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PERSISTENCE AND REMISSION OF INCIPIENT STUTTERING AMONG HIGH-RISK CHILDREN

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This investigation concerns the persistence of stuttering and recovery from it among high-risk children. At the end of the second year of a 6-year prospective study, 26 of 93 preschool children with a parental history of stuttering were classified as stutterers. Four years later, seven of these children were classified as persistent stutterers, and 16 children were classified as recovered stutterers. The articulatory and linguistic skills of these two groups of children and the communicative and speaking behaviors of their mothers, were measured before and after the onset of stuttering. The analysis of these measures revealed that the articulatory skills of the children and the communicative style and language complexity of the mothers differentiated the incipient stutters whose stuttering subsequently became chronic from those who recovered. © 1999 Elsevier Science Inc.

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INTRODUCTION

Stuttering may occur at any time during childhood, but it is most likely to begin between the ages of 2 and 5 years. Many, but not all, children who begin to stutter outgrow the disorder with little or no professional treatment (e.g., Andrews et al., 1983; Bloodstein, 1995). This phenomenon has been called

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spontaneous recovery or natural remission. Estimates of remission range from 36 to 79%, depending on the age group on which the study was conducted (Bloodstein, 1995). Since most of these estimates are based on the subject's retrospective reports, there is the real possibility of a recall bias. More reliable data, obtained from longitudinal studies in which stuttering children were followed for several years from onset or near onset, showed recovery rates of 79% (Andrews & Harris, 1964), 47% (Fritzell, 1976), 80% (Panelli, McFarlane, & Shipley, 1978), and 89% (Yairi & Ambrose, 1992; Yairi, Ambrose, Paden, & Throneburg, 1996). A substantial proportion of these remissions occurred within the first year or two after onset without the assistance of formal treatment (Andrews & Harris, 1964; Yairi & Ambrose, 1992; Yairi, Ambrose, & Niermann, 1993). However, the chance of remission decreased the longer stuttering persisted. Andrews (1984) estimate a recovery rate of only 18% for those children who stuttered for 5 years or more.

Recently, there have been reports of factors associated with the recovery from or the persistence of stuttering. Based on the substantial increase of the male-to-female ratio from almost equal in very young children who stutter (Yairi, 1983; Yairi & Ambrose, 1992) to 4 or 5:1 in older children and adults (Bloodstein, 1995), it would appear that girls are more likely to recover than boys (Seider, Gladstein, & Kidd, 1983; Yairi & Ambrose, 1992; Grinager-Ambrose, Cox & Yairi, 1997). The age of onset also appears to be related to stuttering chronicity. Yairi et al. (1996) found that onset was later for those children whose stuttering persisted than for those whose stuttering remitted. They also found that children who recovered had many more family members who also had recovered from stuttering than those whose stuttering persisted. This suggested that children with a family history of chronic stuttering have an increased risk that their stuttering will persist.

It has been assumed that there is a relationship between stuttering and articulatory and linguistic factors (e.g., Andrews et al., 1983; Bloodstein, 1995). If so, then it might be that these variables would also be related to the persistence of or the recovery from stuttering. However, little is known about this relationship and, as far as we know, empirical data on the possible role of temporal speech parameters, for instance, articulatory rate, on stuttering persistence and recovery is lacking. A first attempt to differentiate children who recover from stuttering from those who do not was recently undertaken by Yairi and colleagues (1996) and Watkins & Yairi (1997). They found that children in both the persistent and recovered group, performed within the average range of language measures.

There also appears to be limited research data that relate to the possible role of environmental factors in the persistence or recovery of stuttering. This in spite of the assumption that environmental factors, especially parental behavior, is influential (Wingate, 1976; Ingham, 1981). Theorists that argue in favor of the contributing role of parents offer supporting evidence in the form

of treatment data which show that their children's fluency is increased when their parents are taught to modify their speech behaviors (Egolf, Shames, Johnson, & Kasprisin-Burrelli, 1972; Guitar, Kopff Schaeffer, Donahue-Kilburg, & Bond, 1992; Langlois & Long, 1988; Stephenson-Opsal & Bernstein-Ratner, 1988). Zebrowski (1995), for example, observed that changes in speech rate and response-time latency of the parents of a child who stutters can enhance the development of speech fluency of some children who stutter. The question remains open, however, as to whether or not there is a relation between "natural," not therapeutically manipulated parental speech behavior, and spontaneous recovery.

The present study was part of a multiyear prospective investigation of 93 preschool children, born into families with a stuttering father and/or mother (Kloth, Janssen, Kraaimaat, & Brutten, 1995a,b; 1998b). In the course of this longitudinal investigation, some of these children always spoke in a normally fluent manner, some stuttered for a brief period and recovered, and some evidenced stuttering that was chronic. The articulatory and linguistic skills of the children whose stuttering persisted and those who recovered as well as the communicative and speaking behaviors of their mothers were compared to see if these factors differentiate the members of these two groups.

METHOD

Subjects

Twenty-three of 93 preschool children, who were subjects of a 6-year longitudinal investigation, participated in the present study. At the beginning of this multiyear project, none of the parents of these children indicated on the Dysfluency Questionnaire (Kloth, Janssen, & Kraaimaat, 1989) that they displayed stuttering dysfluencies. Moreover, no such fluency failures were observed by the experimenters. However, 2 years later 23 children¹ met the preset criteria (see Kloth et al., 1995a,b) that classified them as incipient stutterers. Six years later, the parents of these children were asked again to complete the Dysfluency Questionnaire. In addition, they had to indicate whether or not they regarded their child as a stutterer. At this time, seven (five males and two females) (30%) continued to be regarded as stutterers by their parents (i.e., persistent stutterers), and 16 children (seven males and nine females) (70%) were no longer viewed in this way (i.e., remitted stutterers).

The classification of a child as an incipient stutterer was largely based on the judgement of the parents. This was because at onset, stuttering is likely to

¹Originally, there were 26 families with an incipient stutterer, but three families could not be located in the sixth year of study.

be episodic in nature; it may appear for a few days, then disappear for months and suddenly reappear (Peters & Guitar, 1991). Therefore, clinical judgement runs the risk of underestimation. Parents, however, share the daily speaking environment of the children and therefore are important observers of daily changes in the speech of their children. Since at least one of the parents stuttered, it was assumed that they would be relatively accurate informants (Hedges, Umar, Mellon, & Herrick, 1995). To increase the likelihood of accuracy, both parents had to regard their child as a stutterer and (independently) indicate on the Dysfluency Questionnaire that at least one type of stuttering dysfluency (i.e., rapid sound or syllable repetition, tense silent or oral prolongation) had frequently or very frequently been evidence at home during the previous 2 months. The parental report that their child displayed stuttering forms of dysfluency were bolstered by the presence of these disruptions in the audiotaped speech samples of 21 of the 23 children in the experimental group follow-up test session 1 year after the onset (see Kloth, Janssen, Kraaimaat, & Brutten, 1998a, for more details regarding subject identification).

At the beginning of the longitudinal study, 6 years before the issue of remission was considered, the mean age of the 7 children whose stuttering persisted was 40 months, with an age range from 32 to 52 months (SD 6.45). At that time the mean age for those children whose stuttering later remitted was 36 months, with an age range from 25 to 63 months (SD 9.80).

Procedures

Data collection procedures for the initial pre-onset and follow-up post-onset test sessions, recording environment, and equipment were the same as those previously reported (Kloth et al., 1995a,b). At the start of each test session, a speech pathologist assessed the language development of the children by means of the Dutch versions of the Reynell Language Development Scale (Reynell, 1983; Bomers & Mugge, 1989) and the Peabody Picture Vocabulary Test (PPVT) (Dunn, 1965; Manschot & Bonnema, 1978). Then, 30 minutes of free-play interaction between mother-child dyads was videotaped from behind a one-way mirror. During this play period, the mother was instructed to play and converse with her child as she would at home.

Ten minutes of each of the mother-child taped conversations, during the initial and follow-up test sessions were transcribed by a trained coder. The transcription began at the third minute of videotaping to allow for a 2-minute long "warming-up" period. Subsequently, the 10-minute conversations were separated into utterances according to the criteria of Golinkoff and Ames (1979).

Data Analysis

Child variables. *Language skills.* For each subject, age-equivalent scores for receptive language development were obtained from the Reynell and PPVT

test procedures and for expressive language development from the Reynell test procedure. In addition, each child's mean length of utterance (MLU) transcribed during the 10-minute spontaneous speech periods was used as a measure of their expressive language skill. The MLU was determined by dividing the total number of nonrepeated words spoken by the child by the number of utterances. One-word utterances, stereotype (e.g., thank you), or noninteractive phrases (counting and singing) were not a part of the data analysis.

Articulatory skills. In order to assess the articulatory skills of the children, an acoustical temporal analysis was performed on the first 10 clearly audible and perceptually fluent utterances, made by each of them during spontaneous speech. Utterances were selected that were equal to their individual mean length of utterance. The utterances were recorded at a sampling rate of 10 kHz and displayed as a time waveform with a duration of 2 seconds. Each utterance was measured from the onset of the periodic waveform of the first vowel or voiced consonant to the offset of the periodic waveform of the last vowel or voiced consonant. The simultaneous playback of the audio signal facilitated the identification of the onset and offset of the periodic waveform. Pause duration within an utterance was defined at the absence of spectral energy between two words that exceeded 250 milliseconds. The duration of each utterance in Milliseconds was automatically calculated by the software that followed the positions of the cursors on the waveform. The number of syllables within the measured utterances were also determined.

The articulation rate was calculated by dividing the duration of the utterances, exclusive of pauses, by the number of syllables they contained. These values were then converted to a syllable rate per second. The mean and standard deviation of the utterance durations across the 10 studied utterances were computed for each subject. From these analyses, the children's mean articulation rate was derived. Articulation rate was defined as the duration in syllables per second of an utterance excluding pauses. Intrasubject variability was determined from the coefficient of variation which was derived from the standard deviation divided by its mean (Kent & Forner, 1980).

Mother variables. *Communicative style.* Each of the mother's transcribed utterances was analyzed in accordance with an interaction-analysis method developed by the authors (Kloth, Janssen, Kraaimaat, & Brutten, 1998).

Previous research (Kloth et al., 1998a) involving principal component analysis showed that the communicative behaviors of mothers talking with their children, factored into a nonintervening, explaining, and directing style. The nonintervening style reflects a communicative pattern in which there is no direct pressure from the mother on the child to respond verbally. The mother indirectly encourages the child to take over and hold the speaking turn. In the explaining style, a mother is primarily concerned with providing information to her child. Finally, the directing style describes a mother who is mainly en-

gaged in directing her child's behavior through verbal control. The individual scores on the separate variables of the coding instrument for each of the mothers were first transformed into z-scores. Then, the z-scores of the variables belonging to each of the three communicative styles were summated.

Speaking behavior. Speaking rate and language complexity served as measures for the mother's speaking behavior. With regard to speaking rate, three 6-syllable utterances, four 7-syllable utterances, and three 8-syllable utterances were selected for each mother and subjected to the same acoustical temporal analysis as that of the children, described above. The mother's speaking rate was calculated by dividing the duration of the utterance, including pauses, by the number of syllables. These values were converted into syllable rate per second. The means and standard deviations of the utterance durations across the 10 sampled utterances were then computed for each mother. The mother's mean speaking rate was derived from these data.

The mother's language complexity was assessed in terms of mean length of utterance. The MLU-scores were obtained by dividing the total number of words in the 10-minute sample of the mother's speech by the total number of utterances.

As previously reported (Kloth et al., 1995a,b), interjudge reliability for the children's articulatory and speaking rate measures and the mother's communicative and speaking behavior were highly satisfactory.

RESULTS

The group of children whose stuttering persisted consisted of five males and two females. The group of children whose stuttering remitted was composed of seven males and nine females. Although the rate of recovery among the females was somewhat higher than among males, respectively 82% and 58%, this difference was not statistically significant. Furthermore, the two groups did not differ significantly with respect to mother's age or years of education.

Table 1 shows the means and standard deviations for the articulatory and linguistic skill measures of the children and the communicative style and speaking behavior of the mothers at initial testing and at the follow-up test session 1 year after onset for the youngsters whose stuttering persisted and for those who remitted.

In order to test for statistically significant differences between the subject groups, over time and for group by time interaction, each dependent measure was analyzed by a two-factor analysis of variance with repeated measures in which age served as a covariate. One factor represents the classification of the child as either a persistent or a remitted stutter. The other factor represents time. The results of this analysis are shown in Table 2.

As indicated by the F-values, significant between-group differences were found in the variability of articulation rate of the children and the language complexity of the mothers. As a group, those children whose stuttering per-

Table 1. The child and mother variables for the children whose stuttering persisted and for those whose stuttering remitted

	Initial session				One year after onset follow-up			
	Persistent		Remitted		Persistent		Remitted	
	M	SD	M	SD	M	SD	M	SD
Child variables								
Articulatory skills								
Art. rate	3.64	0.56	3.67	0.48	4.57	0.54	4.06	0.59
Var. art. rate	0.25	0.09	0.20	0.05	0.23	0.05	0.21	0.04
Language receptive								
Reynell	40.57	13.58	40.56	10.68	56.86	15.27	55.50	13.41
PPTV	42.71	12.76	42.81	14.68	61.71	12.49	60.56	13.54
Language Expressive								
Reynell	38.29	8.79	35.67	8.15	49.57	12.09	53.87	14.12
MLU	4.19	0.84	3.96	0.73	4.43	0.94	4.40	0.65
Mother variables								
Communicative style								
Nonintervening	0.90	4.76	-0.95	4.08	-1.22	5.24	-0.04	5.07
Explaining	1.51	4.79	-1.47	3.04	2.35	6.71	-0.42	4.21
Directing	-0.31	2.57	-0.09	3.69	-0.46	2.13	-0.11	2.68
Speaking behavior								
Speaking rate	5.46	0.28	5.91	0.60	5.37	0.69	5.74	0.66
Language complexity	5.30	0.89	4.54	0.47	5.56	0.73	4.90	0.98

sisted had a significantly higher variability of articulation rate than those children who recovered (see also Table 1). Furthermore, the language complexity of mothers of the seven persistent stutterers was significantly higher than that of the mothers of the remitted stutterers. The two groups did not differ with respect to the other factors under study.

With respect to group by time interaction, the articulation rate of the children and the nonintervening communicative style of the mothers reached statistical significance. Post-hoc analyses (a one-factor analysis of covariance) were performed. With regard to the children's articulation rate these analyses revealed that, at initial testing, before the onset of stuttering the two groups did not differ significantly. On the other hand, measured at one year after onset follow-up, there was a tendency for the children who were classified later as persistent stutterers to have faster post-onset articulatory rates ($F = 3.81$; $p = 0.09$) than those children who recovered. With regard to the mother's nonintervening communicative style, the post-hoc analysis revealed that the mothers of the persistent stutterers exhibited a communicative style that was significantly less nonintervening after the onset of stuttering than before ($F = 9.09$, $p = 0.02$). In contrast to this, the mothers of those children whose flu-

Table 2. Two-factor analysis of (co)variance with repeated measures for time, group and time by group interaction

F-value	F-value			
	Covariate	Age	Time	Group
Child variables				
Articulatory skills				
Articulation rate	7.62*	25.16*	0.52	4.27 [†]
Variability art. rate	0.08	0.08	7.17*	0.40
Language receptive				
Reynell	16.93*	72.43*	0.50	0.14
PPTV	8.92*	73.11*	0.28	0.08
Language expressive				
Reynell	15.19*	74.11*	0.90	4.08
MLU	7.26*	56.00*	0.29	0.54
Mother variables				
Communicative style				
Nonintervening	—	0.67	0.11	4.24 [†]
Explaining	—	2.13	2.32	0.03
Directing	0.25	0.02	0.11	0.01
Speaking behavior				
Speaking rate	—	1.07	2.87	0.08
Language complexity	0.33	2.10	6.31 [†]	0.05

* $p < .01$; [†] $p < .05$.

ency failures remitted continued to use more or less the same degree of nonintervening communicative behavior, before as well as after the onset of stuttering in their children.

DISCUSSION

Twenty-three children with a parental history of stuttering, who were viewed as nonstutterers at the start of a 6-year longitudinal study, were the subjects of the present study. Over time, these at-risk children exhibited stuttering symptoms.

Six years after the beginning of this investigation the stuttering symptoms remitted in 70% of the sampled children. This was consistent with findings in a study by Yairi and colleagues (1996). In their preschool sample about two thirds of the stuttering children recovered. Like others before them, they suggested that females tend to have a better chance of recovery than males do (Ambrose, Yairi, & Cox, 1993; Seider, Gladstein, & Kidd, 1983; Yairi & Ambrose, 1992). This assumption was mainly derived from the finding that the male-to-female ratio increases with age from 1.2:1 to 10:1. Our longitudinal data evidenced that 82% of the stuttering females recovered against 58% of the males.

The articulatory skills of the children under study, measured before and soon after the onset of stuttering, distinguished between those youngsters for

whom this dysfluent behavior would persist or remit. The children whose stuttering persisted had a higher variability of articulation rate than those who recovered. The higher variability in articulatory rate in the persistent stutterers is thought to reflect a less well-developed speech motor system (Kent & Forner, 1980; Cherniak & Schneiderman, 1986). The two groups of children did not differ with regard to articulation rate before the onset of stuttering; however, at the time of the onset of stuttering, the children whose dysfluencies persisted, produced articulatory movements that were descriptively faster to an extent that approached statistical significance ($p = 0.09$). In other investigations young stutterers were also found to produce faster articulatory movements in either fluent (Kowalczyk & Yairi, 1995; Pindzola, 1987) or dysfluent speech (Throneburg & Yairi, 1994; Zebrowski, 1994). These and our findings support the assumption of Conture and colleagues (1993) who theorized that children who stutter speak faster than their abilities allow.

Our data demonstrated that linguistic skills did not distinguish those for whom stuttering persisted from those whose stuttering remitted, that is to say, linguistic skills were not predictors of stuttering persistence or remission among the high-risk children studied in this investigation. With respect to linguistic skills, our results are not consistent with the findings of Yairi and colleagues (1996). To a significant extent, they found that chronic stutterers performed more poorly on standardized measures of both receptive and expressive language skills than did those who recovered. However, Watkins and Yairi (1997) failed to find differences between a persistent and recovered group of children on three measures of expressive language derived from spontaneous speech samples. Moreover, the descriptive differences between the data of our study and those of Yairi et al. (1996), if real rather than just apparent because of small sample sizes, may be due to design differences involving subject selection (high-risk children versus incipient stuttering children who were referred to a University Clinic) and prospective versus retrospective assessment of stuttering onset. More specifically, the linguistic skills of our subjects were measured before and closely after onset (on average, the stuttering onset was reported to have begun 2–3 months before the 1-year follow-up visit), while the language tests in the studies of Yairi and colleagues (1996) were administered at the beginning of their study, when the children had already stuttered for about 8 months, and 1 year later.

An important finding of the present study, that relates to the issue of chronicity was that the behavior of the mother seemed to play a significant role in the persistence of stuttering. The mothers of the children whose stuttering persisted used more complex language than the mothers of those children whose stuttering remitted. Because this was found to be so before as well as shortly after the onset of stuttering, the language complexity of mothers may serve as a predictor for stuttering persistence. This supports the assumption of some theorists that the language complexity of parents makes a child more vulnera-

ble for dysfluent speech (Starkweather, 1987). In addition, the finding that the mothers of those children whose stuttering remitted used relatively short sentences confirms the supposition that simple language models stimulate fluent speech (Van Riper, 1982).

Besides the language complexity of the mothers, our findings revealed that the communicative style of the mother was of influence relative to stuttering persistence and remission. The results indicate that while the mothers of those children whose stuttering remitted did not change their communicative style after their children began to stutter, this was not the case for the mothers of the children whose stuttering persisted. Relatively soon after the onset of stuttering, the mothers of the incipient stutterers who later developed into persistent stutterers used a style that was more intervening than they did before onset. In their conversation with their children there were more turn-exchanges, shorter pauses between and within turns, more requests for information and more affirmatives. It would seem that after the onset of stuttering the mothers of the children whose stuttering persisted exerted more direct pressure to respond verbally than they did before onset. Before their child began to stutter they encouraged them more indirectly—through pausing—to take over and hold the speaking turn. This change in communicative style which occurred after the onset of stuttering, may well have led to the persistence of stuttering among these children.

In summary, our findings suggest that the articulatory skills of the children and the language complexity and communicative style of the mothers play a role in the persistence of stuttering. Although these findings are intriguing, they should nevertheless be considered preliminary because of the small size of the subject groups. Future longitudinal research with a larger number of subjects is warranted.

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