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Expressed parental concern regarding childhood stuttering and the Test of Childhood Stuttering

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Abstract

Purpose—The purpose of the present study was to determine whether the Test of Childhood Stuttering observational rating scales (TOCS; Gillam, Logan & Pearson, 2009) (1) differed between parents who did versus did not express concern (independent from the TOCS) about their child's speech fluency; (2) correlated with children's frequency of stuttering measured during a child-examiner conversation; and (3) correlated with the length and complexity of children's utterances, as indexed by mean length of utterance (MLU).

Method—Participants were 183 young children ages 3:0 to 5:11. Ninety-one had parents who reported concern about their child's stuttering (65 boys, 26 girls) and 92 had parents who reported no such concern (50 boys, 42 girls). Participants' conversational speech during a child-examiner conversation was analyzed for (a) frequency of occurrence of stuttered and non-stuttered disfluencies, and (b) MLU. Besides expressing concern or lack thereof about their child's speech fluency, parents completed the TOCS observational rating scales documenting how often they observe different disfluency types in speech of their children, as well as disfluency-related consequences.

Results—There were three main findings. First, parents who expressed concern (independently from the TOCS) about their child's stuttering reported significantly higher scores on the TOCS *Speech Fluency* and *Disfluency-Related Consequences* rating scales. Second, children whose parents rated them higher on the TOCS *Speech Fluency* rating scale produced more stuttered disfluencies during a child-examiner conversation. Third, children with higher scores on the TOCS *Disfluency-Related Consequences* rating scale had shorter MLU during child-examiner conversation, across age and level of language ability.

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Conclusions—Findings support the use of the TOCS observational rating scales as one documentable, objective means to determine parental perception of and concern about their child's stuttering. Findings also support the notion that parents are reasonably accurate, if not reliable, judges of the quantity and quality (i.e., stuttered vs. non-stuttered) of their child's speech disfluencies. Lastly, findings that some children may decrease their verbal output in attempts to minimize instances of stuttering – as indexed by relatively low MLU and a high TOCS *Disfluency-Related Consequences* scores - provides strong support for sampling young children's speech and language across various situations to obtain the most representative index possible of the child's MLU and associated instances of stuttering.

When assessing childhood stuttering, clinicians and researchers alike use various means of measurement, including (1) frequency of stuttered disfluencies (e.g., Yairi & Ambrose, 1999); (2) frequency of all disfluencies (stuttered + non-stuttered) (e.g., Adams, 1977); (3) severity of stuttering (e.g., as measured by the Stuttering Severity Instrument; Riley, 1994); and (4) parent concern about stuttering (e.g., Boey et al., 2007, 2009; Yairi & Ambrose, 1999). Variability is one feature of these measures, as is childhood stuttering itself (e.g., Ingham & Riley, 1998; Meyers, 1986; Sawyer & Yairi, 2006; Yaruss, LaSalle, & Conture, 1998).

Indeed, variability in stuttering is common. For example, children who stutter may exhibit appreciable within-individual differences in stuttering frequency in conditions involving (1) members of their families versus their clinician (Johnson, Karrass, Conture & Walden, 2009; Yaruss, 1997), (2) production of a narrative versus conversational speech (Byrd, Logan & Gillam, 2012; Yaruss, 1997), or (3) when making a statement versus asking a question (Ryan, 2000). These within-individual differences in stuttering frequency can potentially significantly impact an examiner's judgment regarding the presence/absence of childhood stuttering, leading to differing decisions regarding child's stuttering frequency and severity (e.g., an examiner may underestimate the severity of a child's stuttering when relying solely on a single clinic speech sample).

Therefore, given such within-individual variability in children's stuttering, one possible means to enhance clinical, as well as research judgments and decisions regarding childhood stuttering, might be to include an objective index of parental concern about stuttering. Indeed, it may be argued that parents, as compared to clinicians/researchers, have the potential for providing a more general, central tendency of their child's speech fluency and related behaviors. This argument is based on the fact that most parents are able to routinely observe their child across a variety of changing circumstances, places and interactions whereas clinicians/researchers typically observe the child once. Thus, obtaining—in a consistent, reliable and/or replicable manner—detailed documentation regarding parental concern about speech fluency may be important for clinical and/or research diagnosis of stuttering in young children.

To assess whether parents are concerned about their child's fluency, most studies have used a nominal scale of measurement (e.g., yes/no question; Pellowski & Conture, 2002; Yairi & Ambrose, 1999) or relied on an ordinal scale of general stuttering severity (e.g. with zero standing for "normally fluent" speech and 7 for "very severe" stuttering) without providing

specific examples of each different disfluency types (Ambrose & Yairi, 1999). However, there have been criticisms of such methods of determining parental concern, mainly due to apparent lack of measurement reliability. For example, some parents may confuse non-stuttered disfluencies or other speech language disorders (e.g., articulation disorders) with stuttering (Conture, 1997; Diedrich & Carr, 1984; Yairi & Seery, 2011). Similarly, different parents may have different thresholds for the presence of a stuttering problem that may influence their level of concern (Ratner & Silverman, 2000). For such reasons, some clinicians and researchers have not included parental concern as a criterion for determining whether a child stutters. The present authors, however, believe that not including parental concern, is unfortunate because parental expression of concern has potential for providing valuable insight into children's speech disfluency and its related behaviors (e.g., Choi, Conture, Walden, Lambert, & Tumanova, 2013; Clark, Conture, Walden, & Lambert, 2013).

One possible means to address this challenge is to present parents with questions that describe behaviors consistent with stuttering (e.g., "Does the amount or frequency of what you are calling his stuttering go up and down, across days and conditions?") and ask them to answer those questions using an ordinal scale of measurement rather than parents providing a binary yes/no answer or merely stating that they think their child stutters. Fortunately, a relatively recently published test, the Test of Childhood Stuttering (TOCS; Gillam, Logan, & Pearson, 2009), involves asking parents questions that describe behaviors consistent with stuttering. Using the two norm-referenced observational rating scales from the TOCS has considerable potential for providing more consistent, detailed and quantifiable documentation regarding parental concerns about childhood stuttering.

In general, the TOCS is designed to assess speech fluency skills and stuttering-related behaviors in children 4 – 12 years of age. The TOCS involves two broad areas of assessment: (1) speech elicitation tasks administered by the examiner and designed to assess frequency of the child's stutter-like disfluencies in different communicative situations (e.g., picture naming, narration), and (2) parent-report observational rating scales. The present study focuses on the two TOCS's parent-report observational rating scales only: the *TOCS Speech Fluency* scale and the *TOCS Disfluency-Related Consequences* scale. Each of these two parent-report rating scales contains nine questions that ask parents to describe various aspects of their child's *disfluent* behaviors (e.g., questions about parent observations of the frequency and types of their child's speech disfluencies) as well as the parents' observations of the *consequences* of their child's disruptions in fluency (e.g., questions about what the child does when disfluent or how she/he reacts to speech difficulties in general). Parents are asked to provide their judgements about each of their child's behaviors (e.g., child repeats whole words) by rating the frequency of occurrence of these behaviors on a 1 – 4 ordinal rating scale (i.e., never – rarely – sometimes – often).

The TOCS observational rating scales appear to allow both clinicians and researchers to augment the objectivity of their measurement of parent concern about the nature and consequences of their child's speech in a reasonably consistent, reliable fashion. Thus, one goal of the present study was to determine whether the TOCS *Speech Fluency* scale scores does serve as a reliable, objective measure of expressed parent concern about a child's speech fluency.

Another issue that is important to consider when diagnosing childhood stuttering is the notion that young children who stutter may be experiencing social consequences of stuttering such as withdrawal from talking which can complicate diagnostic evaluation for stuttering. Indeed, it has been reported that children who stutter have shown a developing "awareness" of stuttering as early as age two (Ambrose & Yairi, 1994; Boey et al., 2009; Clark et al., 2010; Ezrati-Vinacour, Platzky, & Yairi, 2001; Yairi & Ambrose, 2005). Withdrawal from (or curtailing) talking was the most frequently reported reaction to stuttering in preschool-age children in a sample of 1122 parents of preschool-age children who stutter (Boey et al., 2007). The measurement of stuttering frequency and severity most often relies on clinician/researcher's analysis of children's spontaneous conversational speech samples. If children reduce their verbal output when conversing with an unfamiliar examiner, they are likely to stutter less and stuttering frequency and/or severity may be masked. In fact, several studies have reported that variables such as grammatical complexity and length of utterances influence the frequency of stuttering. For example, Zackheim and Conture (2003) examined the influence of utterance length and complexity (i.e., mean length of utterance [MLU]) on preschool-age CWS's stuttered and normal disfluencies. These researchers reported that utterances above the child's typical MLU are more likely to contain more stuttered and non-stuttered speech disfluencies, suggesting that increases in utterance length and complexity are associated with increases in stuttering (for further review of this issue, see Bloodstein & Bernstein Ratner, 2008, pp. 213–214, 217; Tables 1–3, Zackheim & Conture, 2003). The association between stuttering and utterance length was further supported by Richels, Buhr, Conture, & Ntourou (2010), who reported that preschoolers' stuttering on utterance-initial words increased in longer utterances. Likewise, Sawyer, Chon and Ambrose (2008) analyzed conversational speech of preschool-age CWS and reported that MLU was significantly longer in the section of the speech sample that contained more stuttered disfluencies. Consistent with these findings was Buhr and Zebrowski's (2009) report, based on a sentence-level analyses of preschool-age CWS and CWNS, that sentences containing either stuttered or normal disfluencies were significantly longer and more complex than fluent sentences.

Given that some children who stutter may reduce their verbal output when conversing with an unfamiliar examiner and stutter less than what is typical for them, it may be helpful for an examiner to gain insight into child's speaking patterns in daily communication contexts. The TOCS *Disfluency-Related Consequences* scale enables the examiner to collect information about disfluency-related behaviors, including withdrawal from talking, from parents and other individuals who known the child well. To address these issues, we posed a third research question: Do the TOCS *Disfluency-Related Consequences* scale scores serve as a reliable measure of the impact of stuttering on child's verbal output in situations when they are faced with new people and environments? To answer this question, we empirically studied the relation between children's MLU during conversational speech and parental ratings of disfluency-related consequences using the TOCS *Disfluency-Related Consequences* scale.

In summary, the present study employed a relatively large sample (n=183) of preschool-age children, with roughly half of these children's parents (n=91) expressing concern about stuttering and the other half of these children's parents (n=92) expressing no concern about

stuttering. The present authors asked three research questions: (1) Are there differences in TOCS's observational rating scale scores between parents who do versus those who do not express concern (independent of the TOCS) about their child's speech fluency? (2) What is the association between children's frequency of stuttering during a child-examiner conversation and parent-reported observations of frequency of their child's stuttering (as measured by TOCS *Speech Fluency* scale)? and (3) What is the association, for children whose parents are concerned about stuttering, between children's reaction to their own stuttering (as reported by parents on the TOCS *Disfluency-Related Consequences* scale) and children's MLU during a child-examiner conversation?

Method

Participants

One hundred and eighty-three preschool-age children and their parents participated in the present study. All children were monolingual English speakers. Independent of the TOCS rating scales, parents of 91 children expressed concerns about their child's stuttering (65 boys, 26 girls, *M (age)* = 46 months, *SD* = 7.37, range = 36–68 months), and parents of 92 children expressed no concerns (50 boys, 42 girls, *M (age)* = 49 months, *SD* = 9.79, range = 36–71 months). Children whose parents reported no concern for stuttering were recruited as a control group and had no past history of stuttering. The parents were asked a binary/nominal level (i.e., "yes/no") question to document their concern about stuttering, similar to the method reported in previous empirical studies (e.g., Pellowski & Conture, 2002; Yairi & Ambrose, 1999). A general linear model analysis indicated that the mean difference in chronological age differed between children whose parents reported concern versus children whose parents reported no concern ($F = 6.28$, $p = 0.013$), thus chronological age was a covariate in subsequent inferential analyses.

All participants were paid volunteers whose parents either learned about the study from an advertisement in a monthly parent magazine circulated throughout Middle Tennessee or an e-mail advertisement sent to Vanderbilt University employees, or were referred to the Vanderbilt Bill Wilkerson Hearing and Speech Center for an evaluation. The study procedures were approved by the Vanderbilt University Institutional Review Board. Informed consent by parents and verbal assent by children were obtained.

Measurement of speech fluency

Measurement of speech fluency and MLU was based on a 300-word conversational speech sample during free play between the child and an examiner. All disfluency and word counts were obtained in real-time with the examiner noting the disfluent and fluent words on a disfluency count sheet (Conture, 2001) while playing and conversing with the child.

Present study guidelines for measurement of speech disfluencies are described in detail in Tumanova et al. (2014). In brief, our guidelines were that only one disfluency type (e.g., sound/syllable repetition) could be applied to a single word. If two or more stuttered disfluencies occurred on the same word (e.g., a disfluency cluster containing "sound prolongation + sound/syllable repetition"), only the first disfluency to occur in the word was

included in the data. Phrase repetitions or revisions (which are classified in this study as non-stuttered/normal disfluencies; for examples, see below) occur on units larger than single words. Thus, if a stuttered and a non-stuttered disfluency occurred within the same phrase (e.g., a sound prolongation occurring on one word in a phrase that was revised, i.e., a revision), both were counted (see Yaruss, 1998). Child –examiner interactions were video recorded to assess inter- and intra-judge measurement reliability (described below).

Measurement of mean length of utterances

Measurement of participants' MLU was based on a 300-word conversation during free play between the child and the examiner. MLU in morphemes was computed using Brown's procedure (1973) with minor differences due to additional rules agreed upon by trained coders to increase reliability. Details of obtaining MLU are described below.

Coders used a 2-sec pause to determine when an utterance ended. However, there were two exceptions: a) utterances with embedded dependent clause(s) were not subdivided and b) if a child joined more than two independent clauses with coordinate conjunctions, the resulting utterance was divided after the first two clauses. Speech disfluencies and abandoned utterances were not counted as morphemes. If a child listed items, the item(s) after the second word in the list was/were not included in the morpheme count.

Classification and inclusion criteria

Speech, language and hearing criteria—All participants' speech-language and hearing were assessed using standardized measures to ensure that all participants had age-appropriate skills. Speech sound articulation was measured by the "Sounds in Words" subtest of the Goldman-Fristoe Test of Articulation-2 (GFTA-2; Goldman & Fristoe, 2000). Receptive vocabulary was measured using the Peabody Picture Vocabulary Test-Third Edition (PPVT-4; Dunn & Dunn, 2007) and expressive vocabulary was measured using the Expressive Vocabulary Test (EVT-2; Williams, 2007). Receptive and expressive language abilities were evaluated using the Test of Early Language Development-3 (TELD-3; Hresko, Reid, & Hamill, 1999). All participants included in the final data corpus scored at or above the 16^{th} percentile on the above tests. In addition, all participants received a bilateral pure tone hearing screening to rule out hearing impairments. Descriptive data on participants' speech- language abilities are in Table 1.

Group classification—Participants were classified into one of two groups: (1) children whose parents expressed concern about their child stuttering (CPC; n = 91) or (2) children whose parents did not express concern about stuttering (CNPC; n = 92). These binary parental expressions of concern/no concern were made independently of parent responses to TOCS observational rating scales.

Socioeconomic status—The Hollingshead Four-Factor Index of Social Position (Hollingshead, 1975) was used to provide a descriptive measure of participants' socioeconomic status (SES). This index takes into account both parents' educational levels, occupation, and marital status, based on self-report. Computed scores ranged from 8 to 66, with a higher score indicating a higher socioeconomic status (see Table 1 for descriptive

data). There was no significant difference in socioeconomic status between parents who expressed concern about stuttering versus those parents who did express a concern.

Test of Childhood Stuttering (TOCS) rating scales—The TOCS parent-report observational rating scales allow clinicians and researchers to assess parental concern regarding the nature and consequences of their child's speech (dis)fluency. Documentation included with the TOCS provides support that the instrument is a valid and reliable measure of concerns about stuttering (Gillam, Logan, & Pearson, 2009). Gillam et al. (2009) report that the TOCS was normed on a sample of 173 typically developing children and 123 children who stutter in four age groups: 4–5, 6–7, 8–9 and 10–12 years of age. Documentation for the TOCS indicates that only the scores of children who stutter were used to determine the reliability of the TOCS observational rating scales. The TOCS *Speech Fluency* scale had α = .91 and test-retest reliability r = .86, and TOCS *Disfluency-Related Consequences* scale had α = .89, and test-retest reliability r = .88.

The TOCS observational rating scales were normed on children between 4 –12years of age. However, the present study included 3 year-old children in the sample. This was deemed appropriate given that the present study used raw scores on the TOCS *Speech Fluency* and *Disfluency-Related Consequences* observational rating scales rather than the standard scores based on the TOCS norming sample.

Procedures

The parental aspect of the present study's data collection involved an examiner conducting a parent interview. During this interview, information was obtained regarding the family's SES, history of speech-language and fluency disorders, and parents' expressed concerns about children's speech-language abilities (for further details of this interview process, see Conture, 2001; Richels & Conture, 2010). At the end of the interview, parents completed TOCS observational rating scales to assess speech fluency skills (TOCS *Speech Fluency* scale) and stuttering-related behaviors (TOCS *Disfluency-Related Consequences* scale) in their child.

While parents were being interviewed, a different examiner collected speech-language data from their child in a different room. This examiner conversed with the child during free play, informal activity, taking the "on-line" disfluency counts, from which measures of speech fluency and mean length of utterances were obtained. The conversational play-based sampling procedures used a standard set of age-appropriate toys (a barn set with toy animals and people). Examiners followed"best practice guidelines" regarding speech sample collection (e.g., Rice et al., 2010). This included following the children's conversational lead, engaging in parallel talk, sharing personal experiences, and introducing topics related to past and ongoing events. During the informal conversations with participants, examiners were also trained to keep the use of "yes/no" and wh-questions to a minimum and to avoid dominating the verbal interactions with many utterances. For further details on participant testing procedures see Tumanova et al. (2014).

Description of dependent and independent variables—Dependent measures were (1) TOCS *Speech Fluency* scale score; (2) TOCS *Disfluency-Related Consequences* scale

score; (3) number of children's stuttered disfluencies in a 300-word conversational speech sample, and (4) children's mean length of utterances (MLU) during the 300-word speech sample. These variables were entered as independent variables depending on the research question (see the results section below). Additionally, children's chronological age and TELD spoken language standard score were independent variables in one analysis and children's chronological age was an independent variable in two analyses (please see below).

Stuttering frequency and MLU measurement reliability—Intra-class correlation coefficient (ICC) using the absolute agreement criterion (McGraw & Wong, 1996; Shrout & Fleiss, 1979) were computed to assess inter-judge reliability for MLU and speech disfluencies. Inter-judge agreement for MLU was assessed by the first author and 8 trained coders independently judging MLU for 7 participants from video-recorded samples. The average ICC coefficient was .97, $p < .001$.

Inter-judge agreement for identification of stuttered disfluencies in children's speech was assessed by the first author with 4 trained coders who independently counted disfluencies for 32 participants from video-recorded samples. The average ICC coefficient for identification of stuttered disfluencies was .989, $p < .001$.

Data Analyses

Before conducting the main statistical analyses for each research question, distributions of each dependent variable were checked for normality (results are below). Given non-normal distributions for the TOCS *Speech Fluency*, TOCS *Disfluency-Related Consequences* scale scores and number of children's stuttered disfluencies during child-examiner conversational speech, a generalized linear regression analysis was employed. This analytical procedure can assume various distributions of dependent variables (Nelder & Wedderburn, 1972). Specifically, this procedure was employed to address both research question 1 (i.e., *Are there differences in TOCS observational rating scale scores between parents who do versus those who do not express concern about their child's speech fluency?*) and research question 2 (i.e., *What is the association between children's frequency of stuttering during a child-examiner conversation and parent-reported observations of frequency of their child's stuttering measured by TOCS Speech Fluency scale?)* To control for a potential effect of children's chronological age on parental scores for the TOCS observational rating scales, chronological age was a covariate in the models for research question 1.

For research question 3 (i.e., *What is the association, for children whose parents are concerned about stuttering, between children's reaction to their own stuttering [as reported by parents on the TOCS Disfluency-Related Consequence scale] and children's MLU during a child-examiner conversation?*) a general linear model was employed because the dependent variable in this analysis (i.e., children's MLU) followed a normal distribution. To control for effects of age and language ability on MLU, children's chronological age and TELD spoken language standard score were covariates in the model for research question 3.

Research question 3 was only explored for children whose parents were concerned about stuttering. This is because stuttered disfluencies are not characteristic of speech of typically

developing children and thus their parents typically report no concern about stuttering (Figure 2). Specifically, our data shows restricted variability (a mode of 0) for the TOCS *Disfluency-Related Consequence* scale scores for this "no concern about stuttering" group. Hence, we only used data from the children whose parents were concerned about stuttering (CPC; n = 91; 65 boys, 26 girls), which had more variability for the TOCS *Disfluency-Related Consequence* scale scores (see Figure 2), with a mode of 2.

Although all children in our study exhibited language abilities within the normal range on the basis of standardized test scores, we covaried participants' overall measure of language ability (TELD spoken language standard score) to control for language ability's possible effect on children's MLU. No other tests of speech or vocabulary (e.g., PPVT, EVT or GFTA) were included in the model for two reasons: (1) we had no a priori hypotheses about their relation with MLU; and (2) we wanted to avoid confounding due to the inclusion of correlated independent variables (i.e., several measures of linguistic ability) as covariates.

Results

Descriptive analyses are reported first, followed by inferential analyses of each of the three research question.

Descriptive Analyses

Table 2 provides descriptive data for stuttered and non-stuttered disfluencies and MLU. As mentioned above, because speech disfluency counts are often non-normally distributed and typically follow a binomial distribution (Tumanova et al., 2014), a *generalized* linear model (Nelder & Wedderburn, 1972) was used to inferentially analyze group differences in speech disfluencies. A *general* linear model was employed for group differences in MLU because that variable was normally distributed.

Solely based on the binary/nominal (i.e., yes or no) statement of parent concern about their child's stuttering, those children whose parents expressed concerns about stuttering (CPC) produced significantly more stuttered disfluencies than children whose parents were not concerned (CNPC; Wald χ^2=137.34, df = 1, p < .0001); however, there was no significant group difference (i.e., CPC vs. CPNC) in the frequency of non-stuttered disfluencies (Wald χ^2=2.87, df = 1, p = .09) or in MLU during the child-examiner conversation (F = .43, df= 1, p = .51).

Inferential Analyses

Normality of distributions of parents' responses to TOCS observational rating scales—Parental responses to these two rating scales were not normally distributed. Specifically, the Shapiro Wilk's test of normality of distribution for the TOCS *Speech Fluency* scale scores indicated non-normal distributions for: (1) children whose parents expressed no concern (W=.867, df = 101, p < .0001) as well as (2) children whose parents expressed concern for stuttering (W = .973, df= 94, p = .05). Likewise, the Shapiro Wilk's test of the TOCS *Disfluency-Related Consequences* scale scores indicated a non-normal distribution for: (1) children whose parents expressed no concern (W = .663, df = 101, p < .0001) as well as (2) children whose parents expressed concern for stuttering (W = .902, df =

94, $p < .0001$). Histograms for parent responses to the TOCS *'s Speech Fluency* and *Disfluency-Related Consequences* scales are in Figure 1 and Figure 2 respectively.

Research Question 1: Are there differences in TOCS observational rating scale scores between parents who do versus those who do not express concern about their child's speech fluency?—Results for Research Question 1 pertaining to *the* TOCS *Speech Fluency* scale indicated two main effects, one relating to expressed parental concern and the other relating to children's chronological age. As shown in Table 2, when compared to parents who expressed no concern about their child's stuttering, parents who did express such concern rated their children significantly higher on TOCS *Speech Fluency* scale (Wald $\chi^2 = 150.91$, $df = 1$, $p < .0001$, $\beta = -1.237$). The second significant predictor of TOCS *Speech Fluency* scale score was children's chronological age (Wald $\chi^2 = 3.90$, $df = 1$, $p = .048$, $\beta = -.012$), with parents of older children rating their children lower on the scale. In summary, parents who expressed concern about stuttering, compared to those who did not, perceived more speech disfluencies in their child's speech and also parents of younger children perceived more speech disfluencies in their children speech (with parental judgments of speech disfluencies for both main effects indexed by their responses to the TOCS *Speech Fluency* scale).

Results for Research Question 1 pertaining to the TOCS *Disfluency-Related Consequences* scale indicated one main effect relating to expressed parental concern. Specifically, parents who expressed concern, compared to those who did not, regarding their child's stuttering, scored higher on the TOCS *Disfluency-Related Consequences* scale scores (Wald $\chi^2 = 43.79$, $df = 1$, $p < .0001$, $\beta = -.995$). There was no significant effect for children's chronological age (Wald $\chi^2 = .003$, $df = 1$, $p = .954$). In summary, parents who expressed concern about stuttering, compared to those who did not, gave a higher score on the TOCS *Disfluency-Related Consequences* scale indicating that they *perceived more disfluency-related consequences* (e.g., averting eye contact when speaking, speaking less in certain circumstances, experiencing peer rejection, etc.) for their children.

Research Question 2: What is the association between children's stuttering frequency during a child-examiner conversation and parent-reported frequency of their children's stuttering (measured by the TOCS *Speech Fluency* scale)?—Results indicated that the TOCS *Speech Fluency* scale score was a significant predictor of children's stuttering frequency during child-examiner conversation (Wald $\chi^2 = 117.29$, $df = 1$, $p < .0001$; $\beta = 1.544$). In summary, children whose parents rated them higher on the TOCS *Speech Fluency* scale, exhibited more stuttered disfluencies during a child-examiner conversation.

Research Question 3: For children who stutter, what is the association between children's reaction to their own stuttering (as reported by parents on the TOCS) and children's MLU during a child-examiner conversation?—Results indicated three significant predictors of children's MLU during a child-examiner conversation: (1) TOCS *Disfluency-Related Consequences* scale score ($F_{1, 87} = 7.098$, $p = 0.009$, partial $\eta^2 = .076$), (2) children's chronological age ($F_{1, 87} = 30.46$, $p < .0001$, partial $\eta^2 = .262$) and (3) TELD spoken language standard score ($F_{1, 87} = 15.65$, $p < .0001$, partial

η^2=.154). Specifically, children, of parents who gave their children a higher score on TOCS *Disfluency-Related Consequences* scale, exhibited shorter MLU during the child-examiner conversation. As would be expected, older children and children with a higher overall language ability produced longer MLU during a child-examiner conversation. In summary, after the effects of children's language ability and chronological age were statistically controlled, children, of parents who reported that their children exhibited a stronger reaction to their own stuttering, exhibited shorter MLU during the child-examiner conversation.

Discussion

The present study resulted in three main findings. The first finding indicated that parents who expressed concern about their child's stuttering (independently from their response(s) to the TOCS) rated their children higher on TOCS *Speech Fluency* scale. Related to this, the second finding indicated that children of parents who rated their children higher on the TOCS *Speech Fluency* scale exhibited more stuttered disfluencies during a child-examiner conversation. The third finding indicated that children of parents who reported that their children exhibited a stronger reaction to their own stuttering exhibited shorter MLU during the child-examiner conversation, when effects of children's age and language ability were controlled. Implications of these findings are discussed below.

First main finding: Parents'expression of concern about their child's stuttering are consistent, whether measured nominally or ordinally

This finding supports the use of parents' responses to the TOCS *Speech Fluency* scale (based on answers to 9 questions rated on a 4-point scale) as one documentable, objective means for measuring parental concern about a child's stuttering.

Although present findings support the notion that both clinicians and examiners can use the TOCS *Speech Fluency* scale to augment their determination of parental concern about their child's stuttering, some may remain uncertain regarding the reliability of parents' expressed concern about their children's stuttering. Such uncertainty about the reliability of parental concern about stuttering, especially when based on a parent's response to a single yes/no question (i.e., do you have a concern about your child's speech?), may be related to at least two factors.

First, examiners may assume, based on observation and/or reasoning, that some parents confuse non-stuttered disfluencies and/or other speech language disorders (e.g., articulation disorders) with stuttering (Diedrich & Carr, 1984). Present data, however, provides evidence to the contrary. All participants in our study scored within normal limits on the norm-referenced speech-language measures, yet their parents appeared to accurately attribute their concern regarding their child's speech to stuttering.

Second, examiners may assume that different parents have different thresholds for the presence of a stuttering problem, with such differences influencing their level of concern about their child's stuttering (Ratner & Silverman, 2000). As suggested above, parental differences in thresholds for identifying stuttering as a problem may be impacted by a parent's a priori experience with stuttering, whether their own, their siblings, their parents or

other associates or relatives. Perhaps, such experiences increase parents' sensitivity toward and hence alters their threshold of detection of stuttering in their child (a possibility surely not limited to stuttering, but other disorders as well). Differences in parental thresholds for concern about stuttering may lead some clinicians and researchers to give less credence to parents' expressed concern about their child's stuttering. Present findings, however, suggest that the TOCS observational rating scales may help examiners augment their ability to determine parental concern regarding stuttering in a more comprehensive, documentable, objective way.

Second main finding: Children's stuttering during child-examiner conversation is related to parental ratings on the TOCS *Speech Fluency* scale

This finding indicated that higher parental scores on the TOCS *Speech Fluency* scale were associated with more frequent stuttering by their children during a child-examiner conversation. The first, perhaps, obvious interpretation of this findings is that parents are reasonably accurate, if not reliable, judges of the quantity and quality (i.e., stuttered vs. non-stuttered) of their child's speech disfluencies. Of course, this is, a group finding, with individual differences in the accuracy and reliability of parental judgement quite possible. The second interpretation is that the items in the TOCS *Speech Fluency* scale tap into variables most parents employ to judge their child's stuttering (judgments that eventually may lead to decisions that their child is or is not stuttering). It would be of interest in subsequent studies for researchers to examine items on this TOCS subscale that are most closely associated with examiners' independent judgements of stuttering. Having such information might have value for not only clinical or research measurement of childhood stuttering, but also for instructors training students to identify instances of stuttered disfluencies.

Third main finding: Children who stutter who react more to their stuttering (based on parent response to the TOCS *Disfluency-Related Consequences* scale) exhibit shorter MLU

This finding suggests that even when children's age and language ability were statistically accounted for, children – whose parents rated them as having stronger reactions to their stuttering (based on parental responses on the TOCS *Disfluency-Related Consequences* scale) – exhibited reduced verbal output, at least with an unfamiliar examiner. This interpretation is further supported by the fact that no children in the present sample had sub-par language functioning, as determined by their performance on the battery of standardized speech and language tests. Although some have speculated that children's reactions to stuttering are associated with their amount of verbal output, our third main finding, to the present authors' knowledge, is the first that empirically supports such speculation. Reduction in verbal output, the present authors propose, may result from CWS's negative experiences with speaking in general, and stuttering in specific. That is, due to previous as well as ongoing negative experiences and difficulties with speaking and/or stuttering, CWS may reduce their verbal output to limit stuttering during conversation. This speculation is based on findings indicating that children are more likely to stutter when producing syntactically complex utterances than syntactically simple utterances (e.g., Bernstein Ratner & Sih, 1987; Logan & Conture, 1995, 1997; Sawyer et al., 2008; Zackheim & Conture,

2003). If present speculation is correct, reduced MLU may reflect children's attempts to minimize stuttering, based on prior as well as ongoing negative experiences with stuttering. In addition, it can be further speculated that children who are highly reactive to novelty and the unfamiliar may be more likely to reduce their verbal output when compared to those who are not as reactive (see Choi et al., 2013 for further discussion). Clearly, further empirical study is warranted to support or refute such speculations. Of particular interest, to the degree it can be empirically ascertained, is determining (1) the reason(s) children appear to truncate their verbal output, for example, does such diminution in verbal output reflect children's conscious intention, their less conscious reaction, or some sort of complex mélange of the two, and (2) whether children who stutter who are highly reactive to novelty and the unfamiliar are more likely to reduce their verbal output than those stuttering children who do not show high reactivity to the unfamiliar.

Of course, the notion that preschool-age children who stutter exhibit various reactions to their speech difficulty is not particularly new. For example, children who stutter may physically tense their lip and jaw muscles in attempts to "get out" of a sound repetition (such as the "m" in a word like "m-m-m-mommy"). Young children who stutter have shown a developing awareness of stuttering as early as age two (Ambrose & Yairi, 1994; Boey et al., 2009; Clark et al., 2010; Ezrati-Vinacour, Platzky, & Yairi, 2001; Yairi & Ambrose, 2005). As a result of such awareness, children may withdraw from talking, as some empirical findings indicate. For example, withdrawal from talking was the most frequently reported reaction to stuttering in a sample of 1122 parents of preschool-age children who stutter (Boey et al., 2007). Similarly, Langevin, Packman and Onslowl. (2010) administered a questionnaire to parents of preschool-age children who were either on a wait list for or were receiving treatment for childhood stuttering (Jones et al., 2005). Of 77 parents, the most frequently reported behavioral responses by young children were speaking less overall (25%) and withdrawal (23%). These parental observations for parents concerned about stuttering are consistent with the present finding that the TOCS *Disfluency-Related Consequences* score was associated with lower MLU during child-examiner conversation. Based on this finding, it is recommended that if a child's TOCS *Disfluency-Related Consequences* score is high (particularly if their MLU is relatively low), an examiner should collect speech sample from the child in various situations, a suggestion similar to that of others (e.g., Ingham & Riley, 1998; Yaruss, 1997). Doing so, it is suggested, should increase the chances that the examiner obtains the most representative index possible of the child's MLU and associated instances of stuttering.

Caveats

First, the measurement of MLU was based on a relatively short (300-word) speech sample. Similarly, the measurement of stuttering was also based on the same speech sample, with both perhaps less than fully representative of children's performance in a larger sample (for review of the impact of sample size on measurement of stuttering, see Sawyer & Yairi, 2006).

Second, the young participants' behaviors associated with reaction to stuttering was only measured by parental report. Perhaps future studies employing coded behavioral

observations by independent, trained examiners, may provide additional information on the impact of such behaviors/reactions on childhood stuttering (e.g., Jones, Conture, & Walden, 2014).

Third, the present study's finding that some young children who stutter simplify their verbal output could be related to their reaction to instances of stuttering, consequences of stuttering or both. Our study design does not readily permit further resolution of this issue.

Conclusion

Present empirical findings support the use of TOCS observational rating scales to augment, if not increase the depth and breadth of examiners' ability to determine parental concern about their child's stuttering. This may be particularly true when clinicians or researchers are attempting to assess, identify and measure childhood stuttering, for example, during a diagnostic evaluation. Furthermore, one of our findings suggests that children's MLU – besides providing insight into the length and complexity of children's utterances – may provide additional information regarding children's behavioral, cognitive and/or emotional reaction to stuttering. In short, present findings suggest the possibility that a child who stutters decreases his or her verbal output in attempts to minimize instances of stuttering and their consequences. If MLU is employed to augment the measurement of behavioral reaction to stuttering, it is, of course, important to control for factors known to influence children's MLU (e.g., age and language ability).

Overall, present findings are consistent with the notion that the measurement of young children's stuttering frequency and severity can be meaningfully augmented by considering parents' concerns about their children's disfluency and disfluency-related consequences. Simply put, whereas there may be subjective elements to parental reports about their child and his/her stuttering, there are also likely to be objective elements as attested to by the results of the present study.

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HIGHLIGHTS

- TOCS rating scales can be used as objective means to determine parental concern for stuttering
- Children's MLU may provide information regarding children's behavioral reaction to stuttering
- Some children who stutter may decrease their verbal output in attempts to minimize instances of stuttering

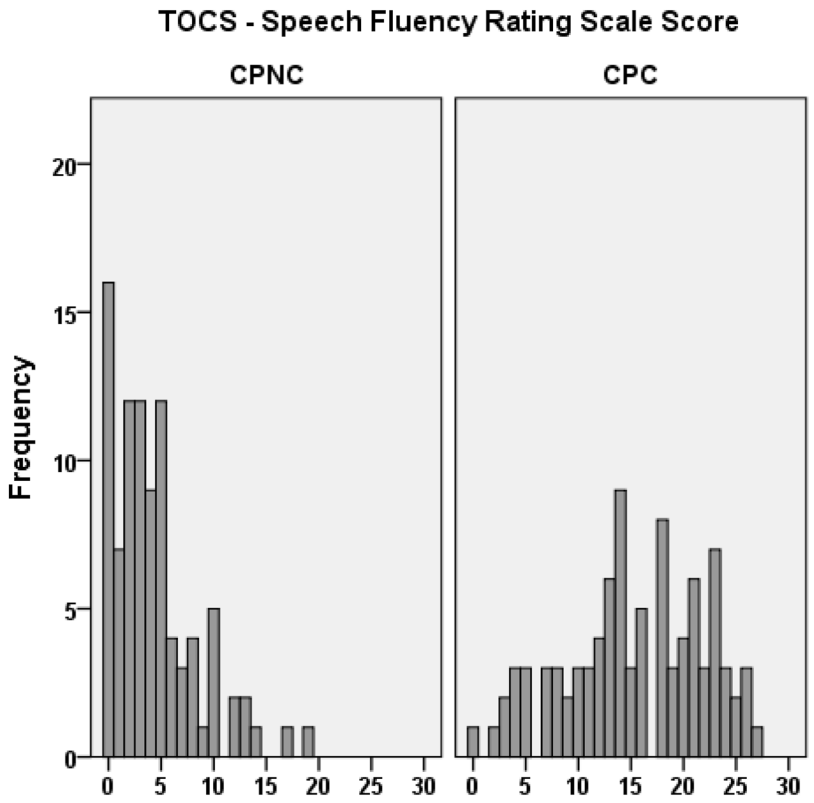

Figure 1.

Distribution of test scores for the Test of Childhood Stuttering's (TOCS; Gillam et al., 2009) *Speech Fluency* scale.

Note: CPNC = children with no parental concern for stuttering (n = 92) and CPC = children with parental concern for stuttering (n = 91).

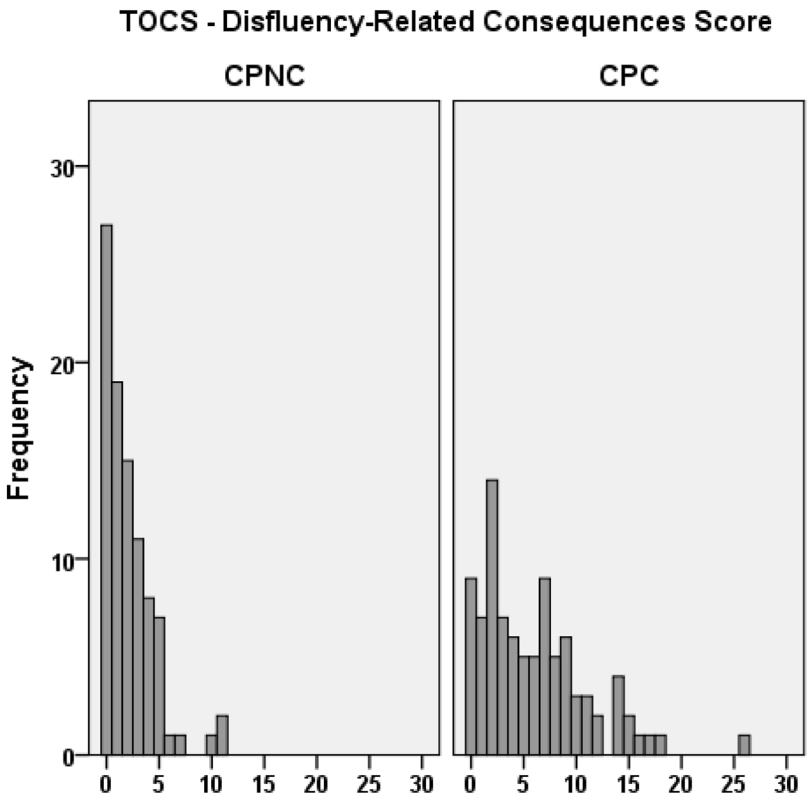

Figure 2.

Distribution of test scores for the Test of Childhood Stuttering's (TOCS; Gillam et al., 2009) *Disfluency-Related Consequences* scale.

Note: CPNC = children with no parental concern for stuttering (n = 92) and CPC = children with parental concern for stuttering (n = 91).

Table 1

Speech and language scores and family socio-economic status information for children with no expressed parental concern (CNPC, n=92) and children with expressed parental concern for stuttering (CPC, n=91).

Independent variable	Group	Mean	Std. Deviation
Age (months)	CNPC	49.34	9.81
	CPC	46.14	7.40
GFTA Standard Score	CNPC	109.71	9.95
	CPC	109.63	10.30
PPVT Standard Score	CNPC	116.53	12.43
	CPC	110.79	13.10
EVT Standard Score	CNPC	118.51	11.24
	CPC	112.97	12.54
TELD Receptive Standard Score	CNPC	120.43	13.58
	CPC	117.46	15.08
TELD Expressive Standard Score	CNPC	114.13	13.48
	CPC	108.67	14.38
TELD Spoken Language Standard Score	CNPC	120.80	13.43
	CPC	115.74	15.69
Family Socio-Economic Status	CNPC	45.79	12.52
	CPC	44.16	12.96

Note: GFTA = Goldman-Fristoe Test of Articulation; PPVT = Peabody Picture Vocabulary Test; EVT = Expressive Vocabulary Test; TELD = Test of Early Language Development.

Table 2

Stuttered, non-stuttered disfluencies and mean length of utterance (MLU), as well as TOCS *Speech Fluency* and *Disfluency-Related Consequences* scores for children with no parental concern (CNPC, n=92) and children with parental concern (CPC, n=91) about stuttering.

Independent variable	Group	Mean	Std. Deviation
SD frequency %	CNPC	1.75	1.46
	CPC	6.82	5.10
ND frequency %	CNPC	3.55	2.46
	CPC	4.04	2.45
TOCS Speech Fluency Rating Score	CNPC	4.34	4.03
	CPC	15.37	6.60
TOCS Disfluency-Related Consequences Score	CNPC	2.11	2.34
	CPC	5.96	5.03
MLU in conversation	CNPC	5.05	1.30
	CPC	4.85	1.13

Note: SD = stuttered disfluencies; ND = Non-stuttered disfluencies; TOCS = Test of Childhood Stuttering