Title: Repetitive Negative Thinking in Adolescents who Stutter

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Disclosures: Seth E. Tichenor, Bridget Walsh, and Katelyn L. Gerwin have declared that no competing interests existed at the time of publication.

Funding Source: R01DC018000 (PI: Walsh)

Acknowledgement: Research reported in this publication was supported in part by the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health under award number R01DC018000. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Abstract

Purpose: Repetitive Negative Thinking (RNT) is the process of engaging in negatively valenced and habitual thought patterns. RNT is strongly associated with mental health conditions and often affects quality of life. This study explored RNT in older school-age children and adolescents who stutter to quantify the relationship between RNT and self-reported anxiety characteristics. An additional aim was to describe how individual differences in an adolescent's goal when speaking influences the frequency they engage in RNT.

Method: Ninety-nine children and adolescents who stutter aged 9-18 years completed a measurement of the frequency/severity of RNT, a screener of anxiety characteristics, and a measure of adverse impact related to stuttering. Children aged 10 and above also answered questions about their goal when speaking.

Results: Individual differences in RNT significantly predicted adverse impact related to stuttering more so than a child or adolescent's age. Higher generalized or social anxiety scores were significantly correlated with more frequent RNT and greater adverse impact related to stuttering. Individual differences in goal when speaking (i.e., whether or not to stutter openly) were found to predict RNT. Finally, children and adolescents (22.2%) also screened positive for Generalized Anxiety Disorder and 32 (32.3%) screened positive for Social Anxiety Disorder.

Discussion: These data provide strong evidence that (a) high degrees of RNT are present in some children and adolescents who stutter; (b) children and adolescents who engage more frequently in RNT or who have greater adverse impact may be at increased risk for more characteristics of generalized or social anxiety; and, (c) individual differences in goal when speaking can predict the degree to which an adolescent engages in RNT.

Repetitive negative thinking (RNT) is the process of engaging in thought patterns that are repetitive, passive or automatic, and negative (Ehring & Watkins, 2008). RNT is strongly associated with the development, severity, and persistence of mental health conditions, such as depression and anxiety (Kuehner & Weber, 1999; Nolen-Hoeksema, 1987, 1991; Reilly et al., 2018). Previous research has shown that RNT significantly predicts adverse impact related to stuttering in adults (Tichenor & Yaruss, 2020). The current study aims to broaden and deepen our understanding of the role of RNT in the development of stuttering's adverse impact by investigating these constructs in children and adolescents who stutter.

Repetitive Negative Thinking

The core characteristics of RNT (thought that is repetitive, passive or automatic, and negative) highlight the underlying nature of it—that these thought patterns are difficult to disengage from, indicative of a habit that is difficult to control and prevent, and often focused on the negative aspects of a person's life experiences (Ehring & Watkins, 2008). The focus of RNT can be on reliving past events or anticipating events that have not yet occurred (Matthews & Wells, 2000). Clinically, RNT often has broader negative life sequelae (Nolen-Hoeksema et al., 1999), leading to an overall decrease in quality of life (Wrosch & Scheier, 2003). For example, increased amounts of RNT are significantly associated with chronic stress, a poorer home life, lower income, and having a less satisfying occupation (Nolen-Hoeksema et al., 1999). As such, it is not surprising that RNT is also strongly associated with the development, severity, and persistence of mental health conditions, such as depression and anxiety (Kuehner & Weber, 1999; Nolen-Hoeksema, 1987, 1991; Reilly et al., 2018).

Over recent decades, various lines of research in mental health-related fields have converged to conceptualize RNT as a process that transcends specific conditions or pathologies,

meaning that the process of engaging in RNT across conditions is more similar than dissimilar (Ehring et al., 2011; Ehring & Watkins, 2008; McEvoy et al., 2010, 2013). That is, a person who engages in thought patterns that are repetitive, passive or automatic, and negatively valenced can be said to be engaging in RNT regardless of the specific content or focus of the thoughts. This view stands in contrast to the more traditional method of investigating and labeling such thought patterns by virtue of the conditions in which they occur, e.g., *rumination* in depression (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008) or *worry* in anxiety (Meyer et al., 1990). This transdiagnostic view of RNT has resulted in measures of RNT that assess the tendency to engage in these core features independent of a specific disorder or content of the thoughts (Ehring et al., 2011; McEvoy et al., 2010). The *Perseverative Thinking Questionnaire* (PTQ; Ehring et al., 2011) and similar transdiagnostic measures of RNT assess the severity of the process of engaging in RNT by asking people how frequently they experience statements, e.g., *the same thoughts keep going through my mind* or *I keep thinking about the same issue all the time*. By assessing the underlying process of RNT rather than assessing the frequency of repetitive thoughts specific to depression (e.g., *how sad I feel*), for example, a clinician can assess whether a person engages in repetitive thoughts independent of specific conditions or disorders. Total Scores on the PTQ have been found to be significantly predictive of both condition-specific RNT measures (e.g., the Ruminative Response Scale (RRS) for depression, see Nolen-Hoeksema & Morrow, 1991) and broader depression and anxiety symptom severity (Ehring et al., 2011, 2012). Thus, assessing RNT independent of specific conditions or disorders is clinically useful in conditions where “high co-morbidity rates, shifting symptom profiles, and complex family contexts” are common (Ehrenreich-May & Chu, 2014, p. 4), as is the case with mental health and developmental conditions.

Control Theory states that the habit of RNT arises when a discrepancy exists between a person's goals—how they wish the state of the world to be vs. how they perceive it to be (see Martin & Tesser, 1996, for discussion). For illustrative purposes, consider RNT in a person with social anxiety who enters a room for a job interview where three interviewers are seated at a table. Upon entering the room, the person forms a mental representation of how they perceive they are being seen by the interviewers. This mental representation requires attentional processing and often is composed of potentially negative aspects of a person's identity (e.g., *they see me sweating, my hair is too long, they can see I'm overweight*, adapted from Rapee & Heimberg, 1997). This person then compares this mental representation of how they think they are perceived by the interviewers with their goal of how they wish to be perceived in an ongoing dynamic fashion that is continually updated (e.g., *why is that person frowning—that answer seemed good, I should have worn a different outfit—this one makes me look heavy*). In this example, RNT would increase when the person's mental representation of how they think they are perceived does not match their goals for how they wish to be perceived. The greater the mismatch between goal and perception, the greater the frequency and intensity of the negative thoughts. The larger the mismatch, the more likely this person engages in the habit of RNT in the future (Wells & Papageorgiou, 2004). And, though two people may experience the same mismatch between goal and perception (i.e., being seen differently than how they want to be seen), a person for whom this goal is more important is more likely to engage in RNT compared to a person for whom this goal is less important (Martin & Tesser, 1996).

In summary, RNT is the habit of thinking repetitively, automatically, and negatively and is associated with a variety of psychosocial conditions and associated negative life sequelae. RNT can take a myriad of forms and develops in a person when their life situation does not meet

"some unachieved standard" as they see the standard to be in the world around them (Treynor et al., 2003, p. 256). RNT only ceases when a person's goal has either been met, is overridden by another goal, or becomes unimportant to the person (Martin & Tesser, 1996). Encouragingly, cognitive therapy have been shown to be highly effective at helping people decrease the frequency and intensity of RNT (Spinhoven et al., 2018).

RNT, Stuttering, and the Development of Adverse Impact

RNT is directly relevant for specifying individual differences in the experience of stuttering and predicting the development of adverse impact. In our previous work with 313 adults who stutter (Tichenor & Yaruss, 2020), we used the PTQ to specify individual differences in adverse impact related to stuttering, hypothesizing that adults who stutter who engage more frequently in RNT would experience greater adverse impact. RNT as measured by the PTQ significantly predicted Total Scores on *The Overall Assessment of the Speaker's Experience of Stuttering* (OASES, Yaruss & Quesal, 2016), a holistic measure of adverse impact related to stuttering. Thus, this research finding in adults who stutter coincides with the broader RNT literature in that the process of engaging in RNT was found to significantly predict condition-specific outcomes (i.e., adverse impact related to stuttering). If RNT is an underlying factor in the development of adverse impact related to stuttering, then identifying at-risk children for earlier intervention may mitigate or even prevent negative life-long outcomes. Understanding RNT in this population is also critical as RNT is associated with the development, persistence, and severity of mental health conditions such as anxiety, which develops in some people who stutter but not others.

Though not a cause of the condition, anxiety related to communication in social situations is a normal and natural response for any person who stutters to experience (Manning & Beck,

2011). Much research over recent decades has documented the commonality of social or communication-related anxiety to the experiences of adults who stutter and its associated negative life outcomes (Bernard et al., 2022; Iverach et al., 2018; Iverach & Rapee, 2014; Messenger et al., 2004). In their review of anxiety and the stuttering condition, Smith et al. (2014) summarized the still-current view of the development of anxiety in people who stutter by stating "anxiety in people who stutter manifests *sometime* in later childhood or adolescence" (p. 30, emphasis added). While some research studies have shown that groups of older school-age children and adolescents who stutter demonstrate higher degrees of anxiety than groups of adolescents who do not stutter (Gunn et al., 2014; Mulcahy et al., 2008), others have not found these differences (Blood et al., 2007; Craig et al., 1996; Craig & Hancock, 1996). In their recent meta-analysis, Bernard et al. (2022) found a moderate effect size indicating elevated anxiety symptoms in children and adolescents who stutter compared to their peers. Yet, when or under what conditions some older school-age children or adolescents may develop anxiety related to communication or stuttering has been an open question—one that careful consideration of individual differences in RNT may provide insight.

Adolescence is a time of transition, where a person may react more strongly to emotional situations than younger school-age children while simultaneously experiencing more mixed or negative emotions compared to adults (Riediger et al., 2014; Stroud et al., 2009). In addition, many mental health conditions develop during adolescence (see Cicchetti & Rogosch, 2002, for review). Thus, it is not surprising then that RNT has been shown to strongly predict adolescent anxiety and depressive characteristics (Abela & Hankin, 2011; Dawson et al., 2022; Esbjorn et al., 2021; Jose & Brown, 2008; McEvoy et al., 2019), emotional abuse and victimization from peers (McLaughlin & Nolen-Hoeksema, 2012), and substance abuse (Nolen-Hoeksema et al.,

2007). Children and adolescents who stutter are at even greater risk for negative outcomes than their peers due to having a communication difference. Research confirms that children and adolescents experience adverse impact related to their stuttering (Franken et al., 2018; Mulcahy et al., 2008; Tichenor, Walsh, et al., 2022). Samson et al. (2022) also provided evidence that adverse impact is higher in adolescence than in early adulthood and that adolescent females who stutter experience higher amounts of adverse impact than adolescent males. Given that adverse impact develops throughout childhood and adolescence, and at least some adolescents who stutter demonstrate clinical characteristics that are associated with RNT (e.g., anxiety; see McAllister, 2016; Smith et al., 2014, for review), it is critical to investigate RNT as a potential risk marker for negative outcomes in youth who stutter.

Our previous work in adults who stutter showed that RNT significantly predicts adverse impact related to stuttering (Tichenor & Yaruss, 2020); thus, studying RNT during adolescence may provide a much-needed perspective into the development of adverse impact related to stuttering itself. As discussed above, the habit of RNT arises from a discrepancy in goals— how a person wishes the state of the world to be vs. how they perceive it to be (Martin & Tesser, 1996). This discrepancy in goals directly captures the fundamental nature of the experience of stuttering—that stutterers respond to the underlying sensation of a loss of control when attempting to speak with a wide range of both overt and covert behavioral reactions based upon who they are, what their life experiences are, and their individual speaking goals (Constantino et al., 2017; Perkins, 1990; Tichenor & Yaruss, 2018). Traditionally and for decades, stuttering behaviors that are more perceptible have been outwardly classified through the observations of listeners and conversation partners (see Tichenor, Constantino, et al., 2022, for review of *fluency*). More recently, researchers have argued for the validity and clinical utility of

considering the speaker's subjective experience of speaking. For example, Constantino (2020) expanded this traditional binary categorization (fluent vs disfluent) into a quaternary categorization, highlighting how both fluency and disfluency can be effortful or spontaneous depending on the internal nature of the experience. Effortful fluency and effortful disfluency are, by definition, goal-directed—they arise directly from a person trying to speak in a way that matches how they want themselves to be seen by others (e.g., outwardly fluent) (Tichenor, Constantino, et al., 2022).

In our recent work, we have used individual differences in goal when speaking (i.e., stutterers' ratings via Likert scales of how often their goal when speaking is to not stutter or to stutter openly) to predict individual differences in the speakers' experiences of stuttering. Tichenor and Yaruss (2019) found that the more often a stutterer has the goal of not stuttering (as opposed to saying what they want regardless of whether they stutter), the more likely they are to experience covert-behavioral reactions (e.g., remaining silent and choosing not to speak) and negative cognitive-affective reactions (e.g., shame, guilt, embarrassment related to speaking and stuttering). Similarly, Tichenor et al. (2022) found that adults whose goal when speaking was more frequently not stuttering were more likely to have poorer emotional regulation as measured via self-report. A person who stutters whose goal when speaking (e.g., fluency or not stuttering) does not align with how they think they are viewed by others (e.g., as stuttering), may be at risk for increased RNT because their goal for how they wish to be seen does not match how they think they are seen by others. Specifically, Control Theory would predict that the habit of RNT may naturally arise in a person who stutters who is attempting to pass as fluent (Constantino et al., 2017; MacIntyre, 2012), drastically increasing a person's risk for negative life sequelae. Alternatively, a person whose goal when speaking is saying what they want to say regardless of

whether they stutter may be less likely to engage in RNT due to a lack of a goal congruence in how they are seen vs. how they want to be seen (see Constantino et al., 2020, for discussion of spontaneity). Thus, the intrinsic nature of a stutterer's goals—what they are trying to do, how they are trying to be seen by others—directly aligns with Control Theory and has the potential to predict the development of RNT, concomitant mental health conditions, and adverse impact, more broadly in the critical developmental window of adolescence.

Purposes for this study

The first purpose of this study was to assess the relationship RNT and adverse impact related to stuttering. Following our previous work in adults who stutter (Tichenor & Yaruss, 2020), it was hypothesized that individual differences in RNT will significantly predict OASES Total Scores in children and adolescents who stutter. Relatedly, a second purpose of this study was to quantify the relationship between anxiety and RNT in adolescents who stutter given the strong association of both in the broader literature. Given that the origin of RNT resides with discrepancy between how a person wants to be seen vs. how they think they are seen, the third purpose of this study was to determine the relationship between adolescents' goals when speaking (i.e., to not stutter or to stutter openly) and the degree to which they engage in RNT. It was hypothesized adolescents who stutter whose goals when speaking are to not stutter, as opposed to stuttering openly, would demonstrate an increased likelihood of RNT.

These research aims will broaden and deepen the understanding of the role that RNT plays in the development of adverse impact in children and adolescents who stutter while simultaneously helping to specify individual differences in adolescents' experiences related to stuttering.

METHOD

Participants and Procedures

Data in this study come from 99 children and adolescents who stutter, all between the ages of 9 and 18 (*Mean* = 12.09, *SD* = 2.69); and is a part of a larger ongoing study investigating the development of adverse impact in children and adolescents who stutter in the Developmental Speech Laboratory at Michigan State University and the Life Impact of Speech and Stuttering Laboratory at Duquesne University. The surveys, described below, included the following published instruments: the *Perseverative Thinking Questionnaire-Child* (PTQ-C; Bijttebier et al., 2015), the age-appropriate version of the *Overall Assessment of the Speaker's Experience of Stuttering* (Yaruss & Quesal, 2016), and the *Screen for Child Anxiety Related Disorders* (SCARED; Birmaher et al., 1997, 1999). All 99 children and adolescents completed the PTQ-C, the SCARED, and the age-appropriate OASES. Children and adolescents aged 10 and above who stutter (n = 76) also answered questions regarding their goals when speaking (Tichenor, Walsh, et al., 2022; Tichenor & Yaruss, 2019). All 99 children and adolescents in this study were reported by their parents to stutter. Of those, parents reported that 94 (95.0%) had been formally diagnosed by a speech-language pathologist or other professional. All but one child (99.0%) had a history of treatment for stuttering; however, only 32 (32.3%) had participated in self-help/support for stuttering. Demographic information for all children and adolescents who stutter can be found in Table 1.

Participants were recruited using a mix of convenience, purposive, and snowball sampling in which recruitment cascades via multiple distribution channels (Goodman, 1961). Word-of-mouth, national and international stuttering associations, and intentionally targeted geographic regions of the United States via distribution of information to speech-language pathologists (SLPs), and specialty stuttering clinics, were all used to recruit respondents.

Recruitment partners were asked to share the survey with as many families of children who stutter as possible to encourage a broad sampling of backgrounds and experiences. Because recruitment was conducted in these varied ways, it is impossible to determine how many parents of children or families were ultimately contacted. Thus, response rates cannot be calculated. Relatedly, these various outreach efforts included the specific targeting of urban areas and lower SES regions to enhance the diversity of our sample.

All parents provided informed consent before completing the surveys. All children and adolescents provided assent to participate. This study was approved by institutional review by the Michigan State University Human Subjects Research Protection Office (Study#00001704).

The Surveys

The surveys were all conducted via the internet using Qualtrics (Qualtrics, 2021). Three different Qualtrics surveys were used to collect the child data reported in this paper along with other variables of interest for the larger study. Using multiple shorter surveys encouraged a higher response rate by facilitating completion of each survey while limiting fatigue and attrition. The first survey contained the age-appropriate version of the *Overall Assessment of the Speaker's Experience of Stuttering* (Yaruss & Quesal, 2006, 2016), used to assess the impact of stuttering on each participant's life. The OASES is based on the World Health Organization's *International Classification of Functioning, Disability, and Health* (ICF, WHO, 2001); it asks people who stutter about their reactions to stuttering, how much stuttering negatively impacts their communication in daily situations, and how much their stuttering negatively affects their quality of life. The OASES versions used in this study were the School-age (OASES-S; ages 7-12) and Teen (OASES-T; ages 13-17). Response forms for these age groups have been shown to be a reliable and stable measure of the impact stuttering has on a person's life (Tichenor, Walsh,

et al., 2022; Yaruss & Quesal, 2016). All OASES response forms were scored in accordance with instructions, and the combined OASES-S and OASES-T Total Scores (a global measure of adverse impact related to stuttering in which higher scores indicate greater adverse impact) was used in the ordinal and multiple linear regression analyses described below.

A second survey asked how participants aged 10 years and up approach stuttering by asking about their goal when speaking using two Likert-based questions (*My goal when speaking is to not stutter*; *My goal when speaking is to stutter openly and not do anything to try to hide it*). The response options for these questions were frequency-based (*never, rarely, sometimes, often, always*). These two questions come from a recent study by Tichenor and Yaruss (2019), who demonstrated that the construct goal when speaking falls along a 2-factor structure (not stuttering vs. stutter openly) via analysis of 6 items using the responses of over 500 adults who stutter. The age at which we presented these items to participants (ages 10 and older) was arbitrarily chosen *a priori*; it will be used as a benchmark to build future work in this area with younger children. We have previously used this goal when speaking question to explore individual differences in adolescents' Emotional Regulation processes (Tichenor, Walsh, et al., 2022). Our minimum age for self-report of goal when speaking falls squarely within recommendations for minimum age of self-report of health-related quality of life which ranges from 7-12 years (see Mpundu-Kaambwa et al., 2022, for review).

The third survey included *The Perseverative Thinking Questionnaire-Child* (PTQ-C, Bijttebier et al., 2015), an adapted version of the Perseverative Thinking Questionnaire (PTQ, Ehring et al., 2011), specifically normed on children and adolescents between the ages of 9 and 15.25. The PTQ-C consists of 15 questions that measure the tendency to engage in the process of RNT. Children and adolescents respond to these questions via a frequency-based Likert scale

(*never, rarely, sometimes, often, almost always*). Responses for *rarely* through *almost always* are scored numerically (1 through 4), and the 15 item scores are summed to create a PTQ-C Total Score (range, 0 – 60). Higher scores are indicative of children and adolescents who more often engage in RNT. The PTQ-C has been shown to have high internal consistency and correlations with other measures of RNT relating to depression and anxiety (Bijttebier et al., 2015). Consistent with the one-factor model purported by Bijttebier and colleagues, the sum of all 15 items (PTQ-C Total Score) was used in the ordinal and multiple linear regression analyses described below.

This third survey also contained selected items from the *Screen for Child Anxiety Related Disorders* child version (SCARED-C; Birmaher et al., 1997, 1999). The entire measure contains 41 items that screen for the presence of panic disorder, generalized anxiety disorder (GAD), separation anxiety disorder, social anxiety disorder (SAD), and significant school avoidance. The SCARED-C asks children aged 9 and up how true statements are of them (e.g., *I am a worrier*) on a three-point scale (i.e., not true or hardly every true, somewhat true or sometimes true, very true or often true). The SCARED-C has proven to be a reliable and valid screening tool for the presence of anxiety disorders in adolescents who stutter (Behrens et al., 2019; Birmaher et al., 1999). Previous research in stuttering has shown that, adolescents who stutter, as a group, demonstrate increased characteristics associated with anxiety, and in particular characteristics related to GAD and SAD (see McAllister, 2016; Smith et al., 2014, for review). As such, the GAD and SAD subscales of the SCARED-C were given to children aged 9 and up in this study. Though the GAD and SAD subscales of the SCARED-C have published cutoff scores that indicate positive screens (scores of 9 and 8, respectively), these were not used in the statistical analyses in this study given the sample size of our data. Instead, the raw number of the GAD and

SAD items (Total Scores) were used in the correlation analyses described below. The raw number of positive and negative screens are reported for data transparency in the Results below.

Data Analysis

R Studio (R Core Team, 2022) and multiple R packages were used for data manipulation, analysis, and visualization (data.table; Dowle & Srinivasan, 2021; car; Fox & Weisberg, 2019; psych; Revelle, 2022; MASS; Venables & Ripley, 2002; tidyverse; Wickham et al., 2019). Though each of the instruments used in this study are supported by previously published reliability data in the broader research literature of their respective fields, we conducted internal consistency measures to examine the internal stability of the measures and factors within this sample of children and adolescents who stutter. Reliability was excellent for the PTQ-C unitary factor ($\alpha = .94$). Reliability was good-to-excellent for each of the OASES-S factors (*General Information:* $\alpha = .75$; *Reactions to Stuttering:* $\alpha = .93$; *Communication in Daily Situations:* $\alpha = .93$; *Quality of Life:* $\alpha = .86$), adequate-to-excellent for each of the OASES-T factors (*General Information:* $\alpha = .69$; *Reactions to Stuttering:* $\alpha = .93$; *Communication in Daily Situations:* $\alpha = .91$; *Quality of Life:* $\alpha = .94$), and excellent for both of the SCARED-C subscales (*GAD*: $\alpha = .81$; *SAD*: $\alpha = .86$). This indicates that the data collected in this study were internally consistent.

One multiple linear regression equation was used to evaluate whether PTQ-C Total Score and Age could predict adverse impact related to stuttering as measured by the OASES Total Score (Model 1 – children and adolescents aged 9-18 years). Note that we combined the OASES-S and OASES-T Total Scores in the model to increase statistical power and decrease the number of statistical tests. This is justifiable as the predicted variable (OASES Total Score) calculated from the OASES-S (ages 9 - 12) or OASES-T (ages 12 - 17) are directly comparable as averages. Age was also included as a variable of interest so that age effects throughout adolescence could

be investigated. The interaction of PTQ-C Total Score and Age was intentionally left out of the model due to sample size limitations (statistical power). Multicollinearity was assessed through variance inflation factors (VIF). VIF values between PTQ-C Total Score and Age did not raise concerns about multicollinearity (see Kennedy, 2003; Neter et al., 1985). PTQ-C Total Score and Age were also investigated for linearity, normality of residuals, homoscedasticity, and the presence of influential values via diagnostic plots in accordance with the assumptions of linear regression. Diagnostic plots indicated that both predictors and outcome variables in Model 1 showed a linear relationship that only deviated in the extreme tails. Likewise, error was judged to be normally distributed, with only slight deviations of normality in upper and lower tails. Both predictors in Model 1 also demonstrated residuals that had a constant variance (homoscedasticity) and independence of residual error terms (i.e., that no observation was more than three times the mean, see Cook, 1979). See supplemental data for more information on diagnostic plots. No data from variables of interest was missing from the surveys apart from demographic questions that some families elected not to answer.

To investigate the third purpose of the study, one ordinal logistic regression (ordered logit/proportional odds model, see Williams, 2016) was performed to investigate individual differences in RNT as a function of adolescents' goals when speaking (Model 2). Ordinal logistic regression was selected because it is a useful analytical approach for analyzing Likert data as a function of continuous or categorical predictors, while accounting for the ordered nature of the Likert data (Williams, 2006, 2016). The goal when speaking of *stuttering openly* rather than *not stuttering* was selected for the model because it provided a more even bell-shaped distribution of subject responses in this data set. The assumption of parallel lines (proportional odds assumption) was tested using the likelihood ratio test of cumulative link models (Christensen,

2019). The assumption was considered to have been met because there was no significant difference between the model and a null model at $p < .01$ (Allison, 1999).

Finally, to quantify the relationship between RNT, anxiety in adolescents who stutter, and adverse impact, Spearman rank correlations were used. Spearman rather than Pearson correlations were chosen due to violations of normality. One correlation was calculated between GAD Total Score and PTQ-C Total Score. A second correlation was calculated between GAD Total Score and OASES Total Score (S or T). Similarly, a third Spearman correlation was calculated between SAD Total Scores and OASES Total Scores (S or T). A fourth Spearman correlation was calculated between SAD Total Scores and PTQ-C Total Score.

RESULTS

The results for the different analyses are presented below in accordance with the research questions and aims of this study: to assess the relationship RNT and adverse impact related to stuttering; to quantify the relationship between anxiety and RNT in a sample of older children and adolescents who stutter; and to specify the relationship between RNT and individual differences in goal when speaking. Data collected to answer these aims (n = 99) represents wide distributions of characteristics related to RNT (*Mean PTQ-C Total Score* = 21.16*, SD* = 11.55), adverse impact related to stuttering (*Mean OASES Total Score* = 2.28*, SD* = .55), and anxiety characteristics (*Mean GAD Total Score* = 5.94*, SD* = 3.64; *Mean SAD Total Score* = 5.7*, SD* = 3.91).

RNT and Adverse Impact Related to Stuttering

In Model 1, PTQ-C Total Score and Age together explained a significant amount of the variance of the combined OASES-S and T Total Score, $F(2, 96) = 23.32$, $p < .001$, $R^2 = .33$,

$R^2_{Adjusted}$ = .31, f^2 = .49, a large effect size (Cohen, 1988). More detailed inspection of the significance of both predictors revealed that PTQ-C Total Score (β = .53, $p < .001$) more strongly predicted the combined OASES Total Score than did Age (β = .18, $p = .04$). These data indicate that adverse impact related to stuttering increases (a) as a child or adolescent ages and (b) the more often they engage in RNT. As evidenced by the standardized regression coefficients, the influence of RNT on adverse impact is stronger than the influence of age on adverse impact. See Table 2 for details. The raw data reflecting these relationships for both PTQ-C Total Scores and Age relating to OASES Total Scores can be found in Figure 1a and 1b, respectively. Figures 1a and 1b also contain a fitted regression line with standard error shaded to aid visualization of these relationships.

RNT and Individual Differences in Goal When Speaking

The degree to which an adolescent engages in RNT, measured via the PTQ-C, was used to predict goal when speaking ("*My goal when speaking is to stutter openly and not do anything to try and hide it*"). The odds ratio for RNT predicting goal when speaking was .96 at a significant 95% CI (range: .92 – .99). Odds ratios less than 1 indicate a decreased probability of occurrence. Thus, this odds ratio indicates that the likelihood of child indicating their goal when speaking was to *stutter openly* decreased for every 1-point increase in RNT score. Predicted probabilities were calculated for each observed PTQ-C Total Score in the data set at each level of the goal when speaking question (i.e., *never* through *always*). These are plotted in Figure 2. The lighter lines (cream and orange) indicate higher PTQ-C Total Scores while the darker lines (purple and black) indicate lower PTQ-C Total Scores. As can be seen visually in Figure 2 via a cross over effect, an adolescent who stutters who is more likely to engage in RNT is less likely to

report that their goal is stutter openly. Conversely, an adolescent who stutters who is less likely to engage in RNT is more likely to report that their goal when speaking is to stutter openly.

RNT and Anxiety

Spearman rank correlation coefficients were computed to assess the linear relationships between GAD and OASES Total Score, GAD and PTQ-C Total Score, SAD and OASES Total Score, and SAD and PTQ-C Total Score. There was a significant positive correlation between GAD and OASES Total Score, $r_s(97) = .52$, $p = <.001$. There was also a significant positive correlation between GAD and PTQ-C Total Score, $r_s(97) = .52$, $p = <.001$. The raw data for GAD, PTQ-C Total Score, and OASES Total Score are plotted in Figure 3a and 3b. There was a significant positive correlation between SAD and OASES Total Score, $r_s(97) = .43$, $p = <.001$. There was also a significant positive correlation between SAD and PTQ-C Total Score, $r_s(97) = .27$, $p = .006$. The raw data for SAD, PTQ-C Total Score, and OASES Total Score are plotted in Figure 4a and 4b. These significant positive correlations provide evidence that the more self-reported characteristics of GAD and SAD, the more frequent the child or adolescent engages in RNT, and the higher adverse impact related to stuttering they experience. Several children and adolescents also screened positive for GAD (22.2%, n = 22) or SAD (32.3%, n = 32) using the published cutoff scores.

Discussion

RNT is a transdiagnostic factor underlying diverse psychosocial conditions. This study sought to determine the relationship between RNT and adverse impact in children and adolescents who stutter. This study also quantified RNT's relationship with anxiety and determined RNT's relationship with goal when speaking. These aims were undertaken to specify individual difference clinical characteristics that can be used to identify children who stutter who

are at-risk for negative outcomes. Each of these aims are discussed below, with clinical implications following.

RNT as a Predictor of Adverse Impact Related to Stuttering

Our previous work in adults who stutter revealed that individual differences in RNT significantly predicted adverse impact related to stuttering (Tichenor & Yaruss, 2020). This study corroborates this view by providing strong evidence that the degree to which children and adolescents engage in RNT significantly predicts OASES Total Scores. Data from this study also establish that many children and adolescents who stutter also engage in RNT at high degrees. Importantly, these data indicate that RNT is both a theoretically meaningful and highly clinically significant marker of children and adolescents who are experiencing greater adverse impact related to stuttering.

This strong prediction of adverse impact related to stuttering by RNT stands in contrast to the weak prediction of adverse impact by a child or adolescent's chronological age. It has long been thought that negative affective and cognitive reactions develop over time, emerging later in the school-age and adolescent years (e.g., Bloodstein, 1995). More recently, however, research has revealed that even preschoolers who stutter may experience negative thoughts, feelings, and behaviors in response to their stuttering (Boey et al., 2009; Langevin et al., 2010; Tichenor, Walsh, et al., 2022; Vanryckeghem et al., 2005). This earlier and developmental perspective is corroborated by research with adults who stutter who have retrospectively reported that their own negative reactions to stuttering developed during childhood or adolescence (Gerlach-Houck et al., 2023). However, delineating how or when some children who stutter develop adverse impact is an open question of great theoretical and clinical importance.

What research that exists specifying adverse impact in adolescence has found that, as a group, adolescents who stutter experience greater life difficulty related to speech or communication compared to peers who do not stutter. For example, De Nil and Brutten (1991) provided evidence that children and adolescents who stutter aged 7 – 14 experience significantly more negative attitudes regarding speech and communication (one aspect of adverse impact) than peers and that this effect increases with age. Rodgers et al. (2020) also found that adolescents who stutter aged 13 and up are more likely to attend to threatening social cues than are adolescents who do not stutter. We previously found that adolescents who stutter who more frequently elect poorer emotional regulation strategies experience higher adverse impact, as measured by OASES Total Scores (Tichenor, Walsh, et al., 2022). Finally, Samson et al. (2022) demonstrated that adverse impact (as measured by OASES Total Scores) was higher in adolescents who stutter than young adults who stutter but that this effect was most pronounced in female adolescents who stutter. The current study adds to a growing number of cross-sectional investigations into the factors underlying stuttering's adverse impact by adding a strong effect of RNT and a weak effect of age as statistical predictors of a child or adolescent's OASES Total Scores. Importantly, RNT is present in children who stutter as young as 9 years of age and clinicians who measure RNT in their clients can assess their client's individual risk factor for negative outcomes associated to RNT in early adolescence.

Greater RNT is Associated with Increased Anxiety

A number of children and adolescents who stutter in this study screened positive for SAD (32.3%, n = 32) and GAD (22.2%, n = 22). More noteworthy is that this study found clear relationships between RNT and anxiety characteristics in adolescents who stutter. Stronger relationships were found between the number of raw GAD characteristics and RNT than between

the number of raw characteristics between SAD and RNT. This is not surprising given that the core characteristic for GAD is excessive worry (DSM-V, *Diagnostic and Statistical Manual of Mental Disorders*, 2013); and, worry has historically been the anxiety-specific term for RNT (Hirsch et al., 2013; McEvoy et al., 2010; Meyer et al., 1990). Thus, assessing transdiagnostic RNT would naturally capture GAD characteristics, a finding supported by other research investigating RNT outside of stuttering (Ehring et al., 2011; McEvoy et al., 2010, 2019) with which our findings coincide. Though GAD and SAD commonly co-occur in the general population (Kessler et al., 2005), older school-age children and adolescents who stutter may be at an increased risk for characteristics relating to SAD given the fact that stuttering naturally interferes with social communication (Jackson et al., 2021), a hypothesis that many in the field in recent years have espoused (see Iverach et al., 2017).

While some research studies have shown that groups of older school-age children and adolescents who stutter demonstrate higher amounts of anxiety than groups of adolescents who do not stutter, others have found null effects or weaker effects (see Smith et al., 2014, for review). In their review, Smith and colleagues highlight many possible reasons why some children may develop social anxiety while others do not, including temperament factors, familial history of mental health conditions, and psychosocial factors (e.g., attitudes regarding speech and communication or bullying). Our findings expand the field's understanding of the prevalence of social anxiety in children who stutter by highlighting RNT as a possible moderating factor in its occurrence. This study found that higher degrees of RNT or adverse impact related to stuttering (OASES Total Scores) significantly correlated with the degree to which a child or adolescent reports characteristics of GAD and SAD. Thus, just as individual differences in RNT can determine what child is at risk for greater adverse impact related to stuttering, so too are

individual differences in RNT and adverse impact associated with the frequency of GAD and SAD characteristics. This has notable implications for more effective intervention through the earlier identification of adolescents who stutter at risk for negative clinical outcomes.

Goal When Speaking as a Predictor of RNT

Our previous research with adults who stutter provided evidence that the goal of *stuttering openly* is inversely related to the goal of *not to stutter* (Tichenor & Yaruss, 2019). A person's position on this continuum between open stuttering vs. concealing stuttering is dynamic and likely changes as a function of situational demands. Yet, these goals are windows into two sides of the experiences that people who stutter face throughout the course of their day—should I try to not stutter? Or, should I say what I want to say regardless of stuttering? The feeling or desire of appearing outwardly fluent arises from a person's conceptualization of themselves in relation to the world around them—a world that expects fluency, establishes it as a normal expectation, all the while fostering negative thoughts and feelings when a person cannot meet that societal expectation (Tichenor, Constantino, et al., 2022). On the other hand, communicating spontaneously, openly, and without fear of or thought to stuttering is freeing and associated with decreased adverse impact (Constantino et al., 2020).

Previous research has shown that having a goal more geared toward fluency (less open stuttering) is associated with increased attempts to pass as fluent as well as higher rates of negative thoughts and feelings in adults who stutter (e.g., shame, embarrassment, and remaining silent and choosing not to speak, see Tichenor & Yaruss, 2019). And, adults who stutter who elect less effective emotional regulation strategies are also more fluency-focused than are adults whose goal when speaking is more geared toward stuttering openly (Tichenor, Walsh, et al., 2022). This study similarly found that the more often an adolescent has goal when speaking of

stuttering openly (saying whatever they want to say regardless of stuttering) the lower the likelihood of engaging in RNT. Conversely, the more likely an adolescent has the goal when speaking to not stutter, the more likely they are to engage in RNT. This pattern supports the hypothesis that RNT in adolescents who stutter may arise when they perceive that their life situation does not meet their expectations (see Treynor et al., 2003). Data from this study expand the previously researched adult perspective into a developmental context and provide strong evidence that individual differences in adolescents who stutter can similarly predict risk factors for negative life sequelae. Thus, as with individual differences in RNT, individual differences in goal when speaking are also an invaluable marker SLPs can use to predict risk factors of negative outcomes in specific clients.

Clinical Applications

The impact of RNT identified in this study underscores the value of holistic therapy approaches that address cognitive aspects of the stuttering experience for children and adolescents who stutter. Addressing RNT may mitigate risk for anxiety and adverse impact related to stuttering. Over the years, various researchers and clinicians have highlighted the importance of cognitive-based therapies in the effective treatment of stuttering (Beilby & Byrnes, 2012; Blood, 1995; Boyle, 2011; Cheasman, 2013; Emerick, 1988; Helgadóttir et al., 2014; Kelman & Wheeler, 2015; Menzies et al., 2008, 2009; Palasik & Hannan, 2013; Plexico & Sandage, 2011; Van Riper, 1973). Cognitive-behavior therapy (CBT) in particular is well-suited for the treatment of RNT in stuttering. CBT emphasizes the power of negative automatic thoughts and teaches clients to learn to evaluate their thoughts in more realistic and adaptive ways, therefore experiencing decreases in negative emotions and maladaptive coping mechanisms (Beck, 2021). Through CBT, a person who stutters can learn how a negative core

belief (e.g., *I am worthless*) is reinforced by intermediate rules (e.g., *I should not speak if I feel that I may stutter*), attitudes (e.g., *It's terrible to stutter*), and assumptions (e.g*., If I try to speak, I'll fail. If I avoid speaking, I'll be ok*). In the CBT framework, these rules, attitudes, and assumptions (also collectively termed *intermediate beliefs*) exist between core beliefs and the trigger situations (e.g., speaking situations) that give rise to automatic negative thoughts (Beck, 2021). Automatic negative thoughts in stuttering may take a myriad of forms (e.g., *they are laughing at my stuttering, I am being judged because I stutter, Stuttering is the reason I'm unhappy, I can't apply for this job because I stutter*). These automatic negative thoughts give rise to further maladaptive emotional, behavioral, and physiological reactions, which reinforce the habit of engaging in automatic negative thoughts. Critically, CBT proposes that these reactions and the automatic thoughts that sustain them reinforce the underlying intermediate and core beliefs that a person harbors. CBT is the process of learning to break this cycle; numerous research studies have shown that CBT if effective in alleviating RNT and improving symptoms of depression and anxiety (see Monteregge et al., 2020; Spinhoven et al., 2018, for reviews). Thus, SLPs who incorporate aspects of CBT in stuttering treatment approaches may help school-age children and adolescents engaging in unhelpful RNT cultivate more positive core beliefs about their stuttering and communication, decrease negative attitudes and false assumptions, and eliminate unhelpful thoughts related to speaking and stuttering.

Findings from this study also suggest the clinical value of co-treating clients who stutter with a qualified mental health counselor to improve both condition-specific outcomes (e.g., adverse impact related to stuttering) and transdiagnostic processes (e.g., decreased RNT). Metacognitive Therapy (MCT) is one such approach that targets transdiagnostic processes like the habit of RNT. In contrast to the core therapeutic principle of CBT, which suggests that

treatment should target specific automatic negative thoughts a client experiences (what CBT terms *cognitive conceptualization*), MCT targets the process of engaging in RNT itself by helping a client learn to identify and change negative thinking patterns when they realize they are experiencing them (what MCT calls *metacognitions*, see Wells, 2009). For example, while in CBT a clinician may ask a client to evaluate the validity of a negative automatic thought, in MCT a clinician helps a client learn mindfulness and other attention training techniques that helps them regain control of their thinking style outside of specific negative thoughts (Wells, 2009). In this milieu, MCT helps a client to stop the habit of RNT itself independent of thought content, leading to improvements in specific areas (e.g., anxiety or depressive characteristics). Though MCT is a relatively new therapy framework, there is evidence that MCT is more effective than CBT in the treatment of generalized anxiety (Nordahl et al., 2018). Beyond MCT, RNT focused treatments have been shown to be more effective at alleviating both depression and anxiety characteristics in adolescents compared to traditional non-RNT focused treatments of depression or anxiety (see Bell et al., 2022, for review). Thus, a therapeutic team comprised of an SLP and a mental health professional may help a child or adolescent engaging in RNT to make therapeutic gains related to both stuttering's adverse impact and to those that translate outside of the stuttering condition.

Future Directions and Limitations

There are several potential limitations to consider when interpreting data from this study and planning future investigations relating to RNT and the stuttering condition. First, future research should recruit larger numbers of participants to investigate the interaction between RNT and age, something we did not attempt to examine due to the sample size of this study. Second, although we found significant relationships between RNT, adverse impact related to stuttering,

and anxiety, future research should specifically investigate these effects with respect to sex. Much research has shown that females are at higher risk for anxiety and depression than males (see Altemus et al., 2014, for review); the broader RNT and anxiety research has shown that RNT accounts for a great deal of the variance associated with adolescent sex differences in anxiety (McEvoy et al., 2019). Our study was unable to investigate these possible effects in adolescents who stutter due to sample size constraints regarding the low number of females (n = 24, 24.2%). Future research with larger samples of female children who stutter should more closely explore sex differences in adolescents' experiences of stuttering to precisely guide treatment recommendations.

Data from this study were also collected at a single point in time, so care should be taken when extrapolating what these data mean over time in a context within a specific school-age child or adolescent who stutters. Relatedly, we assessed RNT, goal when speaking, and anxiety characteristics in children aged 10 and up. Future research could explore these aspects cross sectionally *and* longitudinally in younger children to determine the developmental course of these constructs and relationships therein.

Summary

This study explored individual differences in RNT, adverse impact related to stuttering, anxiety characteristics, and goal when speaking in older school-age children and adolescents who stutter to specify relationships among these factors. Results indicated that RNT significantly predicted adverse impact to greater effect than child age. Higher generalized and social anxiety characteristics significantly correlated with both adverse impact and RNT. Finally, individuals who less often have the goal when speaking of open stuttering were significantly more likely to

engage in more frequent RNT. These data provide valuable clinical markers of risks associated with adverse outcomes related to stuttering based upon individual characteristics.

Data Availability Statement: Data not already presented in this paper but generated during and/or analyzed for the current study are not publicly available due to the risk of identifying participants. Researchers interested in using portions of this data should contact the corresponding author.

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Figure Captions

Figure 1. The predicted relationships between age, the degree a child or adolescent engages in RNT (PTQ-C Total Scores), and adverse impact related to stuttering (OASES S or T Total Scores) is visualized. Age weakly predicts adverse impact related to stuttering (1b), meaning that as a child ages, they are at increased likelihood of greater adverse impact. However, a much stronger effect of RNT is observed. A child or adolescent who engages in RNT to a greater degree is significantly more likely to experience greater adverse impact related to stuttering (1a).

Figure 2. The predicted probability of never, rarely, sometimes, often, or always having a goal when speaking of stuttering openly is predicted by the degree to which a child or adolescent engages in RNT (PTQ-C Total Scores). Having a goal when speaking geared towards open stuttering (as opposed to not stuttering or being outwardly fluent) significantly decreased an adolescent's tendency to engage in RNT. Conversely, the less likely an adolescent's goal when speaking is open stuttering (i.e., the more they are trying to not stutter or appear fluent), the more likely they are to engage in higher degrees of RNT. This cross-over effect is visualized by the colored lines.

Figure 3. Spearman rank correlations visualize the relationships between SCARED-C Generalized Anxiety Total Scores, adverse impact related to stuttering (OASES Total Scores), and RNT (PTQ-C Total Scores) in children and adolescents who stutter. Figure 3a shows a moderate positive correlation between GAD and adverse impact related to stuttering, where higher characteristics of GAD are correlated with greater adverse impact. Similarly, Figure 3b shows a moderate positive correlation between GAD and RNT, where higher characteristics of GAD are correlated with greater degrees of RNT.

Figure 4. Spearman rank correlations visualize the relationships between SCARED-C Social Anxiety Total Scores, adverse impact related to stuttering (OASES Total Scores), and RNT (PTQ-C Total Scores) in children and adolescents who stutter. Figure 4a shows a moderate positive correlation between SAD and adverse impact related to stuttering, where higher characteristics of SAD are correlated with greater adverse impact. Similarly, Figure 4b shows a weak positive correlation between SAD and RNT, where higher characteristics of SAD are correlated with greater degrees of RNT.