A Revised Component Model for Diagnosing and Treating Children Who Stutter

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The original component model was developed in the 1970s as a result of reviewing published reports in the literature about stuttering and our own experiences with children who stutter (CWS). There was a limited number of studies focused on children at that time. Most of the theories on the etiology of stuttering among adults assumed that stuttering was a unitary disorder. For example, a developmental theory was proposed by such researchers as Johnson (1942) and Wischner (1948). An intra- and interpersonal theory was supported by Coriat (1943), Sheehan (1954), Bender (1942), Murphy and Fitzsimons (1960), Glasner and Vermilyea (1953), and Douglass and Quarrington (1952). An organic theory of etiology was proposed by Travis (1931), Karlin (1959), Weiss (1964), and Bryngelson (1940). The assumption that people who stuttered were homogeneous was quite pervasive. However, not all researchers accepted the idea of a unitary causation of stuttering. Some viewed stuttering as having two or more possible causes. Luchsinger and Arnold (1965), Robinson (1964), Bluemel (1957), Wyke (1970), and Boone (1958) viewed the instability of the nervous system as a predisposing factor to stuttering and considered environmental influences to represent an additional cause.

It seemed that we could learn more about the etiology of stuttering if we studied children closer to the onset and development of stuttering before additional behaviors were crystallized. We questioned the unitary theory of stuttering as well as the homogeneity of people who stutter. If CWS were a heterogeneous group, we wanted to know what the differences might be among them, and that required an extensive evaluation of each child. In addition, the idea that an unstable nervous system might be a predisposing factor was attractive. Therefore, determining possible vulnerabilities to stuttering was our orientation. We used differential diagnoses to better profile each child. From our early data, we thought there would be subgroups of CWS. We thought

ABSTRACT: This study describes a revision of a 1979 component model that was proposed as useful in dealing with the multidimensional aspects of stuttering in children. Stuttering, speech motor control, psychosocial behaviors, articulation phonology, and language were assessed in 50 children who stutter (CWS). The resulting revised component model identifies four components that are correlates with stuttering in that they were more prevalent among CWS than would be expected in a random sample. An additional three components were identified that related specifically to CWS and not to a random sample. The components and the percentage of the CWS who exhibited each component were:
- attending disorder (26%);
- speech motor control difficulties (68%);
- high self-expectations (66%);
- overly sensitive (42%);
- disruptive communication environment (54%);
- secondary gains (22%); and
- teased and bullied (36%).
Interactions among the components and implications for diagnosing and treating CWS are discussed.
that one subgroup of CWS would have a primary problem with language formulation; another subgroup would have speech motor problems as the main accompanying problem (Riley, 1971). We assumed that we would find a finite number of subgroups. However, the differential diagnosis data did not place the children neatly into groups. Many of the children had several problem areas, which we first called factors, later naming the most important factors as components of stuttering. We viewed these "components" as being contributing "causes" of the stuttering, based on a multifactorial theoretical model.

Since that time, data have not been forthcoming to relate these components to the etiology of stuttering. We do see that CWS have a greater incidence of these factors than children who do not stutter, based on the norms of each assessment instrument we have used. We continued to investigate the possible etiologic significance of the interaction of these components to result in vulnerability for the development of stuttering. Whatever role these factors have in the development of stuttering, they have the potential of influencing the design of treatment for each child.

The rationale for constructing a component model that includes components related to the child's constitutional makeup and components related to speaker and listener reactions to the stuttering was to improve treatment outcome. By reducing the effects of poor attending, inadequate sentence formulation skills, and compromised speech motor control, we improved the child's system that supports fluent speech. Treatment could be further improved if the effects of stuttering on the child and listener reactions to the stuttering could be reduced. This comprehensive approach to treatment should, it seemed to us, stabilize treatment gains and improve long-term results.

**ORIGINAL COMPONENT MODEL**

Children should be seen and heard. This is what we assumed at the beginning of our work with CWS. When a child walked into the clinic, we expected to learn from the child and the parents. Therefore, we developed a system of listening to and observing the child and the family. We worked on organizing the information we were obtaining. Based on what we had heard and observed, we realized that we could not simply assign the children into subgroups.

Using a multidimensional approach, we looked at three different possible classifications:

1. Each child could be assigned to a single, principle subgroup even though a child often qualified for two or three others. The problem was that more than one subgroup often qualified for the principle factor.

2. Each child could be described in terms of multiple risk factors without indicating that any one factor was more important than the others (Andrews & Harris, 1964). The problem with this approach was that we needed support to indicate that each factor was somehow related to the etiology (risk) of stuttering.

3. Correlates of stuttering were simply concomitants that could be identified by their abnormal distributions among CWS. They were defined as any factor that occurred among the CWS at more than twice the expected rate. For example, normal distribution predicts that 2.3% of a randomly selected group of children will fall 2 standard deviations (SD) below the mean on a standard test. Thus, if 4.6% or more of the CWS score > 2 SD below the mean, stuttering can be considered to be related to the factor being measured.

The components described in our model were best fitted to the correlate definition.

The purpose of the 1979 component model was "to describe and organize several components of stuttering into a useful model to assist in diagnosing and treatment planning for children who stutter" (Riley & Riley, 1979, p. 280). Five assumptions directed the development of the model:

1. Stuttering is not a unitary disorder.
2. A multivariate approach is needed.
3. Systemic conditions as well as stuttering behaviors need to be included in any comprehensive model.
4. The components of the model need not be mutually exclusive.
5. The model needed to be clinically useful rather than purely theoretical.

The 1979 model used data from all 54 children who were assessed and accepted for stuttering intervention at our clinic between 1972 and 1979. The children were aged 3:0 (years:months) through 11:9 and had mild to severe stuttering.

Assessment involved a minimum of three sessions with the child and two sessions with the parents. In addition to a structured parent interview, the parents filled out the Burks Behavior Rating Scales (BBRS, Burks, 1976). A minimum of two speaking samples in the clinic and one at home were obtained. Stuttering was described by percentage of words stuttered, duration of the three longest stutterings, and rating of the amount of physical struggle; these variables were scored on the Stuttering Severity Instrument (SSI, Riley, 1972). Oral motor performance was assessed by measuring the diadochokinetic rate and by observing coarticulation (perceived overlapping of abutting syllables) and sequencing of syllables (McDonald, 1964). Articulation was assessed from the speaking samples and from the Deep Test of Articulation (McDonald, 1976). Language performance was assessed by an analysis of speaking samples and from subtests on the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968).

Two subtests of the BBRS helped describe attending disorder. They were poor attending and poor impulse control. The description of high self-expectations for each child included BBRS ratings of excessive suffering, excessive anxiety, and excessive self-blame, as well as parent and clinician reports of perfectionism.

From the parents’ descriptions of the behaviors of the members of the extended family and the CWS, data were collected that could be used to assess the components of disruptive communication environment, manipulative stuttering, and an abnormal need for the child to stutter.
Data quantification in the 1979 model is described later and compared to methods used in the revised component model (RCM).

Selected variables were subjected to a factor analysis (Riley & Riley, 1980). Linguistic and motoric components emerged from this procedure. Other components emerged from parent reports, children's reactions, and elements of the communication environment. These data from each child who stuttered were combined and organized into nine components that are shown in the left-hand column of Table 1. Five of the components that were selected were more prevalent among children who stuttered than in the general population based on normative data. These components were attending disorder, auditory processing disorders, sentence formulation disorders, oral motor disorders, and high self-expectations. For example, if an attending disorder was measured in a standardized manner, the result would place approximately 2.3% of the children at a severe level (2 SD beyond the mean) and an additional 8% at a moderate level (1.5 SD beyond the mean). The finding that CWS scored in excess of these expectations defines attending disorder as a correlate with stuttering among some children. The other four components resulted from observed behaviors or attitudes that required clinical intervention. They included manipulative stuttering, unrealistic parental expectations, disruptive communication environment, and abnormal parental need for the child to stutter.

We designed treatment for each child based on the diagnostic findings. We attempted to identify strengths and weaknesses of a child's system. Our goal was to address the components that seemed to be contributing to the child's stuttering. For example, if a given child had an attending disorder, oral motor disorders, and a disruptive communication environment, we would address attending behavior modification and seek medical consultation regarding medication. We would use speech motor training to improve (verbal) oral motor coordination and we would

<table>
<thead>
<tr>
<th>Component</th>
<th>1979 model Percentage</th>
<th>Revised component model Percentage</th>
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<tbody>
<tr>
<td>Attending disorders</td>
<td>36 (severe, 20)</td>
<td>Attending disorder 26 (severe, 18)</td>
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<tr>
<td>Auditory processing disorders</td>
<td>27 (severe not reported)</td>
<td>Linguistic uncertainty* 22 (severe, 8)</td>
</tr>
<tr>
<td>Sentence formulation disorders</td>
<td>31 (severe not reported)</td>
<td>Speech motor control difficulties 68 (severe, 50)</td>
</tr>
<tr>
<td>Oral motor disorders</td>
<td>69 (severe, 36)</td>
<td>Articulation/phonological disorders* 50 (severe, 36)</td>
</tr>
<tr>
<td>Articulation disorders*</td>
<td>33 (severe not reported)</td>
<td>High self-expectations 66 (severe, 18)</td>
</tr>
<tr>
<td>High self-expectations</td>
<td>89 (severe not reported)</td>
<td>Overly sensitive 42 (severe, 18)</td>
</tr>
<tr>
<td>Disruptive communication environment</td>
<td>53 (severe not reported)</td>
<td>Disruptive communication env. 54 (severe, 20)</td>
</tr>
<tr>
<td>Unrealistic parental expectations</td>
<td>51 (severe not reported)</td>
<td>Unrealistic parental expectations* 18 (severe, 2)</td>
</tr>
<tr>
<td>Manipulative stuttering</td>
<td>25 (severe not reported)</td>
<td>Secondary gains 22 (severe, 4)</td>
</tr>
<tr>
<td>Abnormal need for child to stutter</td>
<td>5% (severe when present)</td>
<td>Teased and bullied 36 (severe, 6)</td>
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</table>

* These factors were not included as components in the revised component model.
help the family adopt a reduced pace in family conversations with fewer interruptions and no teasing or critical remarks about stuttering. These improvements were primarily achieved before targeting fluency itself.

We observed that the stuttering events became less severe and the physical concomitants diminished. Our goal was to strengthen the child’s system with a resulting reduction in the severity of the blocks. Often, young children required minimal or no direct fluency work after the component modification phase of treatment. Older children (6 to 9 years of age) usually needed direct stuttering treatment. Most often, they responded to a program of easy onset and continuous vocalization at a rate that approached their normal speech. Because this latter approach was not much different from the speech motor training program, we determined that some fluency shaping had been done while training the smooth flow of nonlinguistic syllables from a slow to a normal rate. We speculated that the stability of fluency was increased when the presenting components were addressed. That is, the achieved fluency would be less tenuous and more easily maintained.

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TREATMENT RESULTS

We tracked 36 children through component treatment including fluency shaping as needed and were able to locate 26 of these families 24–48 months after the termination of treatment. We correlated the modification of each component and the reduction of stuttering with the stability of that reduction based on parent response to a questionnaire and a telephone follow-up.

The average child received 48 hours of treatment (or 96 half hours if preschool age). Of these hours, 40 were devoted to component modification and 8 to direct stuttering management. Stuttering was quantified by the SSI (Riley, 1972).

After the component modification phase of treatment and before direct fluency treatment, the conditions described by the components had improved substantially. For example, oral motor disorders were reduced 74%, attending disorder was improved 73% (half with behavior modification alone and half with behavior therapy and medication), adverse effects of exceptionally high self-expectations were reduced 55%, and disruptive communication behaviors were reduced 65%.

Stuttering severity as quantified by the SSI averaged 22.3 (5.5 SD) at intake; at the termination of treatment, the mean was 5.3 (3.0 SD). Thus, stuttering was reduced an average of 76% by component treatment prior to direct modification. After direct modification of the stuttering, 22 of the 26 children (84.6%) had no significant stuttering and 4 had significant stuttering. At follow-up (24–48 months later), 23 (88.5%) had little or no stuttering and 3 had significant stuttering.

If the child had an attending disorder prior to therapy, the chance of having an unacceptable level of stuttering reduction 24–48 months post termination of therapy was significantly increased (r = .48, p = .01). No other variable measured at intake predicted stability of treatment outcome. Notably, stuttering severity was not predictive nor was age at intake or any of the other components.

If certain components were not successfully modified during treatment, their level of severity at the termination of treatment predicted lack of stability of stuttering reduction 24–48 months later. These components were attending disorder (r = .58, p = < .01), oral motor disorders (r = .46, p = .01), and high self-expectations (r = .45, p = .01). Attending disorder reduced treatment effectiveness as well as prevented long-term stability of stuttering treatment. If attending disorder, oral motor disorders, or high self-expectations were not adequately modified, the long-term treatment results were compromised. Thus, successful treatment of these components promoted stability of stuttering treatment results.

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THE REVISED COMPONENT MODEL

During the last 20 years, the view of stuttering as a multidimensional disorder has become part of the mainstream thinking. A demands and capacities model such as the one first applied to stuttering by Andrews and Harris (1964) was described by Adams (1990) and Starkweather and Gottwald (1990). According to this model, CWS have reduced motor and linguistic capacities to develop fluent speaking, and stuttering occurs when these capacities are overwhelmed by demands for rapid, correct speech by the listeners. The component model applies this same type of reasoning to diagnosis and treatment but does not describe any etiologic significance. Most clinicians who applied the demands and capacities model targeted only the demands side, usually by reducing speaking rate, complexity of language, and complex questions. Treatment based on the component model targeted speech motor capacities, sentence formulation capacities, the child’s tolerance for normal imperfections, and so forth, as well as reducing listener demands.

After the concept of using subgroups to accommodate diversity in CWS proved inadequate, the concept of multiple risk factors was suggested as a reasonable approach. This conceptual framework was described by Zimmermann, Smith, and Hanley (1981) and later reviewed as it related to the etiology of stuttering by Smith (1990) and Smith and Kelly (1997). Data may be developed in the future that will qualify some of the components (in the component model) as risk factors.

Over the years, we began to revise the original model as it was applied to clinical practice. For the current model, we analyzed the most recent CWS who have been treated at our clinic. From the data for these children, we replicated or revised the 1979 component model. The purpose of the current report is to describe an RCM to assist in diagnosing and treating CWS. We believe that the treatment results following the use of the original model lend support to the assumption that treating the components that are present in a given child serves to reduce stuttering and stabilize treatment outcome.


METHOD

Subject Selection

In order to obtain a representative sample of CWS, 50 children who met the following criteria were enrolled in the study.

- They were consecutive children admitted for treatment to the Riley’s Speech and Language Institute during 1993–1999.
- They were between the ages of 3:0 and 9:11 (years:months).
- They had no severe disorder such as cerebral palsy, developmental delay, autism, and so forth, either from our observations or by medical report.

The resulting study group consisted of 10 girls and 40 boys. Their age distribution, stuttering severity, and reported stuttering onset data are presented in Table 2. The average age was 6:4 (SD = 2.2). The mean stuttering severity as quantified by the Stuttering Prediction Instrument (SPI, Riley, 1981) for the younger children was 22.2 (SD = 7.0), which is identical to the SPI normative data. The mean SPI score for the older children was 23.4 (SD = 6.8), which is approximately one-fifth SD above the SPI normative data. For the 26 children ages 3:0 to 5:11, the average time from reported onset to the start of treatment was 17.7 months (SD = 9.5). Two children were admitted to treatment within 6 months of onset and five others within 9 months of onset. The other children began therapy 12–39 months after onset. The 24 children ages 6:0 to 9:6 averaged 51.5 (SD = 11.8) months from reported onset to the start of treatment.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years:months)</td>
<td>6:4</td>
<td>2.2</td>
<td>3:0–9:6</td>
</tr>
<tr>
<td>Severity (SPI total score)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 3:0–5:11</td>
<td>22.2</td>
<td>7.0</td>
<td>13–33</td>
</tr>
<tr>
<td>Age 6:0–9:6</td>
<td>23.4</td>
<td>6.8</td>
<td>15–40</td>
</tr>
<tr>
<td>SPI normative data</td>
<td>22.2</td>
<td>7.0</td>
<td>10–27</td>
</tr>
<tr>
<td>Months from reported onset to first treatment session</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 3:0–5:11</td>
<td>17.7</td>
<td>9.5</td>
<td>4–39</td>
</tr>
<tr>
<td>Age 6:0–9:6</td>
<td>51.5</td>
<td>11.8</td>
<td>23–60</td>
</tr>
</tbody>
</table>

Note. SD = standard deviation; SPI - Stuttering Prediction Instrument.

Selection and Development of Instruments

In an effort to improve our measurement of stuttering and speech motor control, we developed two instruments since 1979. In collecting our original data, we used the SSI (Riley, 1972) and found it necessary to write descriptions of the child’s type of stuttering and reactions to the stuttering. This need led to the development of the SPI (Riley, 1981). This instrument allowed for a description of onset, course of development, records of the family history of stuttering, ratings of the parents’ and child’s reactions to the stuttering, scoring of the number and severity of part word repetitions, and measuring of the duration of vowel prolongations, phonatory arrests, and articulatory posturing. Frequency of stuttering in conversation was scored in a manner similar to the SSI.

The Oral Motor Assessment Scale (OMAS, Riley & Riley, 1985) was developed to quantify the clinician’s judgment of the normalcy of syllable production characteristics. It rates voicing accuracy, coarticulation (overlapping production of abutting syllables as perceived by a lack of airflow breaks), sequencing of the syllables, and diadochokinetic rate of production.

These revised instruments became part of the interview, observation, and testing protocol. In addition, assessment procedures for each component were modified as new instruments and protocols were developed. For the revised component model, each component was defined by a set of descriptors that included standardized measurements and clinical observations. The revised assessment protocols are described for each component.

Data Collection

The time-line consisted of an initial parent interview session with one or both parents, two to four assessment sessions with the child, and a treatment planning session with both parents.

A minimum of three 300-word speaking samples were obtained during the assessment sessions. These samples were used to assess stuttering, language, and articulation or phonological variables.

Stuttering severity was assessed using the subtests of the SPI as well as clinical observations and parent reports of the details of the stuttering events and related behaviors and attitudes. Speech motor performance was assessed using the OMAS; its development is described above. Other indications of speech (and nonverbal) motor control came from observation and reports from related professionals. Articulation and phonology were assessed by the McDonald Screening Deep Test of Articulation (MSDTA, McDonald, 1976) using norms provided by Li and Riley (1989). Also, intelligibility of speech was rated.

Behaviors and attitudes of the children were assessed using the BBRS (Burks, 1976). This scale requires the parent to rate each of 105 items on a scale of 1 to 5. Five to seven related items are used to form a subtest such as excessive self-blame or poor impulse control. The BBRS, which was sent home after the first parent interview and returned during the child assessment sessions, was
completed by each parent independently and, when appropriate, by a teacher. The information provided by the BBRS was discussed with the parents. These scales are widely used in research in education and psychology. Normative data were available from Burks’ database.

The BBRS was administered to 26 CWS, 26 children with articulation or phonological disorders, and 26 controls (Riley, 1983). Three BBRS subtests discriminated the CWS from the other two groups. They were excessive suffering, excessive anxiety, and excessive self-blame. These subtests are used to help measure high self-expectation and overly sensitive components. In addition, the poor attending and poor impulse control were used as descriptors of attending disorder. The Hyperactivity Index from the Conners’ Parent Rating Scale (Conners, 1989, 1997) was added as a descriptor of attending disorder.

Language was assessed by evaluation of the speaking samples and by scores from the Clinical Evaluation of Language Functioning–Revised (CELF-R, Semel, Wiig, & Secord, 1987).

Younger children were given the Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979).

**Data Quantification**

In the original model, the descriptors were quantified using a 5-point scale in which 0 equals no problem, 1 equals slight question of normal performance, 2 equals 1.0 to 1.4 SD below norm or judged as mild by trained observer, 3 equals 1.5 to 1.9 SD below norm or judged as moderate, and 4 equals > 2.0 SD below norm or judged as severe. For the revised model, a 7-point scale has been used so that our data can be compared more readily to other treatment outcome data. The 7-point scale is as follows:

1 = at the mean or better. Same as 0 in the 1979 model.
2 = very slight question about normal performance or attitude. Added to the new scale.
3 = clinical judgment that the performance is not at normal level or standard score was .5 to .9 SD below normal. Same as 1 in the 1979 model.
4 = clinical judgment of “mild” or standard score of 1.0 to 1.4 SD below normal. Same as 2 in the 1979 model.
5 = clinical judgment of “moderate” or standard score of 1.5 to 1.9 SD below normal. Same as 3 in the 1979 model.
6 = clinical judgment of “severe” or standard score of 2.0 to 2.4 SD below normal. Same as 4 in the 1979 model.
7 = clinical judgment of “very severe” or standard score >2.5 SD below normal. This value to represent very severe was not in the 1979 scale.

By converting normative test data and clinical judgments to the rating scales, information from various sources can be compared and applied to set of descriptors and a severity level can be determined for each component for a given child.

**Modification of the Component Model**

The RCM of stuttering in children was developed from the information about the CWS that was generated through the above procedures. Figure 1 provides a graphic depiction of the percentage of CWS who exhibit moderate and severe levels of each component. The RCM consists of three types of factors:

1. **Physical attributes**, including attending disorder and speech motor control difficulties.
2. **Temperament factors**, including high self-expectations and overly sensitive.
3. **Listener reactions**, including disruptive communication environment, secondary gains, and teasing/bullying.

**Physical Attributes**

Two of the seven components that make up the RCM are categorized as physical because they describe conditions in the child’s physical capacities. They might also be considered constitutional factors. They are attending disorder and speech motor control difficulties. Table 1 compares the original, 1979 model to the current RCM. The components for each model are shown along with the percentage of children in our sample who exhibited each component. In addition, some factors that were not selected as components are shown.

**Attending disorder.** In the current model, attending disorder is described by abnormal scores or clinical judgment as follows:

- BBRS poor impulse control scale. Sample items include can’t control self, is impulsive, and is hyperactive and restless.
- BBRS poor attention scale. Sample items include cannot finish things, easily distracted, and attention not increased by reward or punishment.
- Conners’ Hyperactivity Index (Conners, 1989). Sample items include excitable, cries easily, destructive, impulsive, and restless.
- The clinician’s judgment that the child had a reduced attention span and was distractible.

Among the 50 CWS who comprise the database for the RCM, attending disorder was replicated as an important correlate to stuttering in children. Twenty-six percent of our population had an attending disorder (18% severe and 8% moderate). The expected distribution as shown on Figure 1 was 2.3% with a severe attending disorder and an additional 8% with a moderate disorder. Whether or not an attentional deficit disorder (ADD) is a risk factor for stuttering has not been established. Poor attending and impulsive behaviors complicate treatment.

Children with attending disorders are treated in a similar manner as children who do not stutter. However, there are reports of children who need to take a stimulant medication to control hyperactivity and distractibility, but
the medication exacerbates the stuttering in some cases (Burd & Kerbeshian, 1991; Lavid, Franklin, & Maguire, 1999). We have observed two similar incidences in the last year. On the other hand, stimulant medication did not negatively affect stuttering in three children in our sample. Thus, it is possible that neurochemical differences among individuals with ADD may relate to the development of stuttering in some children.

In general, children with ADD need a combination of medication and a behavioral modification program; thus, there is a dilemma because without medication, treatment is difficult; with medication, the stuttering can become more severe.

**Speech motor control difficulties.** The speech production characteristics of CWS have been addressed extensively in the literature over the last 20 years. Representative reviews of this body of literature can be found in Denny and Smith (1997), Caruso, Max, and McCowry (1999), Gracco (1997), McClean (1997), and Riley and Ingham (2000).

The revised model uses the OMAS (described above) to quantify selected syllable production parameters. It provides improved normative comparisons of errors in voicing, coarticulation (smooth flow), sequencing, and rate. The current descriptors are as follows:

- Scores on each scale of the OMAS, that is, accuracy of voicing, flow (coarticulation and sequencing), and rate. Diadochokinetic rates for the syllables [puh], [tuh kuh], and [puh tuh kuh] were computed. The child produced each syllable set 10 times at a comfortable rate. Normative data for expected rates for ages 3 through 11 can be found in Fletcher (1972) and Riley and Riley (1985). During the repeated syllable production, noted were (a) any voicing errors such as b/p or d/t, (b) air flow breaks that reduce coarticulation (smooth flow) between syllables and between sets of syllables, (c) any sequencing errors, and (d) rate. Quantification of these observations can be made using the OMAS.

- Reduced intelligibility.
- Articulation or phonology disorder.
- Nonverbal, oral motor difficulties such as problems moving the tongue laterally or poor saliva control.

In our current sample, 68% of the CWS had speech motor difficulties (50% severe and 18% moderate), which is well above the expected distribution of 2.3% severe and 8% moderate. Moderate or severe articulation or phonological disorders were observed in 50% of the current sample. Compromised speech motor control may result in a physical vulnerability that can become overloaded by stress or by interaction with some of the other components.
Speech motor control difficulties can be treated directly with available programs. Riley and Riley (1999) describe the latest version of their speech motor program in a clinically usable format. Daly, Riley, and Riley (2000) describe a program that combines speech motor training with fluency shaping techniques.

Temperament Factors

The 1979 model included a column labeled “intra-personal components.” This column has been renamed “temperament factors” in the RCM and includes two components, high self-expectations and overly sensitive. Manipulative stuttering has been moved to the listener reactions column and has been renamed “secondary gains.”

High self-expectations. This component is defined by scores on the BBRS, by clinical judgments, and by parent reports. The descriptors are:

- BBRS excessive anxiety scale. Sample items include shows many fears, worries too much, and appears tense.
- BBRS excessive self-blame. Sample items include upset if makes a mistake, shows over remorse for wrong doing, and blames self if things go wrong.
- Parent report that child is perfectionistic, child doesn't express feelings easily, or child is very cautious.
- Clinician judgment that the child is perfectionistic or has a low threshold for frustration.

In the current sample, abnormally high self-expectations occurred in 66% of the CWS (18% severe, 48% moderate). If children have unrealistic self-expectations, the goal is to help them to cognitively reframe their expectations that are unrealistic. The emotional tension is manifested in physical tension, affecting the speech. We observe the areas that the children expect perfection from themselves. We then set up absurd scenarios where the children cannot possibly get something “perfect” so that they learn to laugh about the absurdity of getting it “just right.” Then, more realistic expectations are introduced along with increasing the children’s awareness of choice. Some choices are presented to the children, some of which are absurd, some practical, and others which are choices that the children usually make. At this point, they are beginning to feel more freedom to choose, to make a mistake, to be able to laugh at themselves easier, and to let go of unrealistic expectations. There is often a spread effect of this modified attitude to stuttering. We also work with the parents concerning their expectations of the child and learning what to look for to ease the child’s unrealistic self-demands. The parents can model self-acceptance in how they handle tasks. Often, the pressure to perform perfectly is somewhat relieved all the way around.

Overly sensitive. This component has been added to the RCM to further describe the child’s temperament. It describes children who are overly reactive to their environment or are vulnerable. The descriptors include:

- BBRS excessive suffering scale. Sample items include feelings easily hurt, appears unhappy, and sulks. The most frequently reported indicator of overly sensitive was that the child’s feelings were easily hurt and the child reacts to subtle changes in the parent’s mood.
- Parent report that the child is easily upset or the child’s feelings are easily hurt.
-Clinician judgment that the child is easily upset.
- Parent report or clinical judgment that the child is shy and withdrawn.

The overly sensitive component occurred in 42% of the children in the current sample (18% severe, 24% moderate). The goal in working on this component, when it is present, is to first hear and try to understand the children who are overly reactive and whose feelings are easily hurt. They are trying to communicate something and we need to know what it is. Often they are not feeling heard and are feeling powerless. Being aware of what triggers these responses, then talking to the children about their feelings is important. We begin by helping them learn to identify the triggering experiences, their responses, followed by better verbalizing the feelings. These experiences begin to help them feel empowered. At the same time, working with parents to better hear their children is part of the interaction that we are working toward. The children stating their feelings and the parents hearing them or reducing the need for them to be anxious about their parents’ moods that don’t apply to them are part of the desensitization process. We see this component as overlapping high self-expectations.

Listener Reactions

Three components in the RCM describe aversive listener reactions to the child’s stuttering. They include disruptive communication environment, secondary gains (formerly manipulative stuttering), and teasing and bullying (an added component).

Disruptive communication environment. This component includes listener reactions that interfere with the child's attempts to speak. The descriptors include:

- Parent reports that the child has difficulty getting the parents' attention.
- Parent reports that the family members rush the child’s speech.
- Parent reports or the clinician observations that the family members interrupt while the child is speaking.
- Parent reports that the child is or has been teased about the stuttering. (More about this below).
- Parent reports or the clinician observations that people make critical, negative, or sarcastic comments about the child’s speech.

In the current sample, 54% of the families report these descriptors (20% severe, 34% moderate). The goal in working with family members on the disruptive communication environment is to first listen to a description of the dynamics as related by the parents and any other family members, then integrate a system of respectful listening for the entire family. We do not encourage the CWS to be singled out for special treatment.
because we view this as sending a message to them that they are very different and require special privileges. A system is set up in which everyone gets a chance to communicate relatively uninterrupted. The parents aren’t asked to speak slowly, but to interject pauses between phases as recommended by Couture (1982). This modification of the speaking rate seems to be more attainable by the parents and, although it does not seem to slow the rate of the child’s speech, it gives the child more time to process and formulate, thus reducing stuttering. Rushing can’t always be controlled in the family, but we encourage the parents to minimize it when possible. A more relaxed atmosphere is helpful to everyone. Sometimes, it means reducing the number of activities in which children and parents are involved.

**Secondary gains.** It is possible for CWS to use the stuttering to manipulate the other family members and get secondary gains from the stuttering. This type of attitude and behavior is enabled by the family members’ responses to the stuttering. The descriptors (all based on parent report and clinical judgment) include:

- Child gets special privileges because of the stuttering.
- Child is allowed to dominate the family conversation.
- Parents are extremely anxious about the child.
- Parents feel excessive pity for the child.
- Child is not told “no” appropriately because of fear of stress on the child.
- Family members all become silent when the child speaks, but not for others.

Secondary gains was a component in 22% of the current sample (4% severe and 18% moderate).

The parents are often unaware of the secondary gains they are enabling in the CWS. Our goals are to bring these secondary gains into their awareness so they can evaluate the messages the child might be getting from them and analyze possible manipulation by the child. Children who are manipulative may be trying to gain more power. Finding ways to give the child appropriate power can significantly reduce the need for manipulation. Parents may think that they are reducing stress on their child when they hesitate to discipline him or her as the siblings are disciplined. However, the message might be, “You have to be handled very carefully because you are different and fragile.” CWS should have to follow the rules similar to other children. More importantly, they need to have appropriate privileges and choices as they grow. As they gain a sense of power and mastery, the need to manipulate diminishes.

**Teasing and bullying.** This component is described by the parents’ and child’s report of the amount and type of teasing and bullying that the child has experienced. Thirty-six percent of the children reported being teased or bullied (6% severe, 30% moderate).

Teasing and bullying are treated as a separate component, although they are part of the communication environment, because they have such a powerful effect on the child. When adults who stutter are asked when they began to stutter, often they will say when they gave an oral presentation and were laughed at or teased. They most likely started stuttering before that time, but the teasing was so painful that it became an emotional trauma to be remembered. This is a component that should be addressed immediately if it is happening. The goals of this intervention are to educate a group of children (often in the classroom) to be more tolerant of differences, enlist the support and help from adults, and empower the child by providing options. One of the options we help the child to develop is to be assertive in response to being teased and supportive of other children who are teased for various reasons. For the children to be actively involved in solving the problem is giving them a sense of power. Learning how to resolve conflict with help from adults is important. Seeking adult aid to intervene is another option. Adults need to be sensitive to the child being teased and to the one doing the teasing. Group meetings to bring out differences and talk about being teased and/or being the teaser are a powerful approach. Having guest speakers in the classroom on stuttering (e.g., representatives from the National Stuttering Association), hearing problems, and so forth can have an important impact on helping children to be more understanding and tolerant. We recommend a book by Marilyn Langevin (1996) entitled, *Teasing and Bullying: Unacceptable Behavior.*

**OTHER FACTORS THAT INFLUENCE TREATMENT**

Three factors that did not meet the criteria to be included as components in the RCM can be important in the treatment of some children and their families.

**Linguistic Uncertainty**

Auditory processing and sentence formulation disorders that we believe to be related to linguistic uncertainty have been removed from the RCM because the assessment methods we used did not define them very well. We believe that processing involving time delays, self-corrections, need for repeated instructions, reactions to dichotic listening, and so forth will demonstrate processing differences among CWS.

CWS often stutter more on complex sentences and require more time to formulate sentences (Gaines, Runyan, & Meyers, 1991; Logan & Couture, 1995), but their overall sentence formulation ability is comparable to other children (Ratner, 1997; Ryan, 1992). In the 1979 sample, we judged 31% of the CWS to have sentence formulation disorder. However, the data that we are currently using (parent report, clinical observation, and CELF-R) only identified one child (2% of the sample) with a severe sentence formulation problem and three children (6%) with a moderate problem. This distribution is within expected limits for a randomly selected group of children. Thus, if there is linguistic uncertainty, we were not able to identify it from our data.

Concerning auditory processing, when there is a delay or a self-correction, we will often ask the children what they are thinking. At times, they will respond that they want to get the “right” word, which seems to be related to being
perfectionistic; at other times, they will say that they were trying to think of an answer. When children are perfectionistic, they may fear that they will stutter on the word. Other times, they may be experiencing time pressure to respond and then realize that they need to correct their response. When there is a request for repetition of instructions, we explore whether the children are not attending, had difficulty remembering, or could not process them the first time. We have concluded that although auditory processing seems to be a problem with some children who stutter, it is complex and we have not acquired solid data. However, we think that it is an area of future concern and should be investigated in a careful, controlled manner.

Another possible condition leading to linguistic uncertainty may exist when there is a "gap" between exceptionally high receptive language ability and normal production ability. We identified 22% of the current sample of CWS to have such a gap (8% severe and 14% moderate).

**Parent Expectations**

Eighteen percent of the families of CWS had unrealistic expectations (2% severe and 16% moderate) that were reported during assessment. Later in treatment, more families were able to identify and report these behaviors. Even though this component did not qualify for inclusion in our revised model based on the data collected, when it is present, it is addressed. Parents who have unrealistic expectations of their children often respond to basic information about what is realistic to expect. Those who respond can be especially helpful, in this way, as part of the team working with the children toward attaining fluency.

**Abnormal Need for the Child to Stutter**

The component that described families in which there was an abnormal need for the child to stutter has been removed. Approximately one family in 20 had some serious psychological conditions that included the child’s stuttering as part of the overall family dysfunction. However, the problem didn’t become evident until there were treatment gains that the family members could not tolerate. Treatment was often sabotaged, stuttering reduction was denied, and the family tried to distance itself from any real help. When this type of reaction was seen, it was intuitive to refer the family for appropriate counseling because the treatment was outside the realm of speech pathology. Thus, it didn’t seem to be a useful component for a model related to stuttering treatment.

**FUTURE DIRECTIONS**

Although there are many unknowns, there are some general directions developing in research in the field of stuttering. We hope to be a part of this discovery process. Examples of future directions include:

- The Special Interest Division in Fluency Disorders (SID-4) has identified approximately 40 behaviors, attitudes, or cognitive processes that define stuttering treatment outcome. This process will undoubtedly produce improved instruments that will better define the components that we and others continue to observe.

- It may be possible to define some risk factors among the components by integrating them with genetics (Felsenfeld, 1997), longitudinal studies (Yairi, 1997; Yairi, Ambrose, & Niemann, 1993), and other areas of research. Ideally, children at high risk to develop stuttering could be assessed and those who develop stuttering could be compared with those who do not. A model for this type of research is provided by Kloth, Janssen, Kraaimaat, & Brusse (1995, 1998).

- Currently, the brain functions of adults who stutter are being studied at three laboratories in the United States (the National Institutes of Health; the University of Texas, San Antonio; and the University of California, Irvine) and one in Canada (the University of Toronto). A review of this work can be found in Watson and Freeman (1997). At the laboratory that is housed at the University of California, Irvine Brain Imaging Center, the areas of the brain that activate differently in people who stutter compared with controls are being studied. Our specific methods measure glucose uptake to indicate neuro-activation and FDOPA uptake to measure dopamine distribution. Reports from this research can be found in Maguire, Riley, Wu, Franklin, & Potkin (1997); Riley, Wu, and Maguire (1997); and Wu, Riley, Maguire, Najafi, & Tang (1997).

It may be possible in the near future to obtain functional brain imaging in children during speech tasks. This possibility is exciting because it will help answer the question of whether the neurological correlates are the result of the experience with stuttering or if they possibly predate the stuttering. The closer we get to collecting data near the onset of stuttering, the more reasonable will be the application of these data to the etiology of stuttering. The products of these four laboratories and perhaps others later should provide special insights into possible neurological and neurochemical correlates to stuttering. Also, medication that reduces dopamine in certain subcortical regions of the brain are being tried as an adjunct to conventional stuttering treatments. In addition, there may be some pharmaceutical solutions to help children with ADD whose stuttering is made worse by stimulant medication, but this work is in early experimental phases.

- The ongoing research of Yairi and his colleagues may continue to provide valuable insights into conditions related to the onset of stuttering. They are measuring a variety of fluency, articulation, phonology, and language factors as close to the onset of stuttering as possible and then following the children for several years. They are also investigating genetic linkage.

- The temperament components are contributing to our understanding of stuttering. It may be that some aspects of temperament are among the genetic predisposing factors. Are some CWS "programmed" to
be perfectionistic and/or overly sensitive? Whether or not this is the case, we always need to be aware of the interaction of environment on the child. Defining terms such as “perfectionistic” and “overly sensitive” are very important (E. Kelly, personal communication, June 20, 2000). Oyler (1996) and others are investigating these areas.

Our work is interwoven with the work of others in the field, past and present. We count it a privilege to be among those individuals on a path of discovery concerning the very complex problem of stuttering. Components described as some form of capacities and demands will most likely continue to change as more data are available. Recognizing the multidimensional nature of stuttering will be central to improving assessment, treatment, and understanding of risk factors and eventually defining some of the causes of stuttering.

ACKNOWLEDGMENTS

We would like to thank the many outstanding clinicians/scientists who have been working with the children at our clinic over the last 30 years. Their ability, their always questioning minds, their feedback and their concern have contributed to the treatment effectiveness of a multidimensional approach. During the last 19 years, Suzanne McCormick, an extraordinary clinician, has applied a component approach to many children in the current sample. Her astuteness and ability to differentially diagnose and treat each child with care have contributed to lasting results with many. We also thank our administrative assistant who has been with us for more than 20 years. She has provided understanding and a calming voice the first time worried parents have called for information and an appointment. She has been a listener to our parents out in the waiting room. And she has kept us all scheduled and organized. Our heartfelt thanks to Linda Clemens. Also, we would like to thank Doris Dendi along with the many other research assistants down through the years for their careful, conscientious work. Most of all, we want to thank the children and their families who have taught us about stuttering and about the person who stutters.

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