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Recommended Citation

Clark, C., Tumanova, V., & Choi, D. (2017). Evidenced-based multifactorial assessment of preschool-age children who stutter. Perspectives of the ASHA Special Interest Groups 2(4), 4-27, doi: 10.1044/persp2.SIG4.4

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**Evidence-Based Multifactorial Assessment of Preschool-Age
Children Who Stutter**

Published in Perspectives of the ASHA Special Interest Groups, SIG 4, Vol. 2(Part 1), 2017

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Abstract

This review summarizes extant findings supporting multifactorial models of stuttering within the context of preschool-age stuttering assessment. Evidence is given for a number of speech-language and associated factors/domains to consider when evaluating young children who stutter. Selected factors are presented in two parts: (1) Caregiver Interview and (2) Direct Child Assessment. Factors addressed during caregiver interviews include: gender, time since and age at stuttering onset, family history of stuttering, caregivers' perception/concerns about stuttering, and temperament. Factors addressed during direct child assessments include: stuttering behaviors, speech-associated attitudes/awareness, speech rate, as well as speech sound and language development. Interactions/relations among factors are noted, showing their combined effects and contributions to childhood stuttering. Additionally, suggested clinical applications are provided wherever appropriate. Such evidence and practical applications bridge the gap between theory and clinical practice, thus advancing the abilities of speech-language pathologists to conduct well-informed, comprehensive stuttering evaluations.

1. Introduction

The purpose of this review was to bridge the gap between theory and clinical practice. This was accomplished by (1) providing a brief overview of multifactorial models of stuttering; (2) summarizing the existing evidence supporting associations between stuttering, speech-language and other related variables;¹ and (3) applying relevant clinical assessment tools wherever appropriate.² Selected factors are presented in two parts within the context of preschool-age stuttering evaluations: *Caregiver Interview* and *Direct Child Assessment*. With minimal exceptions, findings reported herein will be limited to studies of *preschool-age* children close to stuttering onset (henceforth referred to as “CWS”). Given the evidence, which will be explored in greater detail below, we argue that preschool-age stuttering evaluations should entail the assessment of multiple speech-language and associated factors. That is, stuttering evaluations should not focus on just stuttering behaviors.

2. Multifactorial Models of Stuttering

Childhood stuttering typically emerges between 2 and 4 years-of-age (Bloodstein & Bernstein Ratner, 2008; Yairi & Ambrose, 2005), coinciding with significant and rapid growth in children’s speech sound abilities, vocabulary, morphology, syntax (e.g., Bloodstein & Bernstein Ratner, 2008; Reilly et al., 2009; Yairi & Ambrose, 2013), and temperament (e.g., Berger, Kofman, Livneh, & Henik, 2007; Rothbart, 2011; Rothbart & Rueda, 2005). Studies have shown associations among the differing factors developing at/around the same time as children’s stuttering onset (e.g., attention, language, and stuttering; Clark, Conture, Walden, & Lambert, 2015). Such evidence supports multifactorial theories of stuttering, which generally describe

¹ This paper summarizes current, observable/measurable factors associated with childhood stuttering. An exhaustive review of the literature related to all possible factors is beyond the scope of this paper.

² Please note that we are not advocating for one clinical tool over another, but rather suggesting relevant tools that may be incorporated into the evaluation process.

stuttering as a complex disorder associated with various factors, such as cognitive, linguistic, emotional, and motoric processes (e.g., Smith & Kelly, 1997; Zimmermann, 1980; Zimmermann, Smith, & Hanley, 1981). The specific type of factors may be internal (e.g., child's linguistic abilities or temperament) or external in nature (e.g., linguistic or emotional stressors placed on the child). Smith and Kelly (1997) proposed that the weight or loading of factors more likely contribute to stuttering, rather than the mere presence of singular or several factors. One might further speculate that the weight/loading of variables as well as interactions among variables differ across those who stutter and have varying effects across individuals.

Several theories offer multifactorial views of stuttering (Packman & Attanasio, 2004), one of the first being the Demands-Capacity model (DC; Starkweather, 1987; Adams, 1990; Starkweather & Gottwald, 1990). The DC model suggests that fluency breakdowns occur when external, environmentally driven demands (e.g., caregivers' linguistic input) and/or self-imposed demands (e.g., child attempting to produce longer/more complex utterances) exceed the individual's capacities (e.g., reduced speech-language abilities or speech motor control). The model offers several examples of possible variables contributing to fluency breakdowns, including those of cognitive, linguistic, motoric, or emotional nature.

Another example of a multifactorial model—the Dual Diathesis-Stressor model of childhood stuttering (DD-S; Conture & Walden, 2012)—specifies that linguistic and emotional/temperamental processes contribute to the development of childhood stuttering. The DD-S model proposes that stuttering occurs when *endogenous* speech-language or emotional *diatheses* are activated by *exogenous* speech-language or emotional *stressors*. Specifically, emotional diatheses (internal/endogenous vulnerabilities) refer to emotional reactivity (positive or negative) and regulation (the ability to cope). Stuttering may occur when emotional diatheses

are activated by situational/emotional stress, such as environmental changes like moving to a new house or the birth of a new sibling (exogenous variables). Speech-language diatheses refer to subtle-to-significant receptive or expressive speech-language difficulties (internal/endogenous vulnerabilities). Stuttering may occur when speech-language diatheses are activated by communicative/environmental stress, such as spontaneously being asked to talk in front of guests (exogenous variables), which requires efficient and rapid speech-language production.

According to this model, for some CWS, “the emotional diathesis predominates, for others the speech-language diathesis, and for many children varying combinations of the two diatheses exist” (p. 99). It is important to note that the DD-S model “does not specifically preclude other diatheses, for example, peripheral speech motor control challenges...” (p. 96).

Some have criticized multifactorial models, in general, indicating that they lack specific operational terms, which make them potentially challenging to test or disprove (see Packman & Attanasio, 2004 for a comprehensive review). Nevertheless, these models have shaped our current understanding of childhood stuttering and contributed to our clinical practice (e.g., Franken, Kielstra-Van der Schalk, & Boelens, 2005; Millard, Edwards, & Cook, 2009). Additionally, there is a growing body of research in this area that continuously re-assesses and refines our views of childhood stuttering, thus guiding our evaluation and treatment approaches. Below we provide the existing evidence supporting multifactorial models within the context of preschool-age stuttering assessments. This is done in two parts, in accordance with the procedures we recommend following when evaluating preschool-age CWS: (1) Caregiver Interview; and (2) Direct Child Assessment.

3. Caregiver Interview

Caregivers are essential to the evaluation process given that they have a “far larger dataset than researchers or clinicians can ever hope to assemble; it is also far more representative of the child’s ability, as it is based on the child’s behavior in a wide range of situations” (Bates, Dale, & Thal, 1995, p. 3). Multifactorial assessments of stuttering involve branching out from the stuttering-only questions and tapping into caregivers’ “datasets” involving other, relevant factors associated with stuttering (e.g., temperament). Doing so, clinicians will hopefully form a more holistic profile of the child, informing their clinical diagnosis and prognosis. It is equally important that clinicians know *why* they ask the questions they do, help caregivers understand the relevance of information asked of them, and also provide caregivers with better informed, evidence-based responses to their questions (e.g., “What causes stuttering?”; “Will my child ever grow out of this stuttering phase?”; “What does temperament have to do with my child’s stuttering?”; “I stutter. Is my child just imitating my speech?”). The following section summarizes factors to consider when interviewing caregivers during fluency evaluations, based on extant findings reported in the literature.

3.1 Gender

Stuttering has been estimated to affect approximately 2:1 males-to-females during the preschool-ages (Buck, Lees, & Cook, 2002; Mansson, 2000; Yairi & Ambrose, 1992b; Yairi & Ambrose, 2013). This ratio increases substantially with age, with numbers reported to be as high as 6:1 males-to-females in school-age children and adults (e.g., Ambrose, Cox, & Yairi, 1997; Bloodstein & Bernstein Ratner, 2008; Seider, Gladstein, & Kidd, 1983; Yairi, 1983; Yairi & Ambrose, 2005). Although it appears that more girls are likely to recover than boys, findings regarding gender ratios and stuttering chronicity have been inconsistent across studies. For example, Yairi and Ambrose (1999) found no significant differences between the

ratios of persistent (4.5 boys:1 girl) versus recovered (1.82 boys:1 girl) males and females. Non-significant findings were attributed to the small sample of females in the persistent group ($n=4$). Similarly, in a longitudinal assessment of a relatively small sample size ($n=23$), Kloth, Kraaimaat, Janssen, and Brutten (1999) found non-significant differences in the recovery rates of males and females (58% and 82% respectively). In contrast, Mansson (2000) reported that male:female ratios rose from 1.65:1 to 2.8:1 over the course of 2 years. However, inferential statistics were not conducted to determine the significance. Ambrose et al. (1997) found that significantly more girls recovered than boys in a relatively larger sample ($N=66$), a finding consistent with those reported in large-scale investigations of adults (Porfert & Rosenfield, 1978; Seider et al., 1983).

Several factors may have contributed to the inconsistent findings, such as varying sample sizes and durations of the longitudinal studies. Although further longitudinal research is warranted—particularly those studying larger samples over longer periods of time—overall findings suggest that gender ratios are somewhat comparable during the preschool-ages and become skewed with age. Specifically, more males stutter beyond the preschool-ages compared to females, which suggests that more males persist than females.

3.2 Time Since Onset of Stuttering (TSO)

Empirical data have shown that a significant percentage of children who begin stuttering during the preschool years spontaneously recover within a few months up to 3 years post onset of the disorder (Ambrose et al., 1997; Mansson, 2000; Yairi & Ambrose, 1992a, 1999, 2005; Yairi, Ambrose, & Niermann, 1993).³ Relatively few children have been

³ Yairi and Ambrose (1992a) noted that “much of the amelioration can be expected within approximately 12 to 14 months” post stuttering onset (p. 759). They later reported that recovered CWS exhibited reductions in *stuttering-like disfluencies* up to 2.5 to 3 years post onset of the disorder (Yairi & Ambrose, 1999), with notable changes occurring between 7 to 12 months (Yairi, Ambrose, Paden, & Throneburg,

found to recover with longer TSOs. For example, Mansson (2000) reported a total recovery rate of 85% that occurred within 5 to 6 years post onset, with majority (71.4%) recovering within 2 years of stuttering onset. Additional findings suggest that females tend to recover earlier (12-30 months post onset) than males (24-36 months post onset), however there is some overlap in the reported ranges (Yairi & Ambrose, 1999). Taken together, findings indicate that although spontaneous recovery may occur later, TSOs greater than one year may place children at greater risk for persistence. TSO may further be associated with gender relative to chronicity.

Clinical application. The bracketing procedure is one method that may be used to estimate children's TSO. This procedure involves clinicians asking detailed questions to help caregivers systematically "narrow down the date, manner, and circumstances of the [stuttering] onset" (Yairi & Ambrose, 1992b, p. 783). Caregivers are asked to recall particular events/dates surrounding the first time they noticed their child stutter (before/after significant family events, holidays, birthdays, vacations). For example:

Clinician: You mentioned that you first noticed your child stuttering last summer. What were some summer activities that you did with your child when you heard him stutter?

Caregiver: We went to the beach and played in the sand.

Clinician: How often did you go to the beach that summer?

Caregiver: We actually went just a week. It was a family beach trip.

Clinician: Do you remember the dates of your beach trip?

Caregiver: July 3rd through the 9th of last year.

Clinician: What did his stuttering sound like during the beach trip?

Caregiver: I remember he kept getting stuck when trying to get my attention to show me his sand castles. Something like, "M-m-m-mommy, look at my sand castle. I-i-i-i-it is so big!" He just couldn't get those words out.

Clinician: So you noticed him repeating sounds when talking about his sand castles at the beach. You also mentioned earlier that his birthday is on June 1st. Did you do anything special to celebrate his birthday that year?

Caregiver: Oh, yes. We had his cousins come over for a party.

Clinician: Do you remember the date of the birthday party?

1996). Additional findings suggest that the frequency of *other/non-stuttering-like disfluencies* remains generally stable over time for both persistent and recovered CWS (Yairi et al., 1993; Yairi et al., 1996).

Caregiver: We had the party on June 9th because his cousins were out of town the week of the 1st.

Clinician: Describe your child's speech on the day of the party.

Caregiver: I remember that he was so excited to play with his cousins that he spoke really fast. Come to think of it, he kept repeating words over and over again, but I thought it was because he was so excited and speaking quickly. His older cousin even told him to just get the word out so that they could go outside and play.

Clinician: So on June 9th you noticed that your child was repeating his words?

At this point, the clinician would follow-up with additional questions, going further back in time (e.g., preschool/kindergarten graduation, if applicable, or other significant events prior to June 9th). Doing so might help caregivers pin down a more precise time frame when they first noticed that their child stuttered. Readers are referred to Yairi & Ambrose (1992b) for additional information and examples illustrating this procedure.

3.3 Age of Stuttering Onset

Childhood stuttering typically emerges between 2 and 4 years-of-age (e.g., Bloodstein & Bernstein Ratner, 2008). Some have speculated that persistent CWS tend to begin stuttering at an older age than recovered CWS (e.g., Yairi & Ambrose, 2005). However, empirical findings, albeit limited to date, have not supported such relations between age of onset and stuttering chronicity.⁴ For example, upon retrospectively analyzing diagnostic data obtained from initial fluency evaluations, Yaruss, LaSalle, and Conture (1998) reported no significant age of onset differences among the groups of children who were recommended immediate treatment, re-evaluation, or no treatment/re-evaluation. Similarly, although preliminary longitudinal analyses indicated that persistent CWS tend to begin stuttering 5 to 8 months later than recovered CWS (Watkins & Yairi, 1997, Table 1; Yairi, Ambrose, Paden, & Throneburg, 1996), Yairi and Ambrose (2005) later reported that such differences

⁴ See Seider, et al. (1983) for findings regarding the association between age of onset and stuttering chronicity among adults who stutter. Note, however, that adults have far longer TSOs than children, which could potentially affect accurate recall of information surrounding their stuttering onset.

were non-significant. They further noted a large overlap in the age of stuttering onset among persistent and recovered CWS.

Given the evidence, it is unclear whether age of onset, in and of itself, is indicative of chronicity, nor which precise age(s) of onset would be considered “late.” However, obtaining this information enables one to better pinpoint a child’s TSO, the latter of which is better understood in relation to persistence (see section 3.2 in this paper).

3.4 Family History

Data show that stuttering tends to run in families⁵ (e.g., Reilly et al., 2009; Yairi, 1983; Yairi et al., 1996; Yairi & Ambrose 1992b; Yairi & Ambrose, 2005). Yairi and Ambrose (1992b) reported that 66.3% of preschool-age CWS had family members who stuttered. Of that percentage, 23.3% had only immediate family members who stuttered (i.e., parents and siblings), 19.7% had only extended family members who stuttered (i.e., the latter including grandparents, blood-related aunts/uncles, and cousins), and 23.3% of CWS had immediate *and* extended family members who stuttered. Similarly, Ambrose, Yairi, and Cox (1993) found that 71% of their CWS sample reported a history of stuttering in their immediate or extended family; 43% reported a history of stuttering among immediate family members only.

Regarding group differences, Tumanova, Choi, Clark, and Conture (2015) found that 42% of preschool-age CWS compared to 22% of children who do not stutter (CWNS) had a positive family history for stuttering among their immediate or extended family. Regarding stuttering chronicity, Mansson (2000) found that 67% of persistent CWS had a family history

⁵ Findings regarding genetic links to stuttering are not addressed in the present report because it is not clinically practical nor feasible to measure this factor during standard fluency evaluations. Readers are referred to Kraft and Yairi (2011) for a review of genetics and stuttering.

of stuttering. In contrast, Tumanova et al. (2015) found that family history did not predict whether preschool-age CWS persisted by their 2-year follow-up visit. Others have shown that relatives of individuals who stutter generally follow similar stuttering trajectories; that is, persistent CWS tend to have more relatives who persisted from stuttering, whereas recovered CWS tend to have more relatives who recovered (e.g., Ambrose et al., 1997; Yairi et al., 1996).

Clinical application. A pedigree form (Richels & Conture, 2010) may help caregivers chart their family's history for stuttering and other speech-language difficulties/disorders. A pedigree form is essentially a flow chart representing the presence/absence of speech-language and associated conditions exhibited by immediate and extended families across several generations.

3.5 Caregivers' Concerns and Perception About Their Children's Stuttering, Speech-Related Attitudes, and Awareness

Caregivers' perception and concerns about stuttering. Tumanova, Choi, Conture, and Walden (2014) found that parents who perceived their children to be stuttering described their children's speech as being frequently disfluent on The Test of Childhood Stuttering—Speech Fluency Rating Scale (TOCS-SFRS; Gillam, Logan & Pearson, 2009). Such caregiver “diagnosis” of their children's stuttering has been shown to be associated with that of trained examiners using objective clinical measures (Tumanova, Conture, Lambert, & Walden, 2014). Specifically, parents of 90.8% of CWNS and 82.3% of CWS accurately identified their children as either stuttering/not stuttering, which was confirmed by clinicians' stuttering frequency and severity measures. Interestingly, Groner, Walden, and Jones (2016) found that parents' ratings of children's disfluencies (measured by the TOCS-SFRS) were

associated with children's self-reported negative speech-related attitudes (measured by the Communication Attitude Test for Preschool and Kindergarten Children Who Stutter [KiddyCAT]; Vanryckeghem & Brutten, 2007). Additional findings by Langevin, Packman, and Onslow (2010) indicate that 90.9% of parents reported being worried, frustrated, and anxious about their children's stuttering; they also tend to blame themselves for their children's stuttering. Parental concern for their children's stuttering may be associated with family history (Tumanova et al., 2015). Specifically, findings have shown that parents of CWS with a family history of stuttering are more likely to exhibit concern for their children's speech fluency and related consequences, compared to those without a family history of stuttering (Tumanova et al., 2015). Thus, caregivers' concerns potentially stem from their own experiences with or family history of stuttering.

Caregivers' perception of their children's speech-related attitude and awareness.

Children in the early/initial stages of stuttering⁶ were historically thought to exhibit relatively easy word/syllable repetitions and rare/occasional prolongations or tension (depending on the author), uncomplicated by children's speech-associated awareness,⁷ negative attitudes or reactions (e.g., Bloodstein, 1960a, 1960b; Bluemel, 1932; Froeschels, 1921; Johnson & Associates, 1942, 1955; Johnson & Associates, 1959; Van Riper, 1971, 1982). Such awareness and reactive behaviors were viewed as advanced features of stuttering, which were

⁶ It should be noted that the terminologies and definitions regarding "early/initial" versus "later/advanced" phases of stuttering are rather inconsistent across the older literature cited above. Some theoreticians vaguely used the terms "children," "young children," or "early childhood" without indicating precise age-ranges (e.g., Johnson, 1942), whereas others specified that the initial phase of stuttering occurs during the preschool years (e.g., Bloodstein, 1960a; Froeschels, 1943). Thus, it is unclear whether/how chronological age and time since stuttering onset relate to the "earlier" versus "later" stuttering features according to the historical perspectives.

⁷ Bloodstein (1960a, 1960b) acknowledged that some preschool-age children may exhibit varying degrees of awareness of their stuttering but were largely unconcerned by it. Other theoreticians stated that children in the initial phases of stuttering were completely unaware of their disfluencies (e.g., Bluemel, 1932).

thought to develop over time (see citations above).⁸ Such viewpoints have formed deep roots and influenced the clinical realm, wherein therapists and parents were advised to avoid drawing children's attention to their disfluencies lest they risk developing stuttering-related awareness and negative attitudes (e.g., Ambrose & Yairi, 1994; Ezrati-Vinacour et al., 2001; Johnson, 1949; Morley, 1972; Vanryckeghem & Brutten, 1992).

Contrary to the above, recent empirical findings have indicated that a relatively large percentage of parents perceive their preschool-age children to be aware of and negatively react to their stuttering. For example, Langevin et al. (2010) found that 89.6% of parents perceived their preschool-age children to be frustrated with their stuttering, exhibiting behaviors such as avoidance/withdrawal, reduced verbal output, and commenting about their speech difficulties. Similarly, 73.2% of parents reported that their 2- to 7-year-old CWS are aware of their stuttering; such awareness was found to significantly increase with children's age (Boey, Van de Heyning, Wuyts, Heylen, Stoop, & De Bodt, 2009, Table 4).

Interestingly, Boey et al. noted that more than half (56.7%) of the 2-year-olds were reportedly aware of their stuttering, compared to 89.7% of the 7-year-olds. The authors further noted that parental-reported stuttering awareness among children was not associated with gender (i.e., 73.7% boys vs. 71.6% girls), but was associated with clinician-measured stuttering severity. In other words, children who were aware of their stuttering generally exhibited more severe stuttering. Regarding the association between TSO and parent-reported stuttering awareness among preschool-age children, Boey et al. found that 64% of children with relatively short TSOs (i.e., those who began stuttering within 0-4 months of the

⁸ A comprehensive review of historical perspectives of stuttering is beyond the purpose or scope of this paper. For additional information and examples of such viewpoints, readers are referred to the works cited above, among others.

study) and 83.8% of children with longer TSOs (i.e., > 22 months) were aware of their stuttering, based on their parents' perception. However, this finding did "not remain significant when controlled for chronological age" (p. 341).

To summarize this section, we acknowledge that although "parent report measures do contain some subjective parental components, available evidence indicates that these measures also contain a substantial objective component that does accurately assess children's individual characteristics" (Henderson & Wachs, 2007, p. 402). Indeed, the extant findings summarized above suggest that caregivers provide useful information about their children's stuttering. For instance, caregivers' perceptions/concerns regarding their children's disfluencies may be associated with clinicians' measures, as well as with additional variables (e.g., children's self-reported speech-related attitudes) that inform our clinical diagnosis and counseling/treatment recommendations. Below (in section 4.2), we describe empirical findings regarding *children's self-reported* speech-associated attitudes and awareness, as they relate to direct child assessment.

Clinical application. To better understand caregivers' concerns/perceptions regarding their children's stuttering, one may incorporate parent-reported questionnaires/scales into the evaluation protocol, such as the Test of Childhood Stuttering Observational Rating Scales (TOCS; Gillam et al., 2009), the Impact of Stuttering on Preschoolers and Parents Questionnaire (ISPP; Langevin et al., 2010), and the Palin Parent Rating Scale (PPRS; Millard & Davis, 2016). The PPRS allows clinicians to further assess parents' knowledge about and confidence in managing their children's stuttering. One may also ask relevant, informal interview and follow-up questions as well. In section 4.2 below, relevant measures of obtaining *children's self-reported* speech-associated attitudes and awareness are discussed.

3.6 Temperament

Temperament is a biological trait that is relatively stable across time, yet receptive to environmental influences (e.g., Goldsmith et al., 1987; Lewis & Goldberg, 1997; Sanson, Hemphill, & Smart, 2004; Seery, Watkins, Mangelsdorf, & Shigeto, 2007). It involves an “individual’s sensitivity and responsivity to environmental demands” (Caprara & Cervone, 2000, p.87), and to some degree, helps explain differences across individuals in their reactions or regulation of their reactions to similar environmental experiences. Certain temperamental domains (e.g., attention regulation, effortful control, and executive attention) significantly develop and improve between 3 and 5 years-of-age (e.g., Berger et al., 2007; Rothbart, 2011; Rueda, Posner, & Rothbart, 2005), thus overlapping with the emergence of childhood stuttering and advances in other speech-language domains. Interestingly, certain aspects of temperament have been found to be associated with speech-language development, in general (e.g., attention and articulation [Locke & Goldstein, 1973]; attention and language [Leve et al., 2013; Salley & Dixon, 2007]; see Conture, Kelly, & Walden, 2013 for review), as well as more specifically with stuttering (e.g., Clark et al., 2015; Conture et al., 2013). As mentioned above, relatively recent frameworks, particularly the DD-S model, include temperament as a potential variable contributing to childhood stuttering (Conture & Walden, 2012). Below we discuss empirical findings of studies assessing: (1) between-group (CWS vs. CWNS) differences in temperamental characteristics, and (2) CWS’s temperamental characteristics in relation to stuttering frequency and persistence.

Between-group temperamental differences. Findings have been inconsistent regarding the temperamental differences between CWS and CWNS. Some have reported significant group differences (e.g., Anderson, Pellowski, Conture, & Kelly, 2003; Clark et al., 2015; Eggers, De

Nil & Van den Bergh, 2010; Embrechts et al., 2000; Karrass et al., 2006; Schwenk, Conture, & Walden, 2007; Wakaba, 1997), whereas others found no such differences (e.g., Anderson & Wagovich, 2010; Choi, Conture, Walden, Lambert, & Tumanova, 2013). Summarizing extant findings, Jones, Choi, Conture, and Walden (2014) cautiously concluded that negative affect, atypical attentional processes, and lower adaptability might be associated with the onset of childhood stuttering. In contrast, Alm (2014) concluded that people who stutter (PWS), in general, are “not characterized by constitutional traits of anxiety or similar constructs” (p.5), but that a subgroup of PWS exhibit “traits associated with inattention and hyperactivity/impulsivity” (p.5).

Temperament, stuttering frequency, and persistence. Regarding stuttering frequency, findings suggest that for CWS, *increased* emotional reactivity (positive or negative) may be associated with *increased* stuttering frequency (Choi, et al., 2013, Choi, Conture, Walden, Jones, & Kim, 2016; Jones, Conture, & Walden, 2014, Karrass et al., 2006), and that *increased* emotion/attention regulation may be associated with *decreased* stuttering frequency (Arnold, Conture, Key, & Walden, 2011; Karrass et al., 2006, Kraft, Ambrose, & Chon, 2014; Ntourou, Conture, & Walden, 2013). Regarding stuttering persistence, Ambrose, Yairi, Loucks, Seery, and Throneburg (2015) reported that persistent CWS were judged by their parents to be more negative in temperament than recovered CWS.

Although further research is needed, overall empirical evidence appear to suggest that at least a subgroup of CWS may be temperamentally vulnerable to emotional stress, which potentially contributes to their stuttering onset or persistence. Understanding children’s temperament may further guide our counseling approach and treatment plan/goals (Jones et al., 2014).

Clinical application. Temperamental assessments include but are not limited to informal interview and follow-up questions, as well as caregiver questionnaires, such as the Temperament Characteristic Scale (Oyler, 1996), the Children's Behavior Questionnaire (CBQ, Rothbart, Ahadi, Hershey, & Fisher, 2001), and the Behavior Style Questionnaire (BSQ, McDevitt & Carey, 1978). Children's temperamental behaviors may be further observed throughout the evaluation (e.g., is the child slow/easy to warm up, easily distracted, or impulsive during tasks; Choi et al., 2013).

4. Direct Child Assessment

The emergence of childhood stuttering typically coincides with a period of rapid changes/advancements in speech and language (i.e., the preschool years). Interestingly, findings have shown that stuttering may be associated with speech motor control, as well as speech sound and language development. Furthermore, more preschool-age CWS than CWNS tend to exhibit *imbalances* across the abovementioned speech-language domains (Anderson & Conture, 2000; Anderson, Pellowski, & Conture, 2005; Clark et al., 2015; Coulter, Anderson, & Conture, 2009), and speech-language *disorders* tend to be more prevalent among school-age CWS than CWNS (e.g., Arndt & Healey, 2001; Blood, Ridenour, Qualls, & Hammer, 2003; cf. Nippold, 2001, 2004). Taken together, it is important to directly assess children's speech fluency *as well as* their speech, language and related motoric abilities. It is also necessary to evaluate children's attitudes/awareness of their stuttering during the preschool-ages given that some children, as young as 2 and 3 years-of-age, exhibit negative speech-related attitudes and awareness (Ambrose & Yairi, 1994; Clark, Conture, Frankel, & Walden, 2012; Ezrati-Vinacour, Platzky, & Yairi, 2001; Vanryckeghem & Brutten, 2007; Vanryckeghem, Brutten, & Hernandez, 2005). Below we

explore relevant findings addressing the abovementioned factors to be considered when directly assessing children.

4.1 Stuttering Behaviors

Stuttering frequency and severity. Longitudinal findings have shown that increased frequencies and severity of stuttering—at initial fluency evaluations—are not necessarily predictive of later stuttering persistence (Ambrose et al., 1997; Yairi et al., 1996; Yairi & Ambrose, 1992a; Yairi & Ambrose, 1999).⁹ For example, Ambrose et al. (1997) reported no significant differences in the percent of stuttering-like disfluencies (SLDs)—during initial fluency evaluations—exhibited by children who later persistent versus recovered. Other studies have found the frequency of SLDs at initial evaluations to be higher for children who later recovered compared to those who persisted (Yairi et al., 1996; Yairi & Ambrose, 1999). Importantly, Yairi and colleagues noted, across their studies, that *changes* in stuttering frequencies and severity ratings over time were indicative of chronicity (Ambrose et al., 1997; Yairi et al., 1996; Yairi & Ambrose, 1992a; Yairi & Ambrose, 1999). Specifically, recovered CWS exhibited decreased frequencies and severity over time, whereas persistent CWS exhibited increased or relatively stable frequencies and severity over time.

Sound prolongations. Researchers and clinicians have speculated that increased proportions of sound prolongations ([SP] see also disrhythmic phonations; e.g., Ambrose & Yairi, 1999; Einarsdóttir & Ingham, 2005; Pellowski & Conture, 2002; Williams, Silverman, & Kools, 1968; Yairi & Ambrose, 1992a; Yairi & Lewis, 1984) are associated with more severe (Schwartz & Conture, 1988; Sheehan & Martyn, 1970; Zebrowski, 1994) or persistent stuttering (e.g., Conture & Curlee, 2007; Cooper, 1973; Sheehan & Martyn, 1970; Van Riper, 1982). Such

⁹ Readers are referred to Howell, Davis, and Williams (2008) and Yairi and Ambrose (2005) for findings regarding the association between stuttering severity and persistence among *older, school-age* CWS.

speculations have influenced clinical practice. For example, both the Stuttering Prediction Instrument for Young Children (Riley, 1981) and The Chronicity Prediction Checklist (Cooper & Cooper, 1985) list prolongations and blocks (among other criteria) as risk factors for chronic stuttering. Additionally, Yaruss et al. (1998) found that clinicians tend to recommended immediate treatment to young CWS who present with a mean sound prolongation index (SPI)¹⁰ of 46% and recommend re-evaluation when the mean SPI is 26.7%. However, there are currently insufficient longitudinal studies investigating the association among SPs, stuttering severity and chronicity. Findings of one such study have shown: (1) No significant differences between the frequencies of SPs exhibited by persistent and recovered CWS at initial evaluations; (2) Neither recovered nor persistent groups of CWS exhibited SPs as their most common type of disfluency, at initial or follow-up visits; and (3) Recovered CWS produced fewer SPs over time, whereas persistent CWS exhibited relatively little change in their SPs (Throneburg & Yairi, 2001). Perhaps one take away message is that any reduction in the frequency of SPs, observed during *follow-up* evaluations, could suggest that recovery is underway.

Physical concomitants. Physical concomitants—such as distracting sounds, head/body movements, and facial grimaces/twitches—are considered to be secondary behaviors associated with stuttering. Historically, these behaviors have been viewed as advanced and more severe features of stuttering (e.g., Bluemel, 1932; Froeschels, 1921; Johnson, 1942; Van Riper, 1971), and potential indicators of chronicity (e.g., Cooper & Cooper, 1985; Curlee, 1980, 2007; Van Riper, 1971). However, research has shown that these behaviors could be present close to onset of the disorder for some preschool-age CWS, including those who later recover (e.g., Bloodstein 1960a, 1960b; Conture & Kelly, 1991; Schwartz, Zebrowski, & Conture, 1990; Yairi et al.,

¹⁰ SPI refers to the number of sound prolongations per stuttered disfluencies (SP/SD).

1993; Yairi et al., 1996). To our knowledge, there is currently only one longitudinal study that assessed the association between physical concomitants and stuttering chronicity, findings of which showed no significant differences between the mean number of facial-head movements per disfluent events exhibited by persistent versus recovered CWS, at initial or follow-up fluency evaluations (Yairi et al., 1996).

Clinical application. Given the variable nature of stuttering, multiple speech samples should be collected to assess children's fluency behaviors across contexts (e.g., spontaneous speech during play, picture description, and narratives) and listeners (e.g., clinician vs. caregiver; Johnson, Karrass, Conture, & Walden, 2009; Yaruss, 1997a, 1997b). Care should be taken to elicit sufficiently long and representative speech samples (i.e., containing more than just 1-2 word utterances) given that sample length might influence the identification of children's stuttering (Sawyer & Yairi, 2006).

There are many different methods to assess fluency behaviors; discretion should be used when selecting the appropriate tools/procedures. Generally speaking, stuttering frequency can be measured in real-time or from an audio/video recording (Yaruss, 1998). A stopwatch or acoustic analysis may be used to assess the duration of stuttering (Tumanova, Zebrowski, Throneburg, & Kayikci, 2011), a measure relevant to the assessment of stuttering severity. Stuttering severity may be qualified using the Stuttering Severity Instrument (SSI; Riley, 1994), the Test of Childhood Stuttering (TOCS; Gillam et al., 2009), or other preferred methods. Note observable physical concomitants prior to, during, and immediately after moments of stuttering; this may be done in conjunction with the SSI or using the Behavioral Assessment Battery (Brutten & Vanryckeghem, 2007). Because elevated stuttering frequency and severity levels at initial

evaluations are not necessarily predictive of stuttering persistence, clinicians should monitor changes in these behaviors over time (i.e., follow-up evaluations).

4.2 Children's Self-Reported Speech-Associated Attitudes and Awareness

As mentioned above (section 3.5), historical perspectives of stuttering differentiated between the “earlier” and “later” features of the disorder. Specifically, early stages of stuttering were thought to be simple forms of the disorder, consisting of “just” speech disfluencies—that is, relatively easy word/syllable repetitions and rare/occasional prolongations or tension (inclusion of the latter two features varied across theoreticians; e.g., Bloodstein, 1960a, 1960b; Bluemel, 1932; Froeschels, 1921, 1943; Johnson, 1942, 1955; Johnson & Associates, 1959; Morley, 1972; Van Riper, 1971, 1982). The abovementioned authors noted that young children during the initial stages of stuttering were completely unaware or exhibited varying degrees of awareness of their disfluencies; speech-associated attitudes, fears or emotional reactions were thought to be absent early on (see citations above). In contrast, later stages/phases of stuttering were generally considered to be more advanced/severe, characterized by speakers' development of awareness, negative attitudes, and emotional reactions toward their fluency behaviors (e.g., Bloodstein, 1960a, 1960b; Bluemel, 1932; Froeschels, 1943; Johnson, 1955; Morley, 1972).

More recent empirical findings, based on direct child assessments, have shown that some preschool-age children may be aware of their speech fluency (e.g., Ambrose & Yairi, 1994; Clark et al., 2012; Vanryckeghem & Brutten, 2007). For example, in their longitudinal study of 2- to 6-year-old CWS and CWNS, Ambrose and Yairi (1994) reported that some children from both groups accurately identified their speech patterns (i.e., fluent versus stuttered) with those of puppets. Using similar methods, Ezrati-Vinacour et al. (2001) found that 3- to 7-year-old CWNS were aware of and negatively evaluated stuttering exhibited by puppets, as well as expressed

preference for the fluent puppet.¹¹ Other investigators have further shown that CWS as young as 3 years-of-age exhibit more negative speech-related attitudes compared to CWNS (Clark et al., 2012; Vanryckeghem & Brutten, 2007; Vanryckeghem et al., 2005). Readers are referred to section 3.5 of this paper for findings regarding *caregivers' perception* of their children's speech-related attitude and awareness.

Relative to this topic, one might consider whether there is an association between children's stuttering behaviors (e.g., frequency or severity) and their speech-related awareness or attitudes. For example, it is likely that children who exhibit less frequent/severe stuttering may have negative attitudes towards their speech, whereas those who exhibit more frequent/severe stuttering might not have any negative speech-associated attitudes. In general, findings across studies assessing this topic have been rather mixed results. Regarding stuttering awareness, Ambrose and Yairi (1994) reported no relation between children's awareness (experimentally assessed) and clinician-measured severity of stuttering, whereas Boey et al. (2009) reported that parent-reported stuttering awareness was associated with clinician-measured stuttering severity. Regarding speech-associated attitudes, Groner et al. (2016) found a positive correlation between parents' ratings of their children's stuttering frequency (indicated by their TOCS scores) and their children's self-reported attitudes (based on the KiddyCAT); however, no such association was found between clinicians' measures of stuttering frequency and CWS's self-reported attitudes. Perhaps such inconsistent findings resulted from the different methodologies used across studies (e.g., direct child assessment vs. parent reports; using varying experimental measures vs. parent/child questionnaires). It is also possible that there are different underlying

¹¹ Findings reported by Ezrati-Vinacour et al. (2001) were based on children's performance across several tasks, including: fluency discrimination (i.e., "Do the puppets talk in the same way?"), identification (i.e., "Which puppet talks like you?"), labeling ("What do we call this type of talking?"), and evaluation ("Is that talking good or not good?"; "Which one [puppet] would you like to play with?...Why?") (p. 372).

implications regarding *parent-* versus *child-reports* and *attitudes* versus *awareness*. Future studies are warranted to better understand this topic, findings of which would be of theoretical and clinical importance.

Another interesting consideration is the potential association between TSO and children's self-reported attitudes towards their stuttering. For instance, it is possible that the longer one stutters, the more stuttering-related experiences s/he may have, which might contribute to his/her attitudes toward speaking. As mentioned above (section 3.5), Boey et al. (2009) found no significant trends regarding the association between TSO and parent-reported stuttering awareness among children, when they controlled for chronological age. Using different methodologies, Groner et al. (2016) found a significant negative correlation between TSO and 3- to 5-year old CWS's KiddyCAT scores. The latter result suggests that the longer preschool-age children stutter, the *less* negative speech-related attitudes they have. However, it is unclear whether other variables may have contributed to these children's attitudes over time. For instance, children with relatively long TSO's may have received some form of treatment over time, which could have positively affected their attitudes towards stuttering. Although intriguing, further investigations—particularly those of longitudinal nature—are warranted, given the paucity of studies assessing this topic.

Clinical application. Caregivers have often been the primary source of information regarding their preschool-age children's behaviors across varying contexts. However, parents may under/overestimate their children's speech-associated attitude/awareness (Boey et al., 2009), or impose their own stuttering-related beliefs/attitudes when estimating their children's perception. For example, Vanryckeghem (1995) reported weak correlations between parents' and their *school-age* children's scores on the Communication Attitude Test (CAT; Brannen &

Dunham, 1989). We suggest incorporating both caregiver- and child-reported methods to better understand children's speech-related awareness and attitudes. The importance of caregiver reports and examples of relevant assessment methods are discussed above (see Caregiver Interview, section 3.5, in this paper). Children's self-reported attitudes towards their speech difficulties may be assessed using the KiddyCAT (Vanryckeghem & Brutten, 2007; Vanryckeghem et al., 2005) along with follow-up questions.

4.3 Speech Rate

Speech rate has been referred to in the literature as *overall speech rate* or *articulatory rate*. Overall speech rate measures all verbal output; that is, "the total number of words produced in a set amount of time, including pauses, hesitations, and disfluencies" (e.g., Yaruss, 1997c, p. 264). Articulatory rate only measures fluent speech productions; that is, "the number of syllables or phones uttered per second, after either excluding or removing pauses and disfluent segments from the timed speech sample" (Hall, Amir, Yairi, 1999, p. 1368). Some consider articulatory rate to be a measure of speech motor execution, as it reflects one's ability to coordinate respiration, phonation, and articulation (e.g., Hall et al., 1999; McClean & Tasko, 2003; Nip & Green, 2013).

Findings regarding differences between the articulatory rates of CWS and CWNS have been equivocal. For example, Meyers and Freeman (1985) observed that CWS spoke at a slower rate than CWNS, whereas Kloth, Janssen, Kraaimaat, and Brutten (1995) found CWS to exhibit significantly faster articulatory rate than CWNS. However, Kelly and Conture (1992) and Ryan (1992) reported no significant differences between the articulatory rates exhibited by these two groups (see Sawyer, Chon & Ambrose, 2008, for review). Findings regarding the association between articulatory rate and stuttering chronicity have been conflicting as well. For instance,

Kloth et al. (1999) longitudinally assessed “high risk” preschool-age children (i.e., those who presented with parental history of stuttering) and found no significant differences—at the initial visit (pre-stuttering onset)—between the articulatory rate of children who were later classified as persistent (n=7) and recovered (n=16). However, greater variability was noted in the articulatory rate of persistent CWS compared to those who recovered. Such variability was “thought to reflect [persistent CWS’s] less well-developed speech motor system” (Kloth et al., 1999, p. 261; see also Chermak & Schneiderman, 1986; Kent & Forner, 1980). In contrast, Hall et al. (1999) found that at initial and subsequent follow-up evaluations, recovered CWS (without treatment) exhibited slower articulatory rate (mean phones per second) when compared to persistent CWS and CWNS (Table 2). However, no such group differences were found when rate was measured in syllables per second (Table 1). Findings were taken to suggest that perhaps using slower articulatory rate aided the CWS who recovered without direct therapy.

Despite the abovementioned inconsistencies across findings, reduction in overall speech rate has generally been linked to increases in fluency for adults who stutter (AWS; Ingham, Bothe, Jang, Yates, Cotton, & Seybold, 2009; Logan, Roberts, Pretto, & Morey, 2002). Additionally, slowing down parents’ overall speech rate has been associated with decreased stuttering in young children (Stephenson-Opsal & Bernstein Ratner, 1988; Guitar & Marchinkoski, 2001; Guitar, Schaefer, Donahue-Kilburg, & Bond, 1992; Zebrowski, Weiss, Savelkoul, & Hammer, 1996). Thus, indirect treatment of preschool-age CWS often focuses on reducing caregivers’ speech rate (Ratner, 2004). Given its potential association with stuttering, as well as its relevance to the treatment process, we recommend assessing children’s and caregiver’s speaking rate at initial stuttering evaluations.

Clinical application. Different units of measurement may be used when assessing speech rate, such as phones (sounds), syllables, or words per minute or second. Overall speech rate can be measured with a stopwatch (Pindzola, Jenkins, & Lokken, 1989), whereas articulatory rate may require acoustic analysis software (e.g., PRAAT; Boersma & Weenink, 2013).

4.4 Speech Sound Development

Speech sound development includes both *articulation* and *phonology* (Bauman-Waengler, 2016). Articulation refers to “the totality of motor movements involved in production of the actual sounds that comprise speech” (Bauman-Waengler, 2016, p.5). Phonology refers to “the study of how phonemes are organized and function in a language” (Bauman-Waengler, 2016, p.6). Speech sound difficulties have been shown to co-occur with stuttering more frequently during the school years than any other speech, language, or related disorders (e.g., Arndt & Healey, 2001; Blood et al., 2003).

Articulation. Majority of studies since the 1980’s reported no significant differences between the *articulation* scores of preschool-age CWS and CWNS, based on standardized measures (e.g., Clark, Conture, Walden, & Lambert, 2013; Nippold, 2002; Paden & Yairi, 1996; cf. Anderson & Conture, 2000).¹² Furthermore, findings have generally shown no association between preschool-age CWS’s articulation abilities and their stuttering frequency, severity, or SPI (Clark et al., 2013; Ryan, 1992, 2001). Regarding persistence, Ryan (2001) found that although there are no significant articulation differences between persistent and recovered CWS, articulation *combined* with vocabulary scores (in a discriminant analysis) predicted chronicity with 86.6% accuracy. Such findings suggest that perhaps interactions among articulatory

¹² See Clark et al. (2013) for a comprehensive review of studies assessing articulation and stuttering among preschool-age children.

processes and other factors could affect childhood stuttering, a notion worthy of future investigation.

Phonology. Pellowski, Conture, Anderson, and Ohde (2001) found that preschool-age CWS generally performed more poorly (i.e., exhibited more phonological processes and overall poorer phonological abilities) than CWNS. Louko, Edwards, and Conture (1990) reported that 40% of preschool-age CWS compared to 7% of CWNS exhibited phonological disorders. Similarly, upon analyzing retrospective diagnostic data, Yaruss et al. (1998) found that 37% of preschool-age CWS presented with disordered phonology. Regarding chronicity, longitudinal studies have shown that, at initial fluency evaluations, more CWS who later persisted (1) exhibited more severe phonological deficits; and (2) performed more poorly on measures of phonology compared to CWNS and CWS who later recovered (Paden & Yairi, 1996; Paden, Yairi, & Ambrose, 1999; Yairi et al., 1996). Note, however, that these longitudinal investigators reported considerable variability and overlap of phonology scores among the groups (persistent CWS, recovered CWS, and CWNS).

To summarize, the emergence of stuttering tends to coincide with a period during which children rapidly develop and refine their speech sound systems (i.e., the preschool years). Overall findings suggest that although articulation alone may not differentiate between preschool-age CWS and CWNS, such processes might contribute to stuttering when combined with other variables. Furthermore, preschool-age CWS tend to exhibit poorer phonological abilities than CWNS; reduced/impaired phonology at initial fluency evaluations could be predictive of stuttering chronicity. Additionally, as mentioned above, speech sound difficulties have been shown to co-occur with stuttering more frequently than any other speech, language, or related disorders (e.g., Arndt & Healey, 2001; Blood et al., 2003).

Clinical application. Given the above, comprehensive fluency evaluations should include some measure of children's articulatory and phonological speech sound abilities. Examples of relevant standardized assessments include but are not limited to the Arizona Articulation Proficiency Scale—Third Edition (Fudala, 2000), Goldman-Fristoe Test of Articulation-2nd edition (GFTA-2; Goldman & Fristoe, 2000), and the Khan-Lewis Phonological Analysis-2 (KLPA-2; Khan & Lewis, 2002). Additional phonetic transcriptions of speech samples could further help detect the quality/type of error patterns in children's running speech.

4.5 Language Development

The onset of childhood stuttering coincides with relatively rapid growth in vocabulary, morphology, and syntax (e.g., Bloodstein & Bernstein Ratner, 2008; Reilly et al., 2009; Yairi & Ambrose, 2013). Therefore, not surprisingly, considerable attention has been paid to the relation between the various linguistic domains and childhood stuttering (e.g., Anderson, 2007; Hakim & Ratner, 2004; Nippold, 2012; Ntouriou, Conture, & Lipsey, 2011; Richels, Buhr, Conture, & Ntouriou, 2010; Seery et al., 2007; Wagovich, Hall, & Clifford, 2009).

Findings regarding between-group language differences have been rather mixed. For instance, some have reported that CWS exhibit subtle-to-significant language differences compared to CWNS (e.g., Anderson & Conture, 2000, 2004; Ratner & Silverman, 2000; Murray & Reed, 1977; Ntouriou et al., 2011; Pellowski & Conture, 2005; Westby, 1979), whereas others found that CWS exhibit greater language performance than CWNS (e.g., Häge, 2001; Reilly et al., 2009, 2013; Watkins, 2005; Watkins, Yairi, & Ambrose, 1999). Still others have found no significant group differences (e.g., Bonelli, Dixon, Ratner, & Onslow, 2000; Clark et al., 2013; Nippold, Schwarz, & Jescheniak, 1991; Ratner & Sih, 1987). Similarly, findings have been

inconsistent regarding the association between language and stuttering chronicity. Particularly, some have found *poorer* language abilities to be predictive of persistence (e.g., Yairi et al., 1996), whereas others found *advanced* language abilities to be predictive of persistence (e.g., Häge, 2001). Still others have found no significant language differences between persistent and recovered CWS (e.g., Kloth et al., 1999; Ryan, 2001).

The abovementioned equivocal findings could be attributed to a number of methodological differences across studies, such as varying sample sizes, age ranges, gender distributions, and measures (e.g., norm-referenced/standardized vs. experimental language assessments). Furthermore, it is important to note the challenges involved in drawing general conclusions regarding the overall association between stuttering and language, given the various linguistic domains/modalities assessed across the abovementioned studies (e.g., MLU, expressive versus receptive language, vocabulary, or syntax). Perhaps overall findings suggest that some linguistic domains might be associated with stuttering for at least a subgroup of CWS.

Nevertheless, we must consider several relevant key points regarding this topic. Despite the inconsistent and complicated findings described above, there appears to be some kind of association between language and stuttering. For instance, studies have generally shown that stuttering tends to occur with specific linguistic characteristics, such as : (a) low frequency words (e.g., Anderson, 2007; Palen & Peterson, 1982), (b) the first three words of an utterance (Bernstein, 1981; Howell & Au-Yeung, 1995; Wall, Starkweather, & Cairns, 1981), (c) function words (e.g., Bernstein, 1981; Bloodstein & Grossman, 1981; Howell, Au-Yeung, & Sackin, 1999; Natke, Sandreiser, van Ark, Pietrowsky, & Kalveram, 2004), and (d) longer or more syntactically complex utterances (e.g., Buhr & Zebrowski, 2009; Gaines, Runyan, & Meyers, 1991; Howell & Au-Yeung, 1995; Kadi-Hanifi & Howell, 1992; Logan & Conture, 1995, 1997;

Melnick & Conture, 2000; Richels et al., 2010; Sawyer et al., 2008; Yaruss, 1999; Zackheim & Conture, 2003). Additionally, recent findings suggest that more preschool-age CWS than CWNS exhibit imbalances/dissociations across subcomponents of their speech-language abilities (Anderson & Conture, 2000; Anderson et al., 2005; Clark et al., 2015; Coulter et al., 2009), and that increased linguistic dissociations—particularly among male CWS—are associated with less distractibility (a temperamental construct associated with attention regulation; Clark et al., 2015). That latter finding suggests that there might be a relation among stuttering, language, and other factors developing around the same time (e.g., attention/temperament). Stuttering has also been shown to frequently co-occur with language disorders among school-age CWS (e.g., Arndt & Healy, 2001; Blood et al., 2003; Yaruss et al., 1998; cf. Nippold, 1990, 2004, 2012). Taken together, it appears necessary to assess children’s language during fluency evaluations.

Clinical application. Clinicians should incorporate age-appropriate measures of children’s receptive/expressive vocabulary and language abilities. Several informal/non-standardized as well as formal/standardized measures are available, including but not limited to: the Expressive Vocabulary Test (Williams, 1997); Peabody Picture Vocabulary Test (Dunn & Dunn, 1997); Test of Early Language Development-3 (Hresko, Reid, & Hammill, 1999); and obtaining children’s mean length of utterance (MLU) across varying contexts. Upon analyzing children’s performance, note whether there are any linguistic dissociations or mismatches across the various speech-language subcomponents.

5. Summary

This review summarized empirical evidence supporting a multifactorial approach to preschool-age stuttering assessments. Careful examination of the literature resulted in the following conclusions regarding several factors associated with stuttering:

- Stuttering tends to run in families.
- Stuttering tends to persist among males more so than females.
- CWS with longer TSOs may be at a greater risk for persistence. Knowing children's age at stuttering onset helps narrow down their TSO.
- Caregivers' "diagnosis" of their children stuttering may be fairly accurate when compared to clinicians' objective measures.
- Caregivers' assessment of their children's speech-related attitudes and awareness may be associated with other relevant factors that inform our clinical diagnosis and counseling/treatment recommendations.
- Overall findings suggest a possible relation between childhood stuttering and temperament.
- Changes in fluency behaviors (e.g., stuttering frequency/severity) should be monitored over time to determine whether a child is more likely to persist/recover.
- Children as young as 2 or 3 years-of-age might be aware of their stuttering and have negative speech-related attitudes.
- Preliminary findings suggest that children's self-reported speech-related attitudes may be associated with their caregivers' perception of stuttering; it is currently unclear whether/to what extent other factors (e.g., TSO and objective clinical measures of stuttering frequency/severity) may be associated as well.
- A possible relation exists between speech rate and stuttering. Furthermore, speech rate may play a role in caregiver counseling (e.g., modeling slower speech) and treatment recommendations (e.g., directly targeting child's speech rate).

- Phonological deficits present at initial stuttering evaluations during the preschool-years may be predictive of chronicity. Such findings seem to corroborate or be associated with reports which indicate that speech-sound difficulties tend to co-occur with school-age stuttering more frequently than other speech, language, or related disorders.
- Despite equivocal findings, there appears to be some kind of relation between stuttering and language. For example, stuttering tends to occur on specific linguistic characteristics, and language disorders are more prevalent among school-age CWS than CWNS.

Some of the abovementioned factors are better understood than others regarding their association with childhood stuttering. Nevertheless, studies have shown that although some isolated factors may not singularly affect stuttering, perhaps their combined effects/interactions contribute to the disorder. Similar conclusions have been made regarding the number of genes and brain regions involved in stuttering; simply put, multiple genes (Kraft & Yairi, 2011) and a network/interconnectivity among several brain regions (Chang & Zhu, 2013) are likely involved with stuttering.

To treat or not to treat. Studies have reported that 47-89% of children recover from stuttering before age 6 without any formal intervention (e.g., Ambrose & Yairi, 1999; Bloodstein & Bernstein Ratner, 2008; Panelli, McFarlane, & Shipley, 1978; Yairi & Ambrose, 1999; Yairi et al., 1996). Although “spontaneous” or “unaided” recovery could continue up to 3 years post onset (e.g., Yairi & Ambrose, 1999, 2005),¹³ it is unclear which children will recover immediately or with time. Therefore, it is often challenging to determine whether/when treatment is warranted. Clinicians are encouraged to consider the evidence presented in this review; that is, evaluate relevant factors associated with stuttering (e.g., linguistic abilities/load, speech-motor

¹³ It is presently unclear what “spontaneous” or “unaided” recovery actually entails. For example, caregivers may have consulted with others or practiced fluency-enhancing strategies that they found on the internet.

instability, emotional stress), weigh the risk factors associated with persistence (e.g., gender, family history, TSO), as well as assess parental concerns and children's fluency-related distress.

It is important to note that risk factors are just indicators of potential risk, which do not guarantee stuttering persistence (e.g., some children presenting without any risk factors may continue stuttering beyond the preschool-ages).

6. Conclusion

Speech and language are complex processes that involve many structures and functions, often overlapping and systematically working together. As shown in the present review, stuttering is a complex disorder associated with multiple factors and processes, many of which overlap in their development and/or interact in their function. Interestingly, some variables—such as temperament—are not necessarily viewed as speech/language processes, but have nevertheless been found to be associated with stuttering. Given the above, we argue the importance of evaluating stuttering from a multifactorial perspective, thereby accounting for the factors and processes potentially involved with or contributing to children's stuttering onset/persistence. Smith and Kelly (1997) suggested using “a battery of diagnostic tests that will include examination of linguistic, phonological, familial, and motor variables” (p. 209). Putting these “puzzle pieces” together will help form an overall clearer, more holistic and accurate profile of the child. Such information should help guide our counseling approach and treatment plans/goals.

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