the parent's fault, (3) speaking can be easy and fun, (4) the child is able to be in charge of his speech production system.

In other words, clinicians tend to employ a multifactorial approach whereby the clinician, often with the assistance of one or more parents, helps the child to improve skills or capacities in a number of areas that facilitate a smooth flow of language and speech. The literature on treatment of young children also indicates that treatment for somewhat older school age children is effective (Conture, 1997; Runyan & Runyan, 1993). However, as children experience the penalty of less than acceptable fluency during the early years of school, treatment tends to become more complex.

Whether the clinician chooses to work indirectly or directly with the younger child, however, the essence of treatment consists of both facilitating the child's capacities to produce easily fluent speech and reducing the demands placed on the child that result in fluency disruption. As Starkweather (1999) suggests, "we can prevent the complexity of stuttering from developing, or if it has developed, we can undo it, untie the knots of frustration and struggle. And the younger the child is, the easier the knots are to untie". Certainly the clinician will have many related goals, such as decreasing the child's response to fluency-disrupting stimuli and increasing his assertiveness and risk-taking ability.

Specific tips to parents to enhance fluent speech in children

It is interesting to note that although young children usually respond with greater fluency to slower and less complex speech produced by the parent or the clinician, the reasons for this effect are not well understood. To say to a parent, "Slowing down may help your child to be somewhat more fluent" is correct, but we do not understand why this holds true (Ratner, 1993). Ratner submits there may be some higher-order conversational or interactional factor in operation.

Ramig and Bennet (1995) provide a list of suggestions for the clinician, parents, and teachers when using a fluency-modification approach with younger school-age children. The clinician and everyone else (including parents and teachers) who are involved in the intervention process should:

1. Use basic and understandable terms when explaining and demonstrating what you want the child to do. These terms (e.g., "turtle speech" or "rabbit speech") should be used consistently when identifying target behaviors and reinforcing the child's actions. Regardless of the methods used, children need to have terms and concepts that enable them to think about their speech and language (Cooper & Cooper, 1991a).
2. Model, rather than instruct, the child about how to perform specific target behaviors.
3. Model slow and easy speech when interacting with the child in a variety of treatment and extra-treatment settings.
4. Model slow and easy body movements when interacting with the child, again in a variety of treatment and extra-treatment settings. These movements can be coordinated with easy, slow, and smooth outset and completion of the treatment sessions.
5. Reinforce the child's accomplishments and feelings of self-worth in the context of as many experiences as possible.

Specific treatment strategies to produce fluent speech in school age children

Fluency-enhancing procedures provide the child with techniques for both initiating and enhancing one's fluency. The clinician cannot always assume that because the child's speech is not stuttered, it is necessarily fluent. Speech that is to be expanded and reinforced should have high quality fluency, which is characterized by smooth and effortless production. Following are the treatment strategies that can be adapted to produce fluent speech.

1) Operant conditioning

A different typed of conditioning therapy for stuttering is based on the methods developed by Skinner and his followers. These have lent themselves to use in clinical work with stutterers in a variety of ways (Bloodstein, 1995). Operant conditioning is another behavioral technique that has been advocated for early stuttering. Costello (1983) has developed a clinical program in which children receive social rewards or tokens for fluent utterances and are told to "stop" whenever they stutter. Johnson (1984) trains parents to eliminate all attending responses to stuttering and to increase attention to fluent utterances. Stocker and Gerstman (1983) described a program in which they reinforced reduction in stuttering with bits of candy or pennies. Other methods of indirect treatment of early stuttering are rhythmic speech (Coppola & Yairi, 1982) and Electromyography biofeedback (St. Louis, Clausell, Thompson, & Rife, 1982).

2) Punishment of stuttering

There have been a large number of laboratory demonstrations of temporary reduction in stuttering by contingent application of stimuli as shock, noise, verbal disapproval, Response cost and time out from speaking. Of these, only time out has been put to repeated use in therapy. Martin, Kuhl, and Haroldson (1972) reported its successful use with two

preschool children. Each child had weekly conversations with Suzybelle, a puppet whose voice was provided by a speech clinician through an electronic connection from an adjoining room. During this Time-out Suzybelle's illuminated glass case was darkened and she was silent for 10 seconds. For one child, time-out was made contingent on every stuttering block. It was reported that both children improved markedly, and a one year follow up showed only a few stuttering in each case.

In a clinical application of verbal punishment Reed and Godden (1977) reduced the stuttering of two preschool children by using the words "slow down" as a contingent stimulus during twenty twice-weekly sessions. Tape recordings showed a decrease in stuttering at home.

Stuttering is effectively treated in school age children. As noted in the previous section, treatment of stuttering in preschoolers is efficiently done with fluency reinforcement and reinforcement plus corrective feedback. In treating school age children, fluency shaping and its components are additional procedures the clinicians may use (Guitar, 2006; Shapiro, 1999). Choices for effectively treating stuttering in school age children as explained by Hegde (2004) include:

1. ***Comprehensive Fluency Shaping Procedure***: This includes airflow management, and slow rate of speech achieved through syllable prolongation, and normal prosodic features. Most school-age children can master these fluency skills. This procedure may be needed for children with high dysfluency rate and significant mismanagement of airflow associated with stuttered speech.
2. ***Slower Rate of Speech:*** This procedure uses only one of the skill components of the comprehensive fluency shaping procedure. In this procedure, the clinician targets a slower rate of speech as the single fluency-enhancing skill. Omitting airflow

management simplifies treatment. If the child does not exhibit marked mismanagement of airflow during stuttering, the clinician can use this abbreviated fluency shaping with only slower speech as the treatment target. When slower rate of speech is the treatment target, normal prosodic features are targeted toward the end of treatment to induce natural-sounding fluency.

3. ***Pause and Talk (Time Out):*** Another highly effective procedure is pause and talk, also known as (non exclusion) time-out from positive reinforcement. Because the Time out procedure is much misunderstood and mismanaged in educational settings, the term pause-and–talk is preferred. In this procedure, the clinician continues to socially reinforce the client's fluent speech by maintaining eye contact, smiling, nodding, expressing agreement, and letting the client engage in continuous conversation. However, when the client stutters, the clinician will immediately say "stop!" avoid eye contact for about 5 seconds, and prevent the client from talking during this period of time-out from positive reinforcement. In essence, a stutter results in a brief pause in talking with no social reinforcement; therefore, the term pause-and-talk aptly describes the procedure.

Many recent studies of treatment outcome with school-age children who stutter (Runyan & Runyan, 1993) are based on a clearly explicated and seemingly reasonably motivated treatment program (i.e., the "fluency rules program"), reported significant improvement in 9 of 12 (75%) school-age children. Likewise, in a carefully conducted comparison study of two intervention programs with school-age children, Ryan and Van Kirk Ryan (1995) recently reported significant in-clinic improvement in stuttering for nearly all children studied showed 96% improvement that was reportedly maintained 14 months post treatment.

Conture and Guitar (1993), in their review of the efficacy treating stuttering in school –age children, focuses on the nine most recent studies (published within past 15 years), chiefly because these nine studies (involving over 160 children) presented results that were objectified in considerable detail. These studies reported an average of 61% decrease (range: 33% to over 90%) in stuttering frequency and/or severity in school-age children. One such study (Ryan & Van Kirk Ryan, 1983), which reported a 60% average improvement during transfer (i.e., post treatment) across four different treatment procedures, is particularly noteworthy in terms of its comprehensive study of different treatment approaches (serving as a model for how such research should be conducted) and the fact that it assessed treatment results not only in clinical settings but in the children's classroom as well (the latter, of course, being one of the salient venues in these children's daily life activities).

Conture (1996) reported a child's progress in fluency after intervention. A 9 year child was initially evaluated at a university-based speech and hearing clinic, where he was diagnosed as moderately severe stuttering. During that time he had 11 speech disfluencies per 100 words of conversational speech. He initially assigned to weekly parent-child group treatment to address his speech fluency concerns. Although his parents demonstrated improvement in term as of a number of communicative behaviors thought to exacerbate childhood stuttering (e.g., they spoke at a slower, more appropriate rate; and they lengthened pause time intervals), he made minimal progress. Consequently a combination of group and individual treatment was initiated. Individual treatment targeted two main goals: (a) Helping him learn to speak in a way that prevented or minimized the instances of stuttering, and (b) Helping him learn to effectively and appropriately change or modify instances of stuttering when they occurred. Group treatment was gradually discontinued, and individual treatment was reduced once he began to consistently demonstrate easier and more relaxed speech production in a variety of speaking situations in the clinic, at home, and at school. His

frequency of disfluency was reduced to an average of 5 per 100 words of conversational speech, and considerable improvements were noted (by clinicians, parents, and teachers) in his attitude towards speaking and speaking situations and in his abilities as a speaker. Approximately 16 months after treatment initiation, his speech-language post treatment or maintenance treatment consisted of 8 sessions (approximately one session every 40-45 days throughout 1994) to monitor and maintain his speech fluency skills. Observations during this time indicate that he continued to show decreases in frequency (average 2 to 3 disfluencies per 100 words) and duration of dysfluencies (average: 400 ms or less) as well as increased willingness and ability to speak in greater numbers and varieties of speaking situations outside the clinic-for example, in the classroom, answering the phone at home, and so forth.

A detailed account of the technique is provided below as the current project is based on that procedure.

4. ***Response cost:*** The term *implies* a cost to stuttering-the cost is the loss of a tangible conditioned generalized reinforcer (Hegde, 1998; 2008) the child earns for being fluent. This is highly effective procedure with both preschool and school age children. The procedure includes positive reinforcement for fluent productions by presenting tokens and reinforcement withdrawal for stuttering by removing tokens. Tokens are the most commonly used conditioned- generalized reinforcers (Hegde, 1998). In the initial stages of treatment, tokens can be more effective than verbal reinforcer's because they may be exchanged for a variety of reinforcers (the small gifts the children exchange the tokens for). Once fluency is stabilized, tokens may be unnecessary. refers to the subtraction of already accumulated reinforcement (Weiner, 1962). He has described as a punishment procedure that seems to capture some of the natural contingencies inherent in behavior. would appear to be particularly relevant to the study of such maladaptive behaviors as stuttering in which the act of speaking almost inevitably involves both physical and

social cost to the speaker. Halvorson (1968) found to be a very effective method for reducing stuttering. The procedure does not target such fluency skills as airflow management, gentle phonatory onset, or slower rate of speech. Consequently, the procedure does not induce unnatural sounding speech. Therefore, it is unnecessary to spend time on restoring normal-sounding fluency. This is an efficient procedure to treat children who stutter.

Response cost is an effective alternative technique for treating stuttering in school age (as well as preschool) children. It has a long history of research. The technique was found to be effective in studies conducted several decades ago. Recently, a study involving 6 school age children who stuttered demonstrated that the technique can be extremely effective in treating stuttering school-age (as well as preschool) children (Hegde, 2004). Following base rates, treatment was offered, withdrawn during semester breaks, and reinstated following the breaks. Treatment resulted in marked reduction in stuttering, and initial treatment withdrawal caused an increase in stuttering. Reinstatement of fluency resulted in systematic and clinically significant reductions in stuttering. Increase in stuttering following treatment withdrawal helped rule out the possibility that the children would have recovered without treatment (spontaneous recovery). All 6 school age children achieved normal sounding fluency with a dysfluency rate well under 2% in most cases. Up to four years of follow-up has shown that the children have maintained fluency and that the parents no longer consider their children to exhibit stuttering.

It is important to note that the includes both verbal praise and corrective verbal feedback. In essence, it includes more than one type of contingency for stuttering and fluency. Each token is presented along with verbal praise. For example, the clinician might say, “that was fluent speech, here is your token!”And present the token to the child. Therefore, fluency is reinforced with verbal praise as well as tokens. Similarly, each token

withdrawal is accompanied by verbal corrective feedback. For instance, the clinician might say, “No that was bumpy speech” and withdraw a token from the hold. Therefore, stuttering meets both verbal corrective feedback and token withdrawal.

Eventually, the clinician may fade the token presentation and maintain fluency only with verbal praise. Simultaneously, the token withdrawal is also faded out. An occasional verbal corrective feedback may help keep the stuttering frequency well below the adopted criterion (e.g., less than 4 % of the words spoken).

With the school age children, the Response cost may be initiated at the sentence level. In contrast to the base rate sessions, however, the clinician may model and immediately, ask the child to imitate shorter and longer sentences. Stuttering frequency typically decreases when children immediately imitate a fluent production, which gives an opportunity for the clinician to reinforce fluency. Frequent modeling in the beginning stage of treatment is essential to stabilize fluency at sentence level.

Tokens bridge the gap between the desirable fluent productions and the eventual reinforcer the child gets by exchanging the tokens earned in the treatment session. As noted, positive verbal reinforcement should accompany all token presentation. In the final stages of treatment, only the verbal praise may be sufficient to sustain fluency. The clinician may reinforce fluent productions with variety of verbal statements plus token presentation. While preschoolers seem to better understand the concepts of smooth speech than fluent speech, school-age children understand both smooth speech and fluent speech. Therefore, the terms smooth speech and fluent speech may be used in treating school-age children. Initially, tokens may be presented with an announcement, such as; “That was great! You said it smoothly, here is your token!”, “Wonderful! You are such a smooth talker! You get a

token!", "That was nice fluent speech! Another token for you!", "I like your fluent speech!" (presents a token), "You are doing a great job!" (presents a token).

When the child produces a dysfluency, the clinician withdraws a token while offering verbal corrective feedback. The verbal feedback and then token withdrawal should be prompt. In addition, the verbal feedback should be clear (unambiguous) and objective in tone. The clinician may use several forms of corrective feedback to accompany token withdrawal; initially, the clinician may announce that a token is being withdrawn, but such announcements are not always necessary, like; "Stop, that was bumpy! I get one of your tokens!" "Oh no! You didn't say it smoothly. I am taking a token back!", "That was bumpy!" (withdraws a token), "Stop, you are having trouble saying it, I get a token from you!", and "No, that was not smooth!" (withdraws a token).

At the beginning of each treatment session, the clinician should present a variety of small gifts and ask the child to select one for the day. The gift should be prominently displayed as the child works during the session. The child may be told that he or she will get a token for talking smoothly and that tokens received are like money. He or she should have enough money to "buy" the gift at the end of the session. More than the instructions, the actual experience of earning, losing, and retaining enough tokens to "buy" the gift at the end of the session are what informs the child of the essence of treatment. Although flat, coin-like, plastic tokens are commonly used, the clinician can select tokens of any kind. Some plastic tokens are colorful and come in different shapes. Children are especially attracted to colorful tokens of unusual shapes.

In the beginning stages of treatment, the clinician should frequently model fluent productions, so the child accumulates tokens. The frequency of modeling may be gradually reduced as the child becomes more fluent.

The clinician can use a few strategies to avoid token bankruptcy. Obviously, token bankruptcy is likely when the child earns too few tokens and loses too many. To avoid this problem, clinician must increase the frequency of token presentation and decrease the frequency of token withdrawal. In other words, the clinician should increase opportunities for the fluent productions and decrease the chances of stuttering. To accomplish this, the clinician may:

- Model fluent production more often, resulting in increase fluency and higher level of token earning
- Require single words or phrases, instead of sentences, that also result in increased fluency and higher level of token earning.
- Present two tokens, instead of the typical single token, for longer fluent productions; the clinician in such cases should point out the reason for giving an extra token (e.g., “here is an extra token, because you said a very long sentence fluently”).
- Extend the treatment session by a few minutes to give a few extra tokens for fluency

If the child begins to speak slowly to increase fluency and thus earn more tokens and to avoid token loss due to stuttering, the clinician may instruct the child to speak faster. A normally fast rate may be modeled for the child to imitate. Treatment protocols are offered at four levels of training:

1. Treatment at the sentence level
2. Treatment at the continuous speech level
3. Treatment at the narrative speech level
4. Treatment at the conversational speech level

With school- age children, the method initiated at the isolated sentence level with frequent modeling may be shifted to more continuous speech levels sooner than it is possible

with preschool children. When the method results in significant reduction in stuttering frequency in isolated sentences, the child may be ready to move on to the continuous speech level. If the child's fluency drops significantly when continuous speech is evoked, the clinician should move back to the sentence level for additional training. Continuous speech may be reintroduced after a period of additional training at the level of evoked individual sentences.

To begin with, the clinician may use the stimulus materials that were used in base rating fluency at the continuous speech level. The protocols reflect this strategy. Using familiar stimuli may evoke continuous speech more readily than unfamiliar stimuli. Eventually, the clinician may introduce new materials and topics of conversation to evoke and reinforce fluent speech.

Initially, the clinician encourages the child to produce more continuous speech with such prompts as "tell me about everything you see here," "Say it in longer sentences," "Talk about all that's happening." "Say more than one sentence at a time," and so forth.

The clinician should promptly and enthusiastically reinforce fluent productions with the verbal praise and tokens. The clinician should equally promptly withdraw tokens and offer corrective feedback in an objective tone. In the beginning stage of continuous speech treatment, the clinician should model fluent sentences as often as found necessary and ask the child to imitate. The clinician should model all fluent productions at normal rate. The effect of the method does not depend on a slower rate, an explicit airflow management, or gentle onset of phonation. Therefore, the clinician should not inadvertently induce any of these fluency shaping targets. The duration of treatment at complex levels of response topography (e.g., narration and conversation) will depend on the individual child. The criterion of treatment success and the individual child's progress in treatment will help determine when

to shift training to higher levels. A suggested criterion is less than 2% dysfluency or stuttering rate (based on the number of words spoken) in at least three clinic sessions to initiate treatment in narrative speech and then in conversational speech.

With school-age children, the procedure completed at the continuous speech level should be advanced to the narrative speech level as soon as practical. When fluency systematically increases at the continuous speech level across several sessions, the child may be ready to move on to the narrative speech level. If the child's fluency drops significantly when narrative speech is evoked, the clinician can move back to the lower level for additional training. Narrative speech may be reintroduced after a period of additional training at the lower level. At this stage, the clinician tells stories to the child and asks the child to retell them. The clinician encourages the child to tell the story in all its details and prompts story elements when the child is unsure. Various other strategies to promote good narrative speech in the protocols will follow subsequently. The clinician promptly and enthusiastically reinforces fluent production with verbal praise and a token presentation. The need for modeling at this level of treatment should be minimal. The clinician should tell stories at the normal rate to avoid inducing a slow speech by instructions, modeling, or the manner of storytelling.

The clinician may continue to implement the maintenance strategies introduced in the earlier level. Family members who initially observe the sessions may join the clinician to present a token and verbal reinforcement for each fluent production and withdraw a token while giving corrective feedback for stuttering. Additional information is offered on maintenance strategies in a later section of the protocols. The duration of narrative speech level will depend on the individual's child. The criterion of treatment success and the individual child's progress in treatment will help determine when to dismiss the child from

services. A suggested criterion is less than 2% dysfluency or stuttering rate (based on the number of words spoken) in the clinic sessions and well under 5% in natural settings.

With the school-age children, the method completed at the narrative speech level should be shifted to the conversational speech level as soon as practical. When 98% or better fluency is sustained at the narrative speech level across several sessions, the child may be ready to move on to the conversational speech level. At this level of training, the clinician simply talks with the child. The clinician asks questions and encourages longer sentence productions in the conversational format. Initially, the clinician may ask questions about the child's family, names of parents, siblings, and friends, while encouraging complete sentence productions. The clinician should talk to the child at a normal rate to avoid inadvertently inducing a slower speech rate in the child. The clinician may continue to the use the maintenance strategies introduced in the previous level of treatment. The child may be taken out of the treatment room to informally monitor fluent conversational speech with only verbal praise for fluency and subtle corrective feedback for stuttering (no token presentation or withdrawal).

The duration of treatment at the conversational speech level will depend on the individual child. The criterion of treatment success and the individual child's progress in treatment will help determine when to dismiss the child from services. A suggested criterion is less than 2% dysfluency or stuttering rate (based on the number of words spoken) in the clinic sessions and well under 5% in natural settings. The procedure is applied in the manner described until the child sustains fluent speech at 98% or better across three or more sessions.

Treatment efficacy studies using Response cost in adults

Treatment of stuttering using operant conditioning emerged following the early work of Goldiamond and colleagues (e.g., Flanagan et al., 1958; Goldiamond, 1965), where it was

discovered that the frequency of stuttering could be affected by environmental consequences (Siegel, 1998).

In 1988, Prins and Hubbard conducted a meta-analysis of 68 experimental studies in which PWS were subjected to response contingency paradigms. Over 70% demonstrated that stuttering was modified by either the presentation or withdrawal of a reinforcing stimulus administered closely following the occurrence of the stuttering behavior. Examples of positive stimuli include money, tokens and examiners saying the word 'right' contingent on stutter free speech. The effectiveness of response-contingent time-out in reducing stuttering in adults is well documented.

The first study to describe the effect of time-out was conducted by Haroldson et al. (1968). Results showed that there was at least an 88% reduction in stuttering for each of the four adult participants. Martin and Haroldson (1969) were able to replicate these results with a larger sample. Ten adults who stutter, who were reported to have had no previous treatment, were administered response contingent time-out across eight 50-minute sessions. Relative to session 1, stuttering frequency had reduced by 69% on average in the last session.

A study done by Franklin et al (2007) reported that response-contingent time-out has been shown to be an effective technique for enhancing fluency in people who stutter. The aim of the study was to investigate the effectiveness of using response-contingent time-out to reduce stuttering frequency in adults who stutter. The study included sixty people who stutter half were exposed to time-out following each moment of stuttering over a 40-min period, the remaining participants acted as controls. Results revealed that individuals who stutter are highly responsive to time-out, and that the participants with a more severe stutter responded better than those with a mild stutter.

Three male AWS spoke spontaneously during five experimental segments. In segment I (base rate) stuttering frequency was counted; no response- produced stimuli were delivered. In segment II (punishment 1) an-add-subtract counter was activated; each stuttering response produced subtraction of one point. During segment III (pairing) each stuttering response produced a subtraction of one point and if the first word following was fluent, then 10 points were added. In segment IV (extinction) subtraction and addition of points were withheld. During segment V (punishment 2) one point was again subtracted for each stuttering. Punishment decreased stuttering below the base rate frequency for all three subjects but when reintroduced after pairing with reinforcement, the rate of stuttering did not immediately decrease for one subject. These data indicate that stimulus may be used as a punisher of stuttering behavior, and suggest that punishment for stuttering may acquire discriminative attributes after systematic pairing with a reinforcing stimulus.

A review of literature on punishment of stuttering suggests that various response-contingent stimuli such as electric shock (Martin & Seigel, 1966), loud noise (Flanagan, Goldiamond, & Azrin, 1958), delayed feedback (Goldiamond, 1968), verbal reprimand (Quist & Martin, 1967), and communication interruption (Haroldson, Martin, & Starr, 1968) can be used to suppress stuttering. These findings suggest that stuttering is manipulable as operant behavior and, like a variety of other behaviors, can be reduced in frequency through the use of a certain response- produced stimuli.

At the Prince Henry Hospital in Sydney, Australia, Ingham, Andrews and Winkler (1972) treated PWS in an experimental token economy program in which methods were varied systematically in order to test various clinical hypotheses. Generally a small group of adult PWS spent most of their waking hours together for three weeks. Periodically throughout the day counts were made of percentage of stuttered syllables in their conversation, and tokens were either earned or lost in proportion to decreases or increases in stuttering from

session to session. Tokens were the only means by which they could buy food or other items like cigarettes and magazines. Ingham and Andrews frequently combined this procedure with syllable- timed or “prolonged” speech patterns. The three week program generally resulted in fluent speech by the end of treatment.

Ayllon and Azrin (1965) have demonstrated that punishing stimuli such as shock or noise may produce anomalous results if paired with reinforcement. They hypothesize that maladaptive human behavior may be maintained by punishing stimuli (stimuli which ordinarily reduce response rate if such stimuli are paired with reinforcement) and acquire the ability to signal the availability of reinforcement. If a stimulus is serving the dual role of punishing a previous response and signaling a future response, it may appear to be increasing the response rate – a result contradictory to isolated effects of punishment. If punishment for stuttering is paired with reinforcement for fluency, the punishing stimulus may acquire the ability to signal the availability of the reinforcing stimulus to the PWS, thus maintaining the apparently maladaptive behaviors.

A study done by Andrews and Ingham (1972a), provided therapy using token economy and prolonged syllable –timed speech for 23 adults for a duration of 20 days. The results revealed that mean percent of stuttered syllables reduced from 16.4 to 0.1. The subjects retuned after a follow up of 18 months where the mean percent of stuttered syllable was 7.8, i.e., increased partially. Another study done by Ingham, Andrews and Winkler (1972) provided therapy using token economy for 9 adults for a duration of 2 weeks. The results revealed that mean percent of stuttered syllables reduced from 18.2 to 6.7. Elliott and Williamson (1973) worked with the 10 adults with stuttering using token reward for 12 days, where the subjects showed a 100% improvement and after 6 months of follow up interval the same was noticed in 7 to 8 individuals.

The study by Stocker and Gerstman (1983) on 24 individuals with the mean age range of 6.9 for the duration of mean 7.4 months using reinforcement of fluency showed that 7.4 were rated fluent or exceptionally fluent. Rustin, Ryan and Ryan (1987) conducted a study using verbal reward and punishment, DAF with 107 subjects between the age range of 6-45 years and the treatment was given for a mean of 2.6 months and the results showed that the mean stuttered words per minute decreased from 10.9 to 0.2.

The above studies show that a relatively systematic treatment of stuttering in adults has a longer history than treatment in young children (Bloodstein, 1995; Conture, 2001; Manning, 1991; Guitar, 2006). Nonetheless, significant problems remain in effective treatment of stuttering in adults. Maintenance of fluency over time and across situations has been a major problem. The fluency shaping procedure, which is most often offered to adults who stutter, induces unnatural- sounding speech, possibly leading to a relapse of stuttering.

Treatment efficacy studies in children using Response cost

In recent years, treating children who stutter, especially preschool children who stutter, has gained much philosophical, ethical, clinical and treatment research attention (Conture, 2001; Cordes & Ingham, 1998; Curlee, 1999a; Guitar, 2006; Hegde, 2004). Many clinicians believe that stuttering is effectively treated in young children, perhaps even more effectively than in adults (Curlee, 1999a; Gregory & Hill, 1999; Harris & Onslow, 1999). In recent years, experimental and clinical data on effectiveness of certain treatments offered to preschool and school-age children are emerging (Cordes & Ingham, 1998; Curlee, 1999b; Hegde, 2004; Onslow, 1993). Generally, behavioral treatments, with little or no concern for emotional or attitudinal components of stuttering in young children, have been shown to be effective. Therefore, the treatment protocols include behavioral procedures known to be effective in treating both preschool and school -age children.

An experimental study to date the largest of its kind, completed with about 40 preschoolers (2.6 years to under 6) at the California State University-Fresno supports the use of Response cost (Hegde, 2004). Sessions were held twice weekly, two hours each. All children came to the clinic and left at the same time. Individual Response cost therapy was offered to each child for 30 to 35 minutes in individual therapy rooms. When not in individual sessions, the children were engaged in group interactions in a larger room. The experimental design assessed the effects of only the individual Response cost therapy, not the group interactions. The study ruled-out spontaneous recovery as the source of improvement by repeatedly withdrawing treatment during the typical semester and summer breaks. Any time the treatment was withdrawn in the initial periods of the study, the children's stuttering increased; this showed that without treatment, the children would not have spontaneously recovered. Fluency stabilized only with two or three semesters of treatment. Only three of the 39 children who participated in the study did not complete the treatment because of moving out of the region or not being satisfied with the results (thought not meeting the improvement criterion of less than 3% dysfluency rate in the clinic and less than 5% in natural settings). All other children (36 in total) met and had maintained the normal fluency criterion. Up to four-years of follow-up data available for some of those treated at the beginning of the program, indicate that the children no longer stutter.

Some studies by (Rickard & Mundy, 1965; Browning, 1967; Leach, 1969) report the use of token systems in stuttering therapy programs, but these have been single case study reports in which stuttering was modified within short periods of therapy time. Ingham et al. (1972) reported the design and application of a token system that was integrated with Andrews and Harris' (1964) syllable-timed approach.

In other applications of operant conditioning procedures the stuttering has been ignored and reinforcement has been given for fluent utterances or stutter-free intervals of

time. With a 9 year old boy, Rickard and Mundy (1965) began by increasing his verbal output by verbal rewards or points earned for progressively longer utterances. They then reinforced his fluent verbalizations. The result showed decreased stuttering, but a six month follow up showed that not all the improvement had lasted.

Leach (1969) tried something similar with a 12 year old who stuttered severely. In the first 6 sessions the child earned two cents a minute for each minute of talking. Thereafter during half of each session he earned an extra cent for each 15- sec period of fluent speech. After 42 sessions the stuttering was reduced to less than 2 per minute, and outside the clinic the speech was reported to be normal. A 2-month follow up however showed a partial return of stuttering.

Shaw and Shrum (1972) administered reinforcement for fluency with 3 CWS between the ages of 9 and 11 years. The immediate reinforcement, given for each 5 seconds of fluent speech in the case of one child and for 10 seconds of fluency in the other two cases, was a mark on sheet of paper. A sufficient number of marks brought a reward in the shape of a toy or a piece of candy which the child had selected beforehand. In addition the children were informed at the start about the contingency. In the course of four 20- minute sessions on consecutive days there was a marked improvement in speech which carried over spontaneously into everyday situations and on last observation had apparently persisted for two months in one case and four months in another. The children previously had other types of stuttering therapy, periods ranging from two months to three years without noticeable improvement.

Using essentially the same procedure with three children aged 6, 9, and 11 years, Manning, Trutna, and Shaw (1976) found that tangible rewards were not necessary. Verbal rewards chosen by the subjects (e.g., “good speech,” or “you sounded real nice”) proved as

effective as the tangible ones. Stocker and Gerstman (1983) study done on 24 individuals with the mean age range of 6.9 for the duration of mean 7.4 months using reinforcement of fluency showed the results that 7.4 were rated fluent or exceptionally fluent.

Mallard and Westbrook (1988) used token and verbal reward and punishment in his study and treated 20 subjects who were between the grades KG to 5 and the duration of treatment was 9 months. Results after the treatment showed that the mean percentage of stuttered syllables declined from 12.0 to 9.0, and the mean scores of stuttered syllable was 7.0 after the follow up interval of 4 months.

The literature on behavioral treatment of stuttering provides an illustration of the meaning and measurement of clinical significance within an evidence-based framework. At the same time, clinical researchers have not yet fully established the clinical significance of stuttering treatment outcome because none of the studies described are a direct empirical test of a clinical significant change. But then none of them were explicitly designed with that purpose in mind. Such a research direction is worth pursuing further because the foundations have been established for evaluating such a change.

Researchers suggest number of approaches to treat young child with stuttering. The fact that some treatments are frequently recommended in the absence of unequivocal demonstration that they are effective in helping children who stutter poses serious problems at times. Response cost is one among them with an attractive alternative to fluency shaping. It is effective with young children for whom fluency shaping is not a good option. It does not affect the speech rate and speech naturalness and is easy to administer. Parents accept it and therefore it has high social validity. Early research studies in the late 60s and 70s, and the recent studies demonstrated the effectiveness of Response cost. But those studies are limited as well as experimental, with few participants and little or no follow up. In the Indian context

studies pertaining to the treatment efficacy using Response cost are lacking. There is a need to explore the immediate and long term effects of this procedure. Therefore, the present study was aimed at investing the effectiveness of Response cost in children with stuttering.

METHOD

The primary aim of this project was to determine the treatment efficacy using Response cost and its effects after one month follow up in children with stuttering in the Indian context.

Subjects: The subjects for the study were selected from those children registered with the complaint of disfluencies and diagnosed as having stuttering by qualified Speech-language pathologists based on the following inclusionary criteria:

- Age range: 6 years to10 years
- Diagnosed as having developmental stuttering
- No other speech, language, neurological and hearing problems
- Moderate and severe degree of stuttering

Materials

- A questionnaire was used to gather demographic and other information from the children and parents (Variables like age, gender, nature of onset, current anxiety levels, educational status, social class, family history, attitude, cooperation from parents/clients, understanding and usage of techniques, practice, home training and previous experiences in stuttering therapy).
- Stuttering Severity Instrument-3 (SSI-3; Riley, 1994) to measure severity of stuttering during pre, post treatment and follow up.
- Sony-R 6.1 mega pixels camera for Video audio recording for every therapy session.
- Base rate, Scoring, Treatment recording sheets as per Hegde (2007)

Procedure

The study included four phases and they are as follows:

Phase I: Baseline assessment of stuttering

Phase II: Implementation of intervention program using Response cost

Phase III: Withdrawal of treatment for 1 month period

Phase IV: Reinstatement of treatment using Response cost

Phase I: Baseline assessment

The parents were interviewed for case history and a developed questionnaire was also used to collect more information regarding the child's condition. SSI-3 was administered to measure stuttering severity. Analysis of stuttering was done with reference to type/ frequency/ duration/ percentage of dysfluencies and parent's perceptual rating of severity specific to tasks.

Phase II: Implementation of intervention program using Response cost

In the present study Response cost procedure was used in the treatment protocol. This procedure included positive reinforcement for the production of fluent utterances by presenting tokens and also withdrawal of the reinforcement i.e., by removing tokens for the stuttering blocks/ dysfluencies. A fluent utterance was defined as the effortless flow of speech with absence of extra sounds such as repetitions, prolongations and blocks.

The therapy was held in a quiet room with no distractions. The clinician and the child were seated facing each other. Before starting off with the session clinician explained to the child about the procedure. Response cost procedure included both the verbal praise and corrective verbal feedback procedure. In essence, it included more than one type of

contingency for stuttering and fluency as suggested by Hegde (1998). The protocol was offered at four levels of training, they included treatment at sentence, continuous speech, narrative speech and conversational level. The presentation of the token and verbal reinforcement was dependent on the task used. For e.g., Sentence level training included presentation of tokens for every fluent production and withdrawal for dysfluent sentence. The treatment at continuous speech included the presentation of tokens for every 3 to 4 fluent sentences. Similarly, in narrative speech the tokens were presented for a fluent story telling. Further, at conversation speech level the tokens were presented for a fluent complete sentence in a conversational format. During this intervention program the children were provided a session for 45 minutes on day to day basis and the maximum number of sessions provided for each child was 20. During the therapy session, variety of picture books, various teaching aids and story books were used with the children for elicitation of the responses. In this study the progression of the levels in was taken up only when the frequency of dysfluencies reduced to 2-3% in previous level to proceed with the next level (sentence to continuous speech level to narrative level to conversation level). Therapy was provided by a qualified Speech language pathologist who was familiar with the method. Video audio recording of everyday sessions was performed for the further analysis.

Phase III: Withdrawal of treatment for 1 month period

In an attempt to evaluate the efficacy of the technique i.e., maintenance of fluency, children who had undergone the treatment were asked for a follow up after 1 month of discharge from therapy. During the withdrawal period the parents were instructed not to use the technique either by using tokens or verbal reinforcement. After this phase, only 6 CWS visited the institute again. During the follow up visit the speech sample was video recorded for further analysis.

Phase IV: Reinstatement of treatment using Response cost

All children who visited during the follow up were considered in this phase. However, only 2 CWS could continue attending therapy sessions. Response cost was reinstated as a treatment protocol to reduce dysfluencies. This therapy program was again carried-out individually for 45 minutes duration for 20 sessions for one child and 10 sessions for another child. During follow up therapy clinician provided sufficient treatment at the level of conversation and narration in order to enhance the maintenance of fluency. Video audio recording of everyday sessions was performed for the further analysis. Self monitoring skills were taught and treatment was provided in a more naturalistic situation. Also, the parents were asked to maintain fluency with verbal praise and verbal corrective feedback for stuttering.

Data Analysis

The video recorded speech samples of the children during therapy were analyzed using baseline recording sheet, scoring sheet and treatment recording sheet. The dysfluencies were calculated from the recorded samples and marked accordingly in the recording sheets. The dysfluencies considered during the analysis were syllable repetitions, word repetitions, prolongations, long pauses and tensed articulatory postures. The analysis was done for all the sessions i.e., the percentage of dysfluencies obtained across 20 sessions during the treatment period, reassessment after one month withdrawal and reinstatement of treatment for each child was noted.

The percentage of dysfluencies were calculated using the formula,

$$\frac{\text{Total number of dysfluencies}}{\text{Total number of words spoken}} \times 100 = \text{Total percentage of stuttered words (\% SW)}$$

SSI score was also determined for pre, post treatment, reassessment after one month withdrawal and reinstatement of treatment for each child. The scores were entered in the appropriate statistical tool (SPSS-16) and were subjected for appropriate statistical analyses. For the acquired data the mean and standard deviation (SD) scores were calculated for the percentage of dysfluencies and SSI scores. A non - parametric test i.e., Friedman test was employed for the data to determine the significant difference across the sessions for all children with stuttering. Also, for further analysis a non –parametric test i.e., Wilcoxon signed rank test was used to explain the presence of pair-wise significant difference between the therapy sessions and across different phases.

Results and Discussion

The study aimed at exploring the efficacy of Response cost in children with stuttering. It also aimed at investigating the effects of treatment after withdrawal and reinstatement. A total of 10 CWS in the age range 6-10 years were included in the study. The details of CWS considered in the present study are indicated in table 1.

Table 1: Demographic data of children with stuttering

Children with stuttering	Age	Gender	Severity
Child 1	7 years	M	Moderate
Child 2	8 years	M	Moderate
Child 3	7 years	M	Moderate
Child 4	10 years	M	Moderate
Child 5	6 years	F	Moderate
Child 6	6 years	M	Severe
Child 7	9 years	M	Moderate
Child 8	6 years	M	Moderate
Child 9	8 years	M	Moderate
Child 10	10 years	M	Severe

In the present study 9 (90%) of the CWS were boys and only 1 (10%) was a girl. The sex ratio of stuttering found in this study is 9:1. Out of 10 CWS, majority (8, 80%) exhibited moderate degree of stuttering severity and only 2 (20%) children had severe stuttering. The results are discussed with respect to dysfluencies noticed in the following phases of treatment period;

1) Pre and post treatment condition- Initial therapy
2) Dysfluencies after the withdrawal of Response cost
3) Reinstatement of treatment using Response cost

1) Pre and post treatment condition- Initial therapy

During the initial phase, 10 CWS attended therapy using Response cost for 20 sessions. The data was analyzed for all the children across all the therapy sessions. Mean percentage of dysfluencies and standard deviation (SD) scores were computed across all the therapy sessions (see Table 2). SSI-3 was used to measure the severity of stuttering in CWS during the pre therapy and also post therapy sessions.

Table 2: Mean percentage of dysfluencies during initial therapy (N=10)

Sessions	Mean (%)	SD
Pre therapy	13.33	5.34
Session1	8.54	5.63
Session 2	7.17	5.27
Session 3	4.80	2.75
Session 4	5.94	4.38
Session 5	4.93	4.28
Session 6	4.89	3.89
Session 7	3.10	2.51
Session 8	4.27	3.87
Session 9	3.17	2.58
Session 10	3.21	2.42
Session 11	3.36	2.17
Session 12	2.89	1.44
Session 13	2.49	1.54
Session 14	2.09	1.43
Session 15	2.62	3.02
Session 16	2.77	2.21
Session 17	2.29	1.55
Session 18	1.79	1.27
Session 19	2.18	2.26
Session 20	1.66	1.60

(a) Mean percentage of dysfluencies across pre and post treatment conditions

Analysis of results revealed that the mean percentage of dysfluencies across the therapy sessions decreased from pre therapy to midsession to the last therapy session respectively. The mean percentage score was higher (Mean=13.33, SD=5.34) for pre therapy compared to the 20th session (Mean=1.66, SD=1.60). Though the majority of sessions

showed a decreasing trend of mean percentage of dysfluencies, a slight increase was also noted. Table 2 indicates a slight increase (within 1%) in mean percentage of dysfluencies during the sessions 4, 8, 10, 11, 15, 16 and 19. The probable reason lies behind the nature of variability of stuttering. Another reason for slight increase of dysfluencies could also be due to the complexity of the tasks. In this study the progression of the levels in was taken up only when the frequency of dysfluencies reduced to 2-3% in previous level to proceed with the next level (sentence to continuous speech level to narrative level to conversation level).

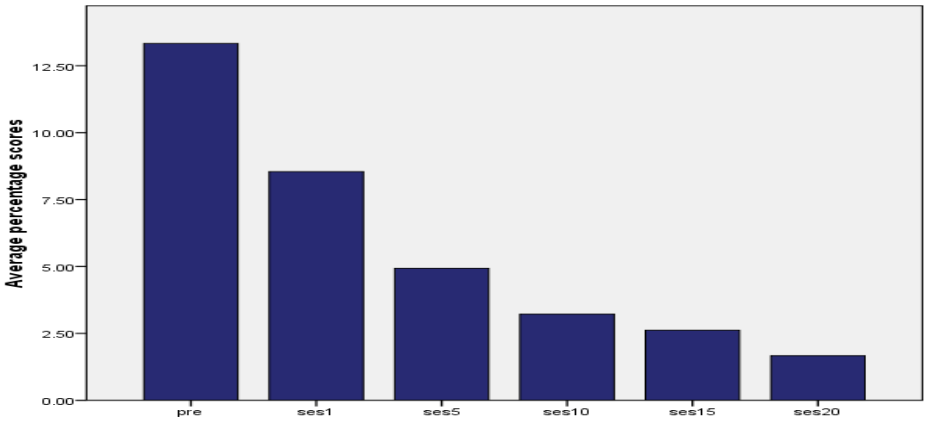

Figure 1: Mean percentage of dysfluencies across sessions

The results indicated that all the children showed a gradual improvement across the therapy sessions respectively. It can be seen from Figure 1 that it depicts a descending pattern of percentage scores of dysfluencies across the sessions i.e., pre therapy, 1st, 5th, 10th, 15th and 20th. This shows that Response cost was very effective in CWS. Non parametric test i.e., Friedman test revealed that there was a significant difference across all sessions for all children i.e., chi square value showed 32.68, $p < 0.05$. Therefore, by knowing the existence of significant difference being present across all the therapy sessions, a non parametric test i.e., Wilcoxon-signed rank test was employed for further analysis to explain the pair-wise

significant difference between sessions. The results revealed that many pairs of therapy sessions showed significant difference and the details are provided in the table 3.

Table 3: Pair wise significant difference across therapy sessions

Pairs of therapy sessions	**/z/**
First and pre therapy	-1.98*
Fifth and pre therapy	-2.70*
Tenth and pre therapy	2.70*
Fifteenth and pre therapy	-2.70*
Twentieth and pre therapy	-2.80*
Tenth and first	-2.39*
Fifteenth and first	-2.80*
Twentieth and first	2.80*
Fifteenth and fifth	-1.98*
Twentieth and fifth	-2.39*
Twentieth and tenth	- 2.19*

(* indicates presence of significant difference at 0.05 level)

The results suggest that the treatment provided using Response cost was very effective for the children with stuttering (see table 2 and figure 1)

(b) Percentage of dysfluencies across individual children with stuttering

The variability with regard to percentage of dysfluencies exhibited by 10 CWS are depicted in figures 2 (child 1-5) and 3 (child 6-10). As seen from figure 2, considering the pre therapy condition child 4 had increased percentage of dysfluencies up to 20% and child 2 had the lowest (8%). Similarly, even in the session 1 the same trend was present. Looking at the dysfluencies for session 5, child 4 had increased percentage of dysfluencies, while 3 CWS (child 1, 3, 5) exhibited decreased dysfluencies. These findings indicate that out of 5 CWS 3

had understood the technique and were using it appropriately which helped them to manage with dysfluencies after 5 sessions. Considering the performance after 10 sessions, all 5 CWS had decreased dysfluencies that ranged from 1-5%. To maintain fluency among CWS therapy continued beyond 10 sessions. By 15 sessions, 4 CWS had maintained the fluency (within 5%) whereas only one CWS (child 3) had an increase of dysfluency to 9%. By the end of 20 sessions all 5 CWS had decreased dysfluencies that ranged from 1-5% which was well within normal limits. Considering the overall performance of 5 CWS, figure 2 shows a decreasing trend in 2 of them, a slight increase of dysfluencies in 3 children in between the sessions was observed. However, the percentage of dysfluencies decreased by 20 sessions in 3 CWS.

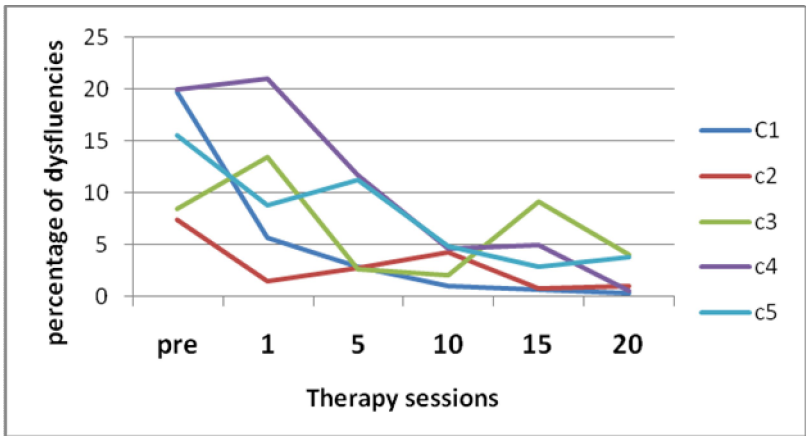

Figure 2: Percentage of dysfluencies for five CWS (C1-C5)

The variability with regard to percentage of dysfluencies exhibited by another 5 CWS (child 6-10) is depicted in figure 3. Considering the pre therapy condition, child 6 had increased percentage of dysfluencies up to 19% and child 7 had the lowest (7%). During session 1 child 9 had increased percentage of dysfluencies up to 11% whereas child 6 had reduced dysfluencies to 6%. By 5 sessions, child 10 had increased percentage of dysfluencies up to 10% whereas child 6 had reduced to 1%. Considering the performance after 10 sessions, 4 CWS had decreased dysfluencies that ranged from 0-5% which was well within normal limits except child 10 (8% of dysfluency). By 15 sessions, child 10 also had

decreased dysfluencies and the remaining CWS had maintained the fluency that ranged from 0-5%. By the end of 20 sessions 4 CWS had decreased dysfluencies that ranged from 0-2% which was well within normal limits except one child (4% dysfluencies). From figure 3, it can be seen that the overall performance of 5 CWS (child 6-10) showed a decreasing trend among 3 of them and a slight increase of dysfluencies in between sessions among 2 CWS. However, percentage of dysfluencies decreased by 20 sessions in all 5 CWS.

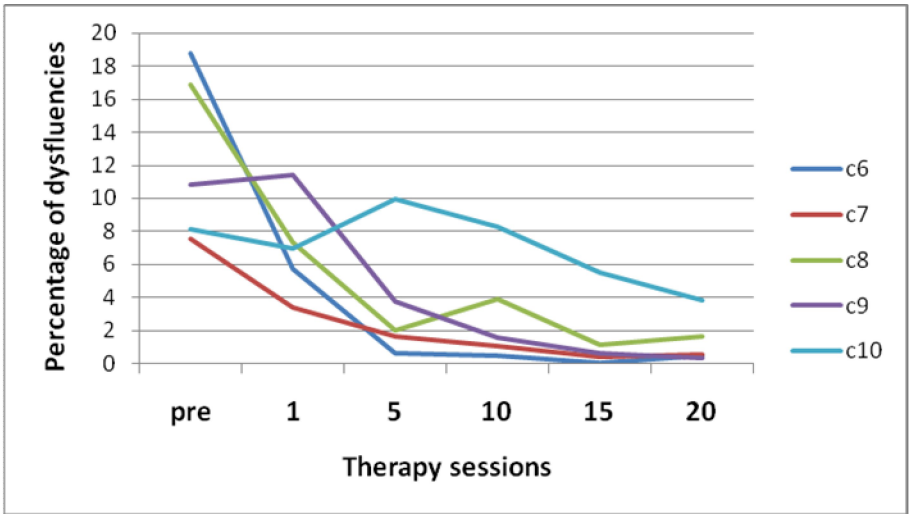

Figure 3: Percentage of dysfluencies for five children (C6-C7)

To summarize the results, there was reduction in percentage of dysfluencies that suggest the effectiveness of Response cost among children. CWS show variability across response to the same therapeutic strategy due to presence of subgroups among children.

c) Pre and post comparison of severity of stuttering

SSI-3 was used to measure the severity of stuttering in CWS during the pre therapy and post therapy sessions. The measures included frequency and duration of stuttering instances and physical concomitants associated with stuttering. The total measure determines the severity of stuttering. Analysis of the results revealed that SSI mean score reduced in post therapy compared to pre therapy condition as seen in the table 4. A greater reduction was

noted in the frequency parameter (15.40 in pre therapy to 3.80 in post therapy) followed by duration parameter (pre therapy -5.20 to post therapy- 2.60) and physical concomitants (pre therapy- 3.30 to post therapy- 1.50). Finally the mean total SSI score reduced from a high score of 23.70 to a low score of 7.90 during post therapy. The score indicates that the majority of children had moderate severity before treatment and the severity changed to very mild after treatment.

Table 4: Pre therapy and post therapy SSI score

SSI parameters	Pre therapy		Post therapy	
	Mean	SD	Mean	SD
Frequency	15.40	1.89	3.80	4.26
Duration	5.20	1.03	2.60	0.96
Physical concomitants	3.30	1.41	1.50	1.08
Total score	23.70	2.16	7.90	5.30

The Wilcoxon signed rank test results revealed that the parameters had pair-wise significant difference for pre and post therapy scores and details are provided in table 5.

Table 5: Pair-wise significant difference across SSI parameters

SSI parameters	/t/ value
Pre and post therapy frequency	7.01*
Pre and post therapy duration	8.51*
Pre and post physical concomitant scores	5.01**
Pre and post total scores	9.52*

(* indicates significant difference at 0.00 level and ** indicates significant difference at 0.001 level)

These findings suggest that the treatment using Response cost was effective in reducing the overall behavior of stuttering. There was a decreased score with regard to frequency and duration of stuttering and also the physical concomitants associated with stuttering.

The results of the present study are in consensus with the findings of Hegde (2004). An experimental study on 40 CWS (2.6 to 6 years) supports the use of Response cost technique which was extremely effective in treating stuttering in school-age as well as preschool children. However, in the present study only school age children (6-10 years) were considered and the technique was found to be extremely effective even in this group.

Our study is also in consensus with Mallard and Westbrook (1988). They used token/ verbal reward and punishment and treated 20 children who were between the grades KG to 5 and the duration of treatment was 9 months. Results after the treatment showed that the mean percentage of stuttered syllables declined from 12.0% to 9.0% and the mean scores of stuttered syllable were 7.0% after the follow up interval of 4 months. Another study conducted by Rustin, Ryan and Ryan (1987) using Delayed Auditory Feedback (DAF), verbal reward and punishment, for 107 subjects between the age range of 6-45 years for a mean duration of 2.6 months showed that mean stuttered words per minute decreased from 10.9 to 0.2. However, in the present study mean percentage of dysfluencies were calculated and there was a greater decline of dysfluencies from 13.33% to 1.66%, which was well within normal limits. The mean total SSI score also reduced from 23.70 to 7.90 indicating very mild severity after treatment. Hence, the present study also supports literature with respect to improvement in fluency using Response cost.

2) Dysfluencies after the Withdrawal of Response cost

a) *Mean percentage of dysfluencies across different phases*

In the present study, 10 children underwent the initial intervention program out of which only six children followed up after 1 month of withdrawal period. Table 6 provides details of percentage of dysfluencies across 3 phases of therapy.

Table 6: Percentage of dysfluencies across different phases of therapy

Therapy phases	Mean (%)	SD
Pre therapy	13.50	5.33
Post therapy	1.70	1.76
Withdrawal	3.74	1.26

The descriptive analysis of the results revealed that the mean percentage of dysfluency scores of 6 children showed an increase during pre therapy (baseline) i.e., when treatment was not started (Mean = 13.50, SD =5.33). With the introduction of Response cost the children showed good improvement, i.e., at the end of post therapy decreased percentage of dysfluencies (Mean = 1.70, SD = 1.76) was observed. As per the second phase of treatment protocol, Response cost was withdrawn for the duration of 1 month. During the follow up visit it was noted that the percentage of dysfluencies had increased although slightly (Mean = 3.74, SD = 1.26) compared to previous post treatment condition (see Table 4). Therefore, the present study revealed that the withdrawal of the treatment resulted in increased number of the dysfluencies though not to pre therapy level. During the withdrawal period the parents were instructed not to use the technique and the same was also verified when they came for a follow up. Some of the parents did report of inconsistent usage of verbal reinforcement with their children. It can be seen from Figure 4 that there was a descending pattern of the percentage of dysfluencies with Response cost treatment and a rise in the percentage of dysfluencies with the withdrawal of the treatment. Non parametric test revealed a significant difference across 3 phases of therapy (pre, post and withdrawal) with a chi square value at 12.00, $p < 0.05$.

Wilcoxon-signed rank test revealed that percent of disfluencies in all the pairs of therapy phases showed the significant difference. They included pre and post therapy condition; pre therapy and withdrawal; and post therapy and withdrawal phase at $z = -2.201$,

p < 0.05. The study indicated increased stuttering when the treatment was withdrawn suggesting the importance of treatment using Response cost.

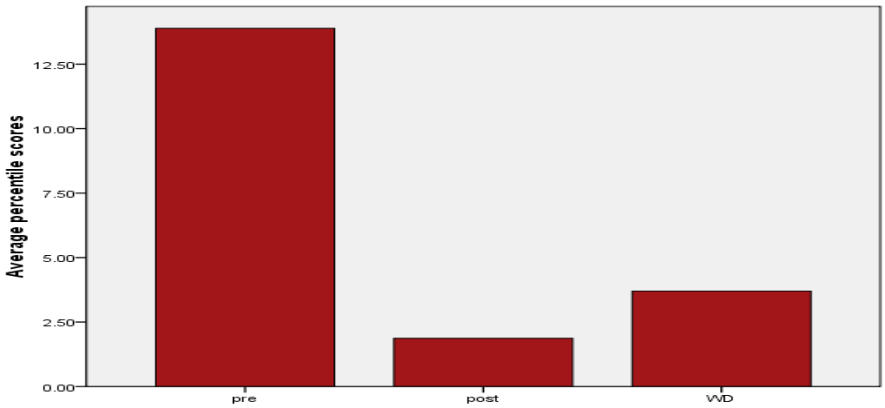

Figure 4: Mean percentage of dysfluencies across therapy phases

(Note: Pre- before treatment; Post- after treatment; WD- withdrawal)

b) *Severity of stuttering across different phases*

SSI-3 was used to measure the severity of stuttering among children across pre, post therapy and after withdrawal period. Analysis of the results revealed that the mean SSI score reduced in post therapy compared to pre therapy and an increased score was noticed after withdrawal (see table 5). The mean frequency score during pre therapy was high and reduced in post therapy but increased after withdrawal. The mean duration score for pre therapy was high which reduced in post therapy and the same score was also noted after withdrawal. The mean physical concomitant scores for pre therapy was high and it reduced in post therapy but increased after withdrawal. Finally, the mean total SSI scores also showed similar results. It can be seen from table 7 that the score indicates that the majority of children had moderate severity before treatment, the severity reduced to very mild after treatment but an increase in severity to mild category was observed after withdrawal of treatment.

Table 7: SSI scores across different phases of therapy

SSI parameters	Pre therapy		Post therapy		Withdrawal	
	Mean	SD	Mean	SD	Mean	SD
Frequency	14.40	1.67	2.00	4.47	8.40	2.60
Duration	5.20	1.09	2.80	1.09	2.80	1.09
Physical concomitant	3.40	1.14	1.60	1.14	2.20	0.83
Total score	22.60	1.51	6.40	6.10	13.40	3.91

Non parametric analysis revealed a significant difference between pre, post and withdrawal phase, the chi square value showing 47.99, $p < 0.05$. Further, Wilcoxon signed rank test revealed pair-wise significant difference between pre and post therapy frequency scores ($z = -2.041$, $p < 0.05$), pre and post therapy duration scores ($z = - 2.121$, $p < 0.05$), pre and post therapy physical concomitant scores ($z = - 2.156$, $p < 0.05$) and pre and post total scores ($z = -2.032$, $p < 0.05$). Thus the results proved that there was reduction in SSI score suggesting treatment to be effective using Response cost technique.

The present study is also supported by Rickard and Mundy (1965). They reported decreased stuttering in the presence of contingent verbal rewards, but a six month follow up showed that not all the improvement had lasted. Another single subject study by Leach (1969) reported that in the first six sessions the child earned more cents for period of fluent speech. After 42 sessions of therapy the stuttering was reduced to less than 2 per minute, and outside the clinic the speech was reported to be normal. But after a 2 month follow up however, the child showed a partial return of stuttering.

In Hegde's (2004) study following base rates, treatment was offered, withdrawn during semester breaks, and reinstated following the breaks. Treatment resulted in marked reduction in stuttering, and initial treatment withdrawal caused an increase in stuttering to 4% to 12%. To support the literature the results of the present study also showed a slight increase

in the percentage of dysfluencies upto 3.74% after the withdrawal period suggesting the poor carry over effect of the treatment.

3) Reinstatement of treatment using Response cost

During the Reinstatement (RI) phase of Response cost, only two CWS reported for follow up to attend therapy again after the withdrawal period. Figure 5 depicts the percentage of dysfluencies noticed across the complete phase of therapy (pre, post, withdrawal and reinstatement) for child 1. Mean percentage of dysfluencies in pre therapy was 7.45% and it decreased to 0.99% in post therapy. However, an increase in dysfluencies to 3.85% was noticed after withdrawal. It can be noted that there was an increase to an extent of 2.86% (3.85-0.99) during follow up. Hence the treatment was reinstated and child 1 attended 20 more sessions. The data indicated reduced percentage of dysfluencies across the booster therapy sessions.

During the reinstatement phase the mean percentage of dysfluencies in pre therapy was 3.85% followed by progressive decrease in dysfluencies. The gradual change in dysfluencies included 3%, 5%, 2% and 0.15% across 5^{th}, 10^{th}, 15^{th} and 20^{th} sessions respectively. But the percentage of dysfluencies in the 10^{th} session showed increase to 5%, which may be because this child attended the 10^{th} session after a gap of 15 days due to reopening of school.

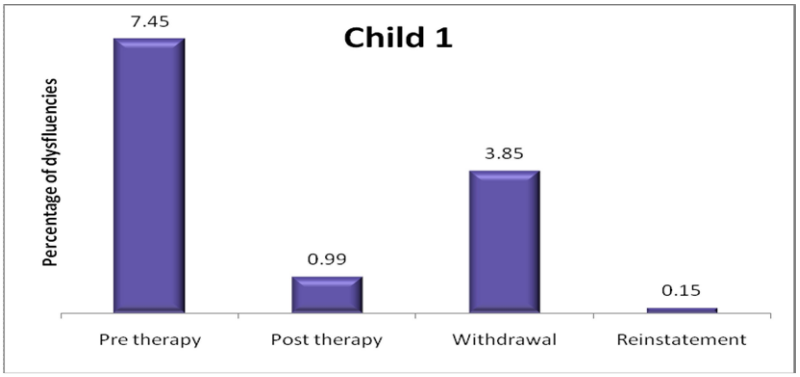

Figure 5: Percentage of dysfluencies across the complete phase of treatment for child 1

The findings suggested decreased stuttering with reinstatement of therapy. It also suggested no maintenance of recovery during the withdrawal of treatment as the percentage of dysfluencies showed increased scores after the withdrawal treatment. However, the percentage of dysfluencies reduced gradually with the reinstatement of treatment using Response cost. Also, as reported by parents their child maintained fluency outside clinical situations like play and at home.

Figure 6 depicts the percentage of dysfluencies noticed across the complete phase of therapy (pre, post, withdrawal and reinstatement) for child 2. Mean percentage of dysfluencies for pretherapy was 13.50% and it decreased to 4.11% for post therapy. However, an increase in dysfluencies to 4.57% was noticed after withdrawal of treatment. It can be noted that there was an increase to an extent of 0.46% (4.57-4.11) during follow up. Hence the treatment was reinstated and child 2 attended 10 more sessions in the reinstatement phase.

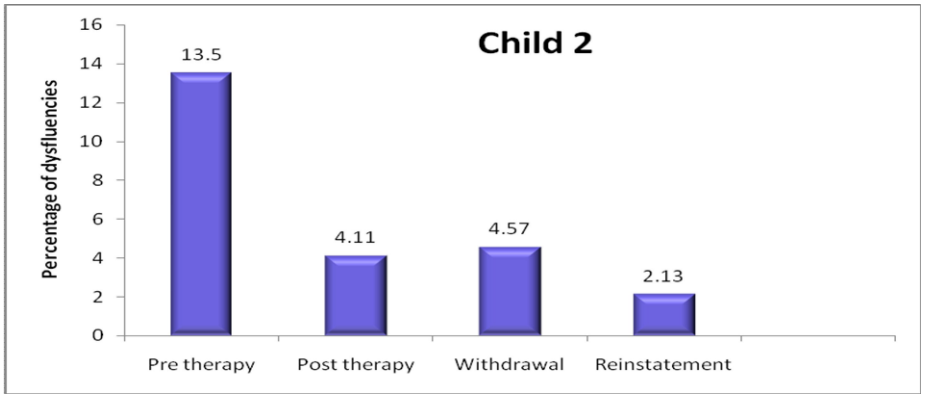

Figure 6: Percentage of dysfluencies across the complete phase of treatment for child 2

The data indicated reduced percentage of dysfluencies across the booster therapy sessions. During the reinstatement phase the mean percentage of dysfluencies for pre therapy was 4.57% followed by progressive decrease in dysfluencies. The gradual decrease in dysfluencies included 3% and 2.13% across 5^{th} and 10^{th} session respectively.

During the pre therapy child 1 and 2 showed higher percentage of dysfluencies compared to the post therapy sessions. Both the children showed an increase in the percentage of dysfluencies after the withdrawal of therapy i.e., 3.85% and 4.57% respectively (see figures 5 & 6), and both showed lower percentage of dysfluencies after reinstatement of therapy (0.15% and 2.13%). This shows that the Response cost is effective in treating CWS. The percentage of dysfluencies reduced gradually with the reinstatement of treatment using Response cost. The parents reported that their children had improved and also could manage to speak fluently outside the clinical settings. Therefore, it indicated that the Response cost is effective in treating CWS because the results of the last sessions showed < 3% of stuttering like dysfluencies. As stated by Halvorson (1971), Response cost has a procedural advantage since both the punishing and reinforcing consequences can be arranged along a continuous stimulus dimension (subtraction and addition of points).

The findings suggested decreased stuttering with reinstatement of therapy. It also suggested no spontaneous recovery or maintenance with the withdrawal of treatment as the percentage of dysfluencies showed increased scores after the withdrawal treatment. However, the percentage of dysfluencies reduced gradually with the reinstatement of treatment using Response cost. The results suggest that without treatment, the children would not have spontaneously recovered. Reinstatement of fluency resulted in systematic and clinically significant reductions in stuttering. Increase in stuttering following treatment withdrawal helped to rule out the possibility that the children would have recovered without treatment (spontaneous recovery). Fluency in both the children stabilized only with reinstatement. Treatment should be provided in a timely fashion to enable better communication abilities in PWS. Such improvements meaningfully can contribute to facets of person's personal and professional life.

The earlier studies paved a way and also suggested that research on Response cost was proved to be effective which was done decades ago (Halvorson, 1971; Kazdin, 1973; Salend & Andrews, 1984). In a more recent experimental study done by Ahlander and Hegde (2000) the authors reported that Response cost was effective with the school-age children, which demonstrated that that it is as effective as pause-and-talk (time-out), a procedure more appropriate for school-age children. Hegde (2010) provides an individual data of 8 preschool children with stuttering who underwent treatment. Base rates of children ranged from 10% to 22% of dysfluencies. The mean percentage of dysfluencies ranged from 1.7% to 5.6% when treatment was offered for about one semester. During semester breaks when treatment was withdrawn, percentage of dysfluencies ranged from 4% to 12%. Treatment was reinstated following the breaks and it resulted in marked reduction in stuttering which ranged from 1.6% to 3%.

Similarly even in the present study children improved with the reinstatement of treatment. The findings suggest that stuttering is manipulable as operant behavior and, like variety of other behaviors, can be reduced in frequency through the use of certain response-produced stimuli. Maintenance of fluency is an important phase in which case stuttering behaviors are reduced by making use of the internal cues that reinforces fluent speech in children with stuttering.

Intervention strategies enable one to deal more constructively with the problem. The literature on behavioral treatment of stuttering provides an illustration of the meaning and measurement of clinical significance within a research-based framework. Evidence based practice can be carried out in a standard clinical settings. Sackett, Rosenberg, Gray, and Richardson (1996) state that “Good doctors use both individual clinical expertise and best available external evidence, and neither alone is enough”. The outcome research is fundamental to progressive and responsible clinical practice.

Reliability Data

10% of the video recorded speech samples across pre treatment, during treatment, post treatment, after withdrawal and reinstatement phases were analyzed by another speech language pathologist to check reliability. The dysfluency data were judged reliable if the ratings of the given session between the two speech language pathologists did not differ by more than 1%. The variations ranged from 0.2% to 0.8%.

To summarize, the present study attempted to evaluate the treatment efficacy in clinical setting using Response cost technique with children having stuttering. The results support the findings of the previous research investigations where the percentage of dysfluencies and severity of stuttering in children showed a drastic reduction from pre therapy to post therapy conditions using technique. Therefore, this study suggests that this technique can be used clinically effectively with children as it is easy to follow. Current information suggests that effective treatment of stuttering will enable one's ability to communicate whenever, wherever, about whatever, and to whomever they want, without worry about stuttering. Future research can include the longer duration of follow up and on larger population and documenting efficacy outside the clinical set up. Such a research is worth pursuing further as there is a need to establish a data base of changes with treatment.

SUMMARY AND CONCLUSIONS

The literature on behavioral treatment of stuttering provides an illustration of the meaning and measurement of clinical significance within an evidence-based framework. Researchers suggest number of approaches to treat young child with stuttering. Response cost is one among them with an attractive alternative to fluency shaping. Early research studies in the late 60s and 70s, and the recent studies demonstrated the effectiveness of Response cost. But those studies are limited as well as experimental, with few participants and little or no follow up. In the Indian context studies pertaining to the treatment efficacy using Response cost are lacking. There is a need to explore the immediate and long term effects of this procedure. Therefore, the present study was planned.

The primary aim of this project was to determine the treatment efficacy using Response cost and its effects after one month follow up in children with stuttering in the Indian context. The subjects considered for the study were children diagnosed as developmental stuttering in the age range 6 - 10 years. The four phases of the study included, 1) Baseline assessment of stuttering; 2) Implementation of intervention program using Response cost; 3) Withdrawal of treatment for 1 month period and 4) Reinstatement of treatment using Response cost. In the present study Response cost procedure was used in the treatment protocol. This procedure included positive reinforcement for the production of fluent utterances by presenting tokens and also withdrawal of the reinforcement i.e., by removing tokens for the stuttering blocks/ dysfluencies. The progression of the levels in Response cost was taken up only when the frequency of dysfluencies reduced to 2-3% in previous level to proceed with the next level (sentence to continuous speech level to narrative level to conversation level).

The video recorded speech samples of the children during therapy were analyzed using baseline recording sheet, scoring sheet and treatment recording sheet. The dysfluencies were calculated across 20 sessions during the treatment period, reassessment after one month withdrawal and reinstatement of treatment for each child. SSI score was also determined for pre, post treatment, reassessment after one month withdrawal and reinstatement of treatment for each child. Mean and standard deviation (SD) scores were calculated for the percentage of dysfluencies and SSI scores. Non parametric tests were employed to determine the significant difference across the sessions and phases for all children with stuttering.

During the initial phase, 10 CWS attended therapy using Response cost for about 20 sessions. Analysis of results revealed that the mean percentage of dysfluencies across the therapy sessions decreased from pre therapy to midsession to the last therapy session respectively. Analysis of the results revealed that mean SSI score reduced in post therapy compared to pre therapy condition. A greater reduction was noted in the frequency parameter, followed by duration parameter and physical concomitants. Non parametric test revealed a significant difference across all sessions for all children. Majority of children had moderate severity before treatment and the severity changed to very mild after treatment. These findings suggest that the treatment using Response cost was effective in reducing the overall behavior of stuttering and also there was reduction with regard to percentage of dysfluencies.

In the next phase of treatment protocol Response cost was withdrawn for the duration of 1 month. During the follow up visit it was noted that the percentage of dysfluencies had increased compared to previous post treatment condition. Therefore, the present study revealed that the withdrawal of the treatment resulted in increase in the number of the dysfluencies though not to pre therapy level. The SSI score indicated that the majority of children had moderate severity before treatment, the severity reduced to very mild after

treatment but an increase in severity to mild category was observed after withdrawal of treatment.

During the Reinstatement (RI) of Response cost, only two CWS followed up to attend therapy again after the withdrawal period. An increase in dysfluencies was noticed after withdrawal of treatment. Hence the treatment was reinstated for both the children. Child 1 attended for 20 more sessions and Child 2 attended 10 more sessions in the reinstatement phase. The findings suggested decreased stuttering with reinstatement of therapy. It also suggested no effect of spontaneous recovery or maintenance with the withdrawal of treatment as the percentage of dysfluencies showed increased scores after the withdrawal treatment. However, the percentage of dysfluencies reduced gradually with the reinstatement of treatment using Response cost. Also as reported by parents their children maintained fluency outside clinical situations like play and at home.

To summarize, the present study attempted to evaluate the treatment efficacy in clinical setting using Response cost technique with children having stuttering. The results support the previous research investigations where the percentage of dysfluencies and severity of stuttering in children showed a drastic improvement from pre therapy to post therapy using Response cost technique. Therefore, this study suggests that this technique can be used clinically effectively with children as it is easy to follow. Current information suggests that effective treatment of stuttering will enable one's ability to communicate whenever, wherever, about whatever, and to whomever they want, without worry about stuttering.

Future research can include the longer duration of follow up and on larger population and documenting efficacy outside the clinical set up. Such a research is worth pursuing further as there is a need to establish a data base of changes with treatment.

Clinical implications of the study

1. The results of this study will enhance the knowledge of speech language pathologists regarding treatment efficacy using in CWS. Clinicians can practice treatment using for CWS with confidence. It is expected that the professionals would choose an appropriate intervention strategy by considering available information, combine it with their own clinical experience and their own clinical data and use entire package to benefit every client.

2. The current study included the time interval measurements as every session was documented and analyzed and also included a follow up after one month. This study will facilitate the professionals in documentation of activities and responses in a scientific manner and make way for a better evidence based practice while using method.

3. Student clinicians and parents can be relatively easily trained in administering this method. After a period of formal treatment method the parents may be trained to maintain fluency in their child only by verbal reinforcement.

Limitations of the study

1. SSI-4, the recent version of stuttering severity measure could not be used due to non availability of the test in our clinical set up. The dysfluencies were measured only in the clinical set up and not beyond clinical settings.

2. Percentage of dysfluencies was calculated by considering the total words stuttered and not syllables.

3. Treatment protocol was used only in the clinical settings. Though, CWS were exposed to different clinicians, generalization of achieved fluency in different settings like home and school settings could not be monitored.

4. Though the parents were asked to provide information about the child's fluency beyond the clinic speaking situations an objective parent evaluation measure (rating) was not considered.

5. A follow up period of only one month was considered. Ideally, in order to be confident about the treatment effects longer and frequent follow ups are recommended.

6. Limited number of CWS for the reinstatement phase of Response cost was included due to poor follow up.

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