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Title: Repetitive Negative Thinking as a Mechanism of Stuttering Anticipation

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ABSTRACT

Purpose: In the context of stuttering, *anticipation* refers to the sensation that one may soon stutter. Although anticipation is widely reported, much is still unknown about how the phenomenon develops and how people respond to it as they live their lives. To address these gaps, this study specified the relationship between Repetitive Negative Thinking (RNT), anticipation, and anticipation responses. This study also determined whether individual differences in a person's *goal when speaking* (i.e., speaking fluently or not stuttering vs. stuttering openly) predicted the different ways people respond to anticipation. Methods: 510 stutterers (427 adults who stutter, ages 18 to 86 years, and 83 adolescents who stutter, age 10 to 18 years) answered questions about anticipation, their responses to anticipation,

how frequently they engage in RNT, and what their goals when speaking are.

Results: Exploratory factor analysis revealed that responses to anticipation can be described in terms of two factors: *Avoidance* and *Acceptance*. *Avoidance* responses to anticipation were more common than *Acceptance* in both groups. Adults and adolescents were more likely to experience anticipation and respond with avoidance behaviors if they more frequently engage in RNT or less often have the *goal when speaking* of openly stuttering. Data also supported and extended evidence that the anticipation is commonly experienced in adolescents and adults who stutter. Discussion: Findings extend the understanding of how anticipation and anticipation responses may develop by considering engagement with RNT and *goals when speaking*. The relationship between RNT and anticipation underscores the need of future investigations focusing on preventing the development of maladaptive responses to anticipation via holistic, cognitive-based therapies.

Keywords: Stuttering; Anticipation; Repetitive Negative Thinking

1 Anticipation Related to Stuttering

2 In the study of stuttering, the term *anticipation* commonly describes the sensation that 3 one may stutter, either imminently or at some future time (Bloodstein, 1958, 1972; Briley, 2023; 4 Brocklehurst et al., 2013; Jackson et al., 2015, 2020; Johnson, 1972; Knott et al., 1937; Tichenor & Yaruss, 2018; Wingate, 1975). Historically, research on anticipation has primarily focused on 5 6 whether the premonition or expectation of impending stuttering is predictive of clinician- or researcher-observed stuttered speech in children and adolescents (Bakker et al., 1991; Goldfarb 7 et al., 2023; Milisen, 1938; Silverman & Williams, 1972; Van Riper & Milisen, 1939) and also 8 adults (Knott et al., 1937; Milisen, 1938; Van Riper, 1936; Van Riper & Milisen, 1939; Wingate, 9 1975). Results of such inquiries have been mixed, with some studies that primarily involved 10 adolescent or adult participants showing clear relationships between anticipation and observable 11 12 stuttering behavior (Knott et al., 1937; Van Riper & Milisen, 1939; Wingate, 1975) and other studies that primarily involved child or adolescent participants showing ambivalent relationships 13 or no relationship at all (Bakker et al., 1991; Milisen, 1938; Silverman & Williams, 1972; Van 14 Riper, 1936). More recently, clinical interviewing techniques and participant ratings of self-15 generated words have been used to provide evidence that adults and older school-age children 16 who stutter *can* accurately identify words on which they are likely to exhibit observable 17 stuttering (Goldfarb et al., 2023; Jackson et al., 2020). Yet, it is not clear if the historically 18 equivocal picture relating to anticipation and overt stuttering has resulted from (a) speakers' 19 20 difficulties in predicting when moments of stuttering are about to occur; (b) listeners' difficulties with knowing for certain when stuttering has occurred, given that not all stuttering behavior is 21 overt; (c) differences in speakers' success at hiding overt stuttering; or (d) differences in how 22 23 anticipation has been conceptualized and operationalized in research paradigms. Indeed, despite

24	the many studies on anticipation conducted over the years, it is still unknown what anticipation
25	actually is. In other words, it is not clear whether the phenomenon of anticipation is: (a) a
26	thought, (b) a perception of a disruption in the processes underlying speech or language
27	formulation, (c) a response to a thought or perception, or (d) some other phenomenon that is not
28	fully understood. It is also not clear how anticipation occurs or develops in a person. This
29	uncertainty persists despite the fact that anticipation has been shown to be a very common
30	feature of the experience of stuttering (Bloodstein, 1960; Jackson et al., 2015, 2018, 2019).
31	Out of a large clinical sample ($n = 418$) collected over 6 years, Bloodstein (1960)
32	reported that 155 children and adolescents aged 8 – 16 experienced anticipation by asking: "Can
33	you sometimes tell that you're going to stutter on a word before you say it?" (p. 227). In this
34	sample, anticipation was increasingly more common in older children and adolescents than in
35	younger children; anticipation was reported by 38% of children aged 8-9, 45% of adolescents
36	aged 10-11, 62% of adolescents aged 12-13, and 71% of adolescents aged 14-15. More recently,
37	Jackson and colleagues reported higher percentages of children and adolescents aged 9-12
38	(87%), adolescents aged 13-17 (91%), and adults (100%) who reported experiencing anticipation
39	at least sometimes ($n = 50$ children / adolescents, $n = 30$ adults, see Jackson et al., 2015, 2018).
40	Thus, the current available evidence suggests that anticipation occurs in children, is more
41	common in adolescents, and is most common in adulthood. However, past research has not
42	statistically examined whether this apparent trend of increasing anticipation with increasing age
43	is significant or meaningful.
44	Qualitative and mixed-method studies exploring anticipation have provided evidence that

45 the phenomenon of anticipation is often difficult to prevent, inhibit, or cease (Jackson et al.,

46 2015; Tichenor & Yaruss, 2018). Other research has shown that, for many stutterers of all ages,

47 the experience of anticipation is often emotionally negative. Specifically, research has shown that stutterers respond to anticipation with both negatively valenced cognitive, emotional, and 48 behavioral responses (Jackson et al., 2015, 2019; Tichenor & Yaruss, 2018). Avoidance 49 responses (e.g., leaving a situation because you might stutter, avoiding words or sounds, 50 choosing not to speak) are more common, while acceptance responses (e.g., advertising, 51 pseudostuttering, acceptance) are less common and primarily arise from therapy or though self-52 help/support groups (Jackson et al., 2015, 2019; Tichenor & Yaruss, 2018). Consistent with these 53 experiential findings, other researchers have highlighted the physiological responses associated 54 55 with anticipation, including heightened autonomic arousal (Bowers et al., 2012). Overall, this 56 body of research confirms a range of experiences with anticipation and its generally negative effect on peoples' lives. Yet, the processes that lead to the development of coping responses to 57 anticipation are under-specified: there is a critical gap in scientific knowledge explaining why 58 59 some people respond more negatively than others, as well as in clinical knowledge about how clinicians might help speakers change their anticipation responses and thereby reduce negative 60 61 experiences.

Part of the difficulty in studying anticipation may be that the term has been used in 62 63 different ways over time by different researchers. This has led to ambiguity and, at times, contradictions in how studies are designed and in how research and clinical findings are 64 interpreted. Some meanings of the word anticipation in the literature are primarily event-related, 65 66 corresponding to a specific speaking situation or an immediate, impending moment of stuttering in a speaker's speech. For example, Jackson et al. (2015) stated "Broadly, anticipation refers to a 67 speaker's proprioceptive and/or cognitive sense that he or she is about to stutter"(p. 39, emphasis 68 69 added). Jackson et al. (2020) later provided another event-related definition, stating,

70	"anticipation refers to the speaker's cognitive sense that upcoming speech will be stuttered
71	should that speech be executed as planned" (p. 2, emphasis added). This meaning of anticipation
72	overlaps considerably with definitions of the loss of control put forth by Perkins-wherein, just
73	before a moment of possible overt stuttering, stutterers experience the perception that they are
74	stuck or unable to proceed in speech (Perkins, 1983, 1990). This meaning of anticipation thereby
75	may reflect a sensation that something has gone awry in the process of speech production or
76	language formulation (Jackson et al., 2018; Tichenor & Yaruss, 2019a). The ways in which
77	speakers respond to this perception (e.g., openly stuttering vs. choosing to avoid) determine what
78	listeners might see and hear during that moment of stuttering (Perkins, 1984, 1990; Tichenor,
79	Constantino, et al., 2022; Tichenor & Yaruss, 2019b).
80	Other researchers have emphasized aspects of the experience of anticipation that reflect a
81	learned process that develops over time and is rooted in negative cognitive-affective reactions
82	experienced in past speaking situations. For example, Bryngelson, Bloodstein, and others
83	thought that anticipation develops and is further reinforced by beliefs about past negative
84	communication experiences as people who stutter live their lives (Bloodstein, 1958, 1972, 1975;
85	see also Brocklehurst et al., 2013; Bryngelson, 1935, 1937; Sheehan, 1953; Van Riper, 1973).
86	Sheehan's (1953) approach avoidance and Van Riper's (1973) abnormal preparatory sets both
87	are also built upon this same core idea— that previous communication experiences lead people
88	to respond to and manage stuttering differently than they would have if they had not had those
89	prior negative experiences. A key aspect of this meaning of anticipation is that it is a "learned
90	response," rooted in one's prior experiences-(Bloodstein & Ratner, 2008, p. 281). Wingate
91	(1975), summarized these views, stating that, "(1) [anticipation] precipitates occurrences of
92	[overt] stuttering, and (2) it has a long-term base, that is, it is founded in, and operates in terms

of, previously established associations." (p. 31). These descriptions help to explain the origin of
the sense of anticipation; however, additional information is needed about the ways in which *past* communication-related experiences might influence the ways in which speakers cope with *present and future* experiences.

These "associations" (as Wingate referred to them) or "beliefs" (as Bloodstein often 97 called them) about prior speaking situations are the negative thoughts and emotions formed as a 98 person copes with both prior moments of stuttering and the broader impact of stuttering they 99 100 have experienced. These negative thoughts and emotions, which are commonly experienced in 101 the daily life of stutterers, may arise naturally from any communication exchange. These learned 102 associations can lead someone to become more likely to fear future communication exchanges or moments of stuttering (Bloodstein, 1958, 1975; Bryngelson, 1935, 1937; Johnson, 1959; 103 104 Sheehan, 1970; Van Riper, 1982; D. E. Williams, 1957; Wingate, 1975, 1988). This fear, in turn, 105 can influence how speakers cope with, manage, and respond to moments of stuttering as they 106 encounter them. For illustrative purposes of this process, consider an adolescent who is laughed 107 at by peers when they stutter. Single experiences like this or repeated experiences over time may 108 increase the adolescent's fear of stuttering and cause them to anticipate the negative reactions of 109 others in future moments of stuttering. This, in turn, may affect the ways in which the adolescent 110 responds to peers, for example, by choosing not to speak or avoiding sounds or words. Similarly, 111 an adult may stutter during a phone call, be hung up on, and feel (understandably) frustrated or 112 embarrassed. They may attribute the person's rudeness to their own stuttering, resulting in 113 further negative emotional reactions to stuttering. This, in turn, can increase their fear of 114 stuttering and their anticipation of future negative reactions when they make phone calls. As a 115 result, they may opt to communicate online or via text in the future. In summarizing the thenextant work on the origins of anticipation, Wingate (1988) acknowledged the influence of these
past experiences by stating, "[The] central explanatory notion is typically some variant of the
concept of *fear*...claimed to occur prior to stutter events" (p. 5, emphasis added). Thus, a
speaker's prior experiences shape not only the emotional reactions the speaker may have to
future moments of stuttering but also the ways in which they perceive and respond to speaking
situations in general—and the sensation that they are about to stutter.

Though the term *anticipation* has been used to describe multiple phenomena over 122 123 differing time courses-the sensation of errored speech-language formulation vs. fear or worry 124 about future communication or stuttering-understanding the development of how speakers 125 respond and attach negative meaning to future communication will help to explain how negative reactions and the sense of fear surrounding future moments of stuttering might develop. Yet, 126 127 currently, the mechanisms by which past negative experiences influence how speakers experience and respond to the sense they are about to stutter (hereafter, anticipation) are 128 currently unclear, and many questions remain. For example: How does fear or worry about 129 130 potential future speaking or stuttering events develop in a stutterer? And, how do past negative 131 experiences influence a person's decision to elect one management strategy or response over 132 others? In this paper, we consider the ways in which people cope with the sense of anticipation as we evaluate one possible mechanism underlying these coping behaviors and management 133 decisions. In so doing, we more deeply specify how stuttering manifests in the lives of people 134 135 who stutter, with the ultimate goal of improving intervention by linking the experience of 136 anticipation to clinical methods for reducing negative reactions.

137 Repetitive Negative Thinking and Anticipation

138

Repetitive Negative Thinking (RNT) is the habit of engaging in persistent and intrusive

thoughts that have a distressing or negative focus (Ehring & Watkins, 2008) and that negatively 139 140 impact quality of life (Wrosch & Scheier, 2003). RNT is recurrent in daily life, often related to 141 the negative aspects of a person's life experiences, and is difficult to control or prevent once it 142 becomes habitual (Ehring & Watkins, 2008). RNT is also a transdiagnostic process that occurs in various conditions and disorders and has historically been often labeled with condition-specific 143 terms (e.g., rumination in people with clinical depression and worry or post-event processing in 144 people with anxiety, see McEvoy et al., 2010; Meyer et al., 1990; Nolen-Hoeksema et al., 2008). 145 146 Previous research has found that the degree to which a child, adolescent, or adult engages in 147 RNT significantly predicts measures of adverse impact related to stuttering and that differences 148 in RNT can identify children and adolescents who are more likely to exhibit characteristics of generalized or social anxiety characteristics (Tichenor, Gerwin, et al., 2023; Tichenor & Yaruss, 149 150 2020). Using an anxiety-specific measure of RNT, Croft and Byrd (2023) also found that higher 151 social anxiety characteristics and lower self-compassion were significantly associated with 152 greater RNT after a stressful speaking task. 153 These core features of RNT-that it is repetitive, emotionally negative, easy to start, and

154 hard to cease—coincide with what is known about how speakers respond to anticipation. As 155 discussed above, anticipation is commonly experienced in daily life, and people who stutter 156 frequently respond to anticipation with negative affective, behavioral, and cognitive reactions (Bloodstein, 1960; Jackson et al., 2015, 2018; Tichenor & Yaruss, 2018). Certainly, these 157 158 negative reactions are understandable when a person wishes to conceal stuttering in a world that 159 is often hostile to stuttering; hiding stuttering or stuttering covertly may reflect choices that a 160 person may make to protect themselves from perceived negative experiences (Constantino et al., 161 2017; Gerlach et al., 2021; Tichenor, Constantino, et al., 2022). Yet, they are by definition

reactions—habits that stutterers learn to engage in based on their past experiences (Tichenor & Yaruss, 2019a). These reactions become more automatic and habitual with time and repeated use. Given this similarity between RNT and the experience of anticipation, evaluating the ways in which stutterers engage in RNT may help to explain how stutterers experience and respond to anticipation in their lives—the first hypothesis of this study.

167 Control Theory and Anticipation

A further way that the development of anticipation and anticipation responses can be 168 169 more deeply understood is through what is known about the development of RNT. Control 170 Theory states that RNT arises due to a mismatch or discrepancy between a person's goals in life 171 and how they think they are or are not meeting those goals (see Martin & Tesser, 1996). We provided evidence that older children and adolescents' goals when speaking (i.e., the frequency 172 173 with which a child or adolescent seeks to stutter openly and not do anything to try and hide it) 174 are significantly predicted by the degree to which a child or adolescent engages in RNT 175 (Tichenor, Gerwin, et al., 2023). This finding connecting RNT and goal when speaking is 176 applicable to the current discussion because, like anticipation, goal when speaking develops from and is influenced by past communication experiences (see Tichenor, Gerwin, et al., 2023, for 177 discussion of Control Theory and Goal When Speaking). Sheehan (1958, 1968) famously 178 179 postulated that the stuttering condition arises from a conflict between roles— how a person wishes to present or not present themselves socially. Though inadequate as a theory of the origin 180 181 of the stuttering condition, the concept of role avoidance is highly applicable to discussions of 182 how stutterers experience moments of stuttering by virtue of who they wish to be, who they are trying not to be, and who they are showing others they are. According to Sheehan (1970), role 183 184 avoidance (i.e., not wishing to be seen as a person who stutters) is the most fundamental form of

185 avoidance because it taps into identity, who the person wishes to be vs. who they fear they might 186 appear to be. In avoidance reduction therapy, by more overtly stuttering and decreasing 187 behavioral avoidances, the stutter begins "accepting the role of a stutterer" (Sheehan, 1970, p. 188 283). This concept of role identity is identical to Control Theory, though Sheehan did not use such terms. It is therefore likely that goal when speaking can directly inform our understanding 189 190 of how stutterers respond differently to anticipation because goal when speaking captures a speaker's desired role-to be themselves (a stutterer) or to be seen as a non-stuttering fluent 191 192 person.

193 Gerlach-Houck et al. (2023) highlighted in a recent qualitative retrospective study that 194 concealment or avoiding overt stuttering behaviors is a process that develops throughout childhood and adolescence. Moreover, the development of learning to avoid is strongly 195 196 influenced by broader societal or environmental factors and internalized by stutterers as they live 197 their lives. Therefore, considering goal when speaking as a measure of a person's role identity 198 can directly inform how they currently anticipate and respond to anticipation. A person who 199 experiences a greater mismatch between their goals in life (e.g., not stuttering or not being seen as a person who stutters) and how they think they are perceived (e.g., as stuttering or as a person 200 201 who stutters) may be *more likely* to respond to anticipation with management strategies aimed at 202 concealment or avoidance. Conversely, and again in accordance with Control Theory, a person who stutters whose goal when speaking is to stutter openly may be less likely to conceal or avoid 203 204 stuttering because their goal for how they wish to show themselves or be seen aligns more 205 closely with how they think they show themselves or are seen by others. Therefore, accounting for individual differences in goal when speaking may differentiate how stutterers engage in RNT, 206 207 experience anticipation, and respond to anticipation—the second hypothesis of this study.

208 This study explored these two hypotheses via the following aims: To explore RNT. 209 anticipation, and anticipation responses to determine whether a relationship exists between RNT, 210 the frequency that stutterers report anticipation, and how they respond to anticipation (Aim 1). Specifically, it is predicted that: (a) people who engage more often in RNT will be more likely to 211 212 experience anticipation and react negatively and (b) people who engage less often in RNT may be less likely to experience anticipation and react negatively. Given how RNT and anticipation 213 are thought to develop in accordance with Control Theory, we also examined whether 214 215 differences in *goal when speaking* predict anticipation or anticipation responses to further 216 differentiate these relationships (Aim 2). It was predicted that: (c) people who more often have 217 the goal of speaking fluently or not stuttering will be more likely to experience anticipation and react negatively and (d) people who less often have the goal of speaking fluently or not stuttering 218 219 will be less likely to experience anticipation and react negatively. Because RNT is a habit that develops over time based on prior experiences, a broad view of stutterers' experiences related to 220 221 anticipation is critical for understanding how speakers experience, manage, and respond to 222 stuttering across the lifespan. Therefore, these predictions were evaluated in both adolescents and 223 adults who stutter to provide one explanation for how and why stutterers experience anticipation 224 and learn to respond to the sensation¹.

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METHOD

227 Participants and Procedures

¹ According to the National Institutes of Health, adolescence defines the period development between the ages of 10 and 19. So, the term *adolescent* is used as a way to describe participants in this study within this age range (see Sacks et al., 2003, for discussion).

228	This study involved survey data collected from 510 stutterers (427 adults who stutter,
229	ages 18 to 86 years, and 83 adolescents who stutter, age 10 to 18 years). All adults and
230	adolescents self-reported to be people who stutter. All adolescents who stutter were also reported
231	to be people who stutter by their parents. Parents indicated that 79 adolescents (95.2%) had also
232	been diagnosed by a speech-language pathologist or other professional. Most adolescents ($n =$
233	82, 98.8%) and adults ($n = 270, 64.3\%$) indicated a history of treatment, but fewer adolescents (n
234	= 29, 34.9%) or adults ($n = 175, 41.7\%$) indicated prior participation in self-help and support.
235	Demographic information for all adolescents and adults who stutter is presented in Table 1.
236	Participants were recruited using a mix of purposive, convenience, and snowball sampling in
237	which recruitment cascades via multiple distribution channels (Goodman, 1961). Adolescents in
238	this study were recruited as part of a larger project on the adverse impact of stuttering on
239	children conducted by the Developmental Speech Lab at Michigan State University (see
240	Tichenor, Gerwin, et al., 2023; Tichenor, Walsh, et al., 2022; Walsh et al., 2023). Adolescents
241	were recruited via school SLPs, specialty stuttering clinics, and Friends: The National
242	Association of Young People who Stutter. Recruitment details were shared only occasionally
243	online by the research team with specific parties (e.g., stuttering-specific parent support groups)
244	to reduce the risk of fraudulent responses. For the adult survey project, recruitment was broader
245	and intentionally used similar methods, as well as larger social media efforts, to recruit
246	participants. The surveys, described below, were shared to the stuttering sub-reddit (r/stutter) in
247	two separate posts and to the ASHA Special Interest Group 4 in three separate posts. The surveys
248	were also shared with colleagues and personal contacts of the authors, stuttering specialty clinics,
249	and to the National Stuttering Association via mass emailing efforts. Finally, the surveys were
250	shared with prior participants from the adult survey project in three separate emails. All

recruitment partners were asked to share the survey with as many adults and families of adolescents 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 adults or parents of adolescents were contacted. Thus, response rates cannot be calculated.

All survey measures were completed via the Internet using Qualtrics (Qualtrics, 2023). 256 All adult participants and parents of adolescent participants provided informed consent before 257 258 receiving and completing the surveys. All adolescents also provided assent. Adolescent surveys 259 included a question asking whether an adult assisted in the completion of the surveys. We 260 stipulated that adults could assist their child by reading questions or typing answers on the computer, but we emphasized that they should not provide answers for their child or attempt to 261 262 influence their child's responses. All adults who supported adolescents in completing the survey 263 indicated their agreement with this request. We documented that 59 adults assisted in survey 1 264 and 71 adults assisted in survey 2 (see below for details on the survey measures). The adult data 265 collection was deemed exempt from institutional review by the Michigan State University Human Subjects Research Protection Office under statute 45 CFR 46.101(b) 2 of the Federal 266 267 Policy for the Protection of Human Subjects (Study#00000539). The adolescent study was approved by institutional review by the Michigan State University Human Subjects Research 268 Protection Office (Study#00001704). 269

270 Survey Measures

Two different Qualtrics surveys were used to collect the adolescent data on measures and variables of interest reported in this paper. Similarly, the adult data reported in this study comes from two different Qualtrics surveys which are part of a larger study aimed at exploring

274	individual differences in adverse impact in adults who stutter (see Tichenor et al., 2021;
275	Tichenor, Palasik, et al., 2023; Tichenor & Yaruss, 2021). For both survey projects, participants
276	were free to complete the surveys in any order they wished.
277	The first adolescent and adult surveys contained The Perseverative Thinking
278	Questionnaire - Child (PTQ-C, Bijttebier et al., 2015) and The Perseverative Thinking
279	Questionnaire (PTQ, Ehring et al., 2011), respectively. The PTQ-C is adapted from the PTQ and
280	is specifically normed for children and adolescents between the ages of 9 and 15.25. Items in
281	both the PTQ and PTQ-C ask about the frequency of repetitive negative thoughts (e.g., My
282	thoughts are not much help to me and My thoughts take up all of my attention), Following our
283	previous work (Tichenor, Gerwin, et al., 2023), and given the high similarity of items between
284	the PTQ and PTQ-C, we elected to give the PTQ-C for adolescents up through age 18, as they
285	were enrolled in the adolescent study. The PTQ and the PTQ-C consist of 15 questions that
286	measure the tendency to engage in RNT. Respondents read these questions and responded via a
287	frequency-based Likert scale (never, rarely, sometimes, often, almost always). Responses for
288	rarely through almost always are scored numerically (1 through 4), and the 15 item scores are
289	summed to create a PTQ-C or PTQ Total Score (range, $0 - 60$). Studies have found that groups
290	of adults with mental health-related clinical diagnoses (e.g., depression or anxiety) frequently
291	have significantly higher PTQ Total Scores compared to groups of adults without such clinical
292	diagnoses (Černis et al., 2016; Ehring et al., 2011). However, non-significant differences in PTQ
293	Total Score between clinical and non-clinical groups also exist (Ehring et al., 2011). For this
294	reason, there is no clinically significant cutoff value to indicate atypical RNT. Moreover, studies
295	of RNT generally investigate individual or sub-group differences in PTQ or PTQ-C Total Scores
296	across demographics or other grouping variables (e.g., Bijttebier et al., 2018; Peixoto & Ribeiro,

297 2022), as we have done in our previous stuttering research (see Tichenor, Gerwin, et al., 2023; 298 Tichenor, Palasik, et al., 2023; Tichenor & Yaruss, 2020). Regardless, higher scores are 299 indicative of people who more often engage in RNT. The PTO-C and PTO have been shown to 300 have high internal consistency and correlations with other measures of RNT relating to depression and anxiety (Bijttebier et al., 2015; Ehring et al., 2011). The sum of all 15 items 301 (PTQ-C or PTQ Total Score) was used in the regression analyses described below. The 302 completion rate for this adolescent survey was 99.2%, and the completion rate of this adult 303 304 survey was 91.2%.

305 The second adolescent and adult surveys measured speaker's experiences related to 306 anticipation. Adults were asked if they experienced anticipation via a single agreement Likertbased question (I can sense that I am about to stutter—that is, I experience a sense of 307 308 anticipation before I stutter). Respondents responded to this question via a frequency-based 309 Likert scale (never, rarely, sometimes, often, always). Those who provided an answer other than 310 *never* were then asked a series of 21 items which probed possible responses to a prompt about 311 anticipation (When I sense that I am about to stutter...) (see Figure 1 and Table 2). These items 312 were adapted from previous anticipation-related work in stuttering (Jackson et al., 2015, 2018; 313 Tichenor & Yaruss, 2018), though new items were also created via a piloting process. 314 Specifically, 15 items were drafted and piloted with approximately 30 adults who stutter. 315 Feedback was garnered regarding how they respond to anticipation and if these possible items 316 captured all their responses. New items were added based upon this process, yielding a total of 317 21 items. The majority of these 21 items were negatively worded; however, through the piloting process this balance of more negative and less positive experiences was confirmed by the 30 318 319 adults who stutter as being representative of their experiences. Therefore, the researchers did not attempt to balance positively worded items with negatively worded items. The adolescent survey
adapted these adult items based upon the adult data factor analysis described below (see Data
Analysis). The order of the 21 adult items and 9 adolescent items were randomized across all
adult and adolescent subjects in Qualtrics to prevent order effects. The completion rate for this
adolescent survey was 93.0%, and the completion rate for this adult survey was 74.6%.

Lastly, the goal when speaking of all participants was explored using two agreement-325 scale Likert-based questions: "My goal when speaking is to not stutter" and "My goal when 326 327 speaking is to stutter openly and not do anything to try to hide it." For adolescents, the latter goal 328 when speaking question was also qualified with the added text of "(say what I want to say 329 regardless of how I say it)." These two questions come from a study by Tichenor and Yaruss (Tichenor & Yaruss, 2019b) involving more than 500 adults who stutter which showed that the 330 331 construct goal when speaking falls along a 2-factor structure (not stuttering vs. open stuttering) 332 that is negatively correlated. Each of these items were the highest loading item on each factor. 333 This construct has been shown to relate to several aspects of the broader experience of stuttering 334 and is instructive for revealing how individuals cope with stuttering in their lives (Tichenor, Gerwin, et al., 2023; Tichenor, Palasik, et al., 2023; Tichenor, Walsh, et al., 2022). 335 336 All 427 adults who stutter answered questions about their goal when speaking; 358 adults 337 completed the PTQ. All 83 adolescents who stutter completed the PTQ-C and answered questions relating to their experience of anticipation. Data relating to RNT from 76 of these 83 338 339 adolescents (91.6%) were previously reported in a recent paper (see Tichenor, Gerwin, et al., 340 2023). RNT data from 201 of the 358 adults completing the PTQ (56.1%) have previously been

reported in our two previously published adult RNT-related papers (see Tichenor, Palasik, et al.,

342 2023; Tichenor & Yaruss, 2020). Different numbers of participants completed the various

343 measures because participants in the adult survey project were volunteers who were given the 344 option of completing as many surveys or measures as they wished. Participants in the adolescent 345 survey project were compensated for their time spent completing the surveys via electronic gift 346 cards for the number of surveys completed. Adolescents were not required to complete all 347 surveys available to them. As such, some demographic information is missing because 348 participants elected to not provide that information (Table 1).

349 Data Analysis

Multiple R packages were used for data management, manipulation, analysis, and 350 351 visualization (Im.beta; Behrendt, 2023; ordinal; Christensen, 2019; car; Fox & Weisberg, 2019; 352 viridis; Garnier et al., 2021; ggiraph; Gohel & Skintzos, 2019; olsrr; Hebbali, 2020; ggpubr; Kassambara, 2020; sjPlot; Ludecke, 2020; AICcmodavg Mazerolle, 2020; psych; Revelle, 2022; 353 354 MASS; Venables & Ripley, 2002; plyr and ggplot2; Wickham, 2011, 2016; tidyverse; Wickham 355 et al., 2019; knitr; Xie, 2021). All data were manually checked for coding or entry errors before 356 manipulation and analysis. Participant responses across surveys were linked via emails or 357 personally generated unique codes if the participant wished to remain anonymous. Internal 358 consistency measures were conducted to examine the internal stability of the RNT unitary factor 359 within this sample of adolescents and adults who stutter. Internal consistency as indicated by 360 Cronbach's alpha were good for the PTQ-C unitary factor ($\alpha = .86$). Reliability was adequate to excellent for each for the three PTQ factors (Core Characteristics of RNT: $\alpha = .92$, 361 Unproductiveness of RNT: $\alpha = .77$, Capturing Mental Capacity: $\alpha = .83$). 362 To evaluate the structure and internal consistency of the anticipation responses generated 363 364 for this study, exploratory factor analysis (EFA) was conducted on the adult anticipation data. Confirmatory factor analysis based upon previously identified anticipation response factor 365

structure (e.g., action and non-action responses, see Jackson et al., 2019) was not completed for two reasons. First, given the inclusion of different and novel items, it was probable that the action and non-action structure previously demonstrated by Jackson and colleagues would not necessarily apply to the current dataset. Second, the sample size in this data set was significantly larger than previous anticipation response-related research (see Jackson et al., 2019). Thus, to reduce the likelihood that new structures may be overlooked, an EFA was conducted.

The factors were assumed to correlate with one another because prior research in 372 373 stuttering has shown that various aspects of the condition (e.g., affective, cognitive, and 374 behavioral factors) are conceptually related to one another (Smith & Weber, 2017; Tichenor & 375 Yaruss, 2019b; Yaruss & Quesal, 2006). Therefore, an oblique (promax) rotation was used in the factor analysis consistent with best practices in EFA for correlated data (Costello & Osborne, 376 377 2005). In order to estimate the number of factors, eigenvalues were estimated and plotted via scree plot. The estimated eigenvalues were plotted via parallel analysis. Lower and higher factor 378 379 loadings were explored for interpretability with scree plots as a guide. A minimum factor loading 380 of .32 was required for an item to load on a factor (Tabachnick & Fidell, 2019), and items that 381 cross-loaded on more than one factor were removed from both factors (Costello & Osborne, 382 2005). The factor structure from the larger adult data set was applied to the adolescent data for direct comparisons (See Figure 2). A second EFA on adolescent data was not conducted due to 383 the much smaller sample size and because the items created were directly adapted from the adult 384 385 items nearly verbatim.

The two factors (Acceptance and Avoidance) were used to create the sum scores
described below and reported in the results. Each of these summed scores was used in two
separate simple linear regression equations, where PTQ Total Scores in adults who stutter used

389 to predict Avoidance and Acceptance Total Scores (Models 4 and 5, respectively). Similarly, one 390 multiple linear regression equation was built to evaluate whether PTQ-C Total Scores and Age 391 would predict Avoidance Total Score in adolescents who stutter (Model 6). This combined 392 model with an adolescent's age was created to evaluate whether avoidance responses to anticipation increase as adolescents get older. The interaction of PTQ-C Total Score and Age in 393 the adolescent data set was intentionally left out of the model due to sample size limitations of 394 the adolescent data set (statistical power). Multicollinearity was assessed through variance 395 396 inflation factors (VIF). VIF values between PTQ-C Total Score and Age did not raise concerns 397 about multicollinearity (see Kennedy, 2003; Neter et al., 1985). All three models were 398 investigated for linearity, normality of residuals, homoscedasticity, and the presence of influential values via diagnostic plots in accordance with the assumptions of linear regression. 399 400 Diagnostic plots indicated that predictors and outcome variables in Models 4, 5, and 6 showed a linear relationship that only deviated in the extreme tails. Likewise, error was judged to be 401 402 normally distributed, with only slight deviations of normality in upper and lower tails. All 403 predictors across the models also demonstrated residuals that had a constant variance 404 (homoscedasticity) and independence of residual error terms (i.e., that no observation was more 405 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 406 demographic questions that some adolescents or adults elected not to answer. 407 408 One ordinal logistic regression equation (ordered logit/proportional odds model, see R. Williams, 2016) was performed to investigate the relationship between adolescents' age and the 409

411 equations were performed to investigate the relationship between PTQ or PTQ-C Total Score

frequency with which they experience anticipation (Model 1). Two ordinal logistic regression

410

412	and anticipation itself (the sense that one may soon stutter) in adults (Model 2) and in
413	adolescents (Model 3). Two additional ordinal logistic regression equations were performed to
414	investigate the relationship between Avoidance Total Score and the goal when speaking of open
415	stuttering in adults (Model 7) and in adolescents (Model 8). Open stuttering rather than the goal
416	of not stuttering was chosen for these models because it demonstrated a more bell-shaped
417	distribution of subject responses in this data set. Ordinal logistic regression was selected because
418	it is a useful analytical approach for analyzing ordinal data as a function of continuous or
419	categorical predictors (R. Williams, 2006, 2016). The assumption of parallel lines (proportional
420	odds assumption) was tested for all models using the likelihood ratio test of cumulative link
421	models (Christensen, 2019). The assumption was considered to have been met because there was
422	no significant difference between the models and a null model at $p < .01$ (Allison, 1999).
423	
424	RESULTS
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experience anticipation *often* or *always*. The full distribution in responses to this question for adults are visualized in Figure 1. The distribution in responses to that same question in adolescent stutterers was similar, though the experience of anticipation was less pervasive in adolescents than in adults, with a larger percentage of adolescents (n = 11, 13.2%) indicating that they *never* experience anticipation. And, less than half (n = 37, 44.6%) of adolescents indicated that they *often* or *always* experience anticipation. Responses to this question for adolescents are visualized in Figure 2.

The majority of those 11 adolescents who reported that they had never experienced 442 anticipation (n = 6, 54.6%) were the youngest we sampled, just 10 years of age. The number of 443 444 adolescents who reported that they had never experienced anticipation decreased dramatically as age increased: two adolescents aged 11 years old reported to never experience anticipation and 445 446 one adolescent reported to never experience anticipation at ages 13, 14, and 15, respectively. The 447 odds ratio for predicting Frequency of Anticipation from Age was 1.22 at a significant 95% CI (range: 1.03 - 1.45) (Model 1). The odds ratio in this ordinal regression equation indicates that 448 449 for every yearly increase in age, the odds of an adolescent indicating that they more frequently experience anticipation is multiplied by 1.22 (i.e., increases 22%). Predicted probabilities were 450 calculated for every age from 10 to 18 at each level of the frequency of anticipation question 451 (i.e., never though always) for adolescent data. These data are plotted in Figure 3, which show 452 that experiencing anticipation is more likely as an adolescent ages. Overall, these data support 453 454 and expand past research suggesting that the phenomenon of anticipation is both pervasive in 455 adults and increases in likelihood as an adolescent ages.

456 Anticipation Frequency and RNT

457	To evaluate the relationship between individual differences in anticipation and RNT,
458	PTQ ($M = 28.44$, $SD = 11.13$) and PTQ-C Total Scores ($M = 20.11$, $SD = 11.91$), were used to
459	predict frequency of anticipation in adults and adolescents. In adults (Model 2), the odds ratio for
460	predicting the frequency of anticipation from PTQ Total Score was 1.04 at a significant 95% CI
461	(range: 1.01, 1.08). In adolescents (Model 3), the odds ratio for predicting the frequency of
462	anticipation from PTQ-C Total Score was similarly 1.04 at a significant 95% CI (range: 1.01,
463	1.09). These odds ratios indicate that for every 1-point increase in PTQ or PTQ-C Total Score,
464	the odds of an adult or adolescent indicating that they more frequently experience anticipation is
465	multiplied by 1.04 (i.e., increases by 4%). Because odds ratios are unstandardized effect sizes
466	(i.e., the PTQ and PTQ-C Total Scores range from 0 to 60, so a 4% increase for each additional
467	point is difficult to interpret), the effect of this prediction can be best interpreted visually via
468	predicted probability plots. These were calculated for each observed PTQ or PTQ-C Total Score
469	at each level of avoidance response (i.e., never through always) and are plotted in Figure 4. The
470	lighter color lines indicate lower PTQ or PTQ-C Total Scores while darker colored lines indicate
471	higher PTQ or PTQ-C Total Scores. As can be seen in Figure 4, a significant cross-over effect
472	can be seen in both plots, where higher amounts of RNT are significantly associated with more
473	frequently experiencing anticipation while lower amounts of RNT are significantly associated
474	with less frequently experiencing anticipation.

475

Anticipation Responses: Factor Analysis

A two-factor structure was identified for the anticipation responses of adults. For ease of 476 interpretation, these two factors are referred to as Avoidance and Acceptance. The EFA revealed 477 lower-performing items with inadequate factor loadings or significant cross-loadings. These 478 479 items were removed from the factors before creating the Avoidance and Acceptance Total Scores 480 (Field, 2003). Cronbach's alpha was calculated for both factors to measure internal consistency (Cronbach, 1951). Table 2 shows the item wording, factor loadings, and internal consistency 481 482 coefficients. The internal consistency of the Avoidance factor was high ($\alpha = .84$), while the 483 internal consistency of the Acceptance factor was low ($\alpha = .58$). This low Cronbach alpha is likely due to the small number of items comprising that factor (see Costello & Osborne, 2005, 484 for discussion). The average inter-item correlation for items comprising that factor still fell 485 486 within the range of optimal mean inter-item correlation values (.22; see Briggs & Cheek, 1986, for discussion of optimal range of .20 to .40 for inter-item correlations). For the Avoidance Total 487 Score, used below in the regression equations, item number 15 was reverse coded in accordance 488 with the negative factor loading. Raw data on both the Avoidance and Acceptance Factors are 489 presented graphically in Figure 1. Raw data on the adapted adolescent Avoidance Factor are 490 491 presented graphically in Figure 2. On average, Avoidance responses were more common in the 492 adult data than Acceptance Responses. In the adolescent data, Avoidance responses were more evenly distributed but skewed slightly toward less frequent avoidance (i.e., more *never* or *rarely* 493 494 and less frequent often or always responses). There was a significant and moderately strong negative correlation between the Avoidance and Acceptance Factors in the adult data set r(407)495 = -.27, p = <.001. 496

497 Anticipation Responses and RNT

The three Avoidance responses most *often* or *always* experienced by adults were (11) *My muscle(s) tense*, (9) *I feel uncertain or anxious*, (5) *I feel anxiety or fear* (see Figure 1). The three Avoidance responses most *often* or *always* experienced by adolescents were (4) *I use starter words or fillers (um or er) to try not to stutter*, (2) *I substitute or avoid sounds or words*, (8) *My muscles tense* (see Figure 2). Two simple linear regression equations were built to describe the relationship between RNT and anticipation responses in adults. In Model 4, PTQ Total Score explained a significant amount of the variance in Avoidance Total Score in adults who stutter $F(1, 115) = 37.51, p < .001, R^2 = .25, f^2 = .32$, indicating a medium to large effect size (Cohen, 1988). In Model 5, PTQ Total Score did not explain a significant amount of the variance in Acceptance Total Score in adults who stutter $F(1, 113) = 1.89, p = .173, R^2 = .016$. See Figure 5. See Table 3 for more detailed information on regression results.

One multiple linear regression equation was built to evaluate the relationship between 509 510 RNT, avoidance responses, and an adolescent's age. In Model 6, PTQ-C Total Score explained a 511 significant amount of the variance in Avoidance Total Score in adolescents who stutter F(2, 68)= 14.06, p < .001, $R^2 = .29$, $R^2_{Adjusted} = .27$, $f^2 = .41$, indicating a large effect size (Cohen, 1988). 512 More detailed inspection of the significance of both PTQ-C Total Score and Age revealed that 513 514 PTQ-C Total Score ($\beta = .52, p < .001$) more strongly predicted Anticipation Total Score than did Age ($\beta = .086$, p = .410). See Figure 6 and Table 3 for more details. These data indicate that 515 516 adults and adolescents who stutter who engage in RNT more frequently also report responding to 517 anticipation with avoidance more frequently. Importantly, as evidenced by the non-significant 518 prediction of adolescent age, this relationship is present throughout adolescence. This indicates 519 that adolescents as young as 10 years can demonstrate frequent avoidance responses to 520 anticipation that can be predicted by RNT.

521 Anticipation Responses and Goal when Speaking

To determine the relationship between differences in *goal when speaking* and avoidance responses, Avoidance Total Score in adults and adolescents who stutter was used to predict *goal when speaking*. In adults (Model 7), the odds ratio for predicting Avoidance Total Score from *goal when speaking* was .93 at a significant 95% CI (range: .91 - .95). Similarly, in adolescents 526 (Model 8), the odds ratio for predicting Avoidance Total Score from goal when speaking was .92 527 at a significant 95% CI (range: .86 -.98). The odds ratios in these ordinal regression equations 528 indicate that for every 1-point increase in Avoidance Total Score, the odds of a stutterer 529 indicating that their goal when speaking was to stutter openly is multiplied by .93 or .92 (i.e., decreases 7-8%). This indicates that avoidance responses and open stuttering are inversely 530 531 related in both adolescents and adults who stutter. Predicted probabilities were calculated for each observed Avoidance Total Score at each level of the goal when speaking question (i.e., 532 533 never though always) for adolescent and adult data. These are plotted in Figure 7. The lighter and 534 cream-colored lines indicate higher Avoidance Total Scores, while the darker purple and black colored lines indicate lower Avoidance Total Scores. As can be seen in Figure 7, there is a 535 significant cross-over effect where (a) more frequent avoidance responses are significantly 536 537 associated with less often having the goal of open stuttering when speaking, and (b) less frequent 538 avoidance responses are significantly associated with more often having the goal of open 539 stuttering when speaking. These findings suggest that goal when speaking can be used as to 540 measure a person's role identity relating to stuttering, which can directly inform how they are 541 currently anticipating and responding to anticipation.

542

DISCUSSION

People who stutter widely report experiencing anticipation, though much is still unknown about how it develops and how people respond to the sensation as they live their lives. This study sought to (a) specify the relationships between RNT, anticipation, and responses to anticipation and (b) determine whether differences in *goal when speaking* predict anticipation responses. In so doing, this study also replicated and extended evidence that anticipation is commonly experienced in adolescents and adults who stutter. It was predicted that adolescents and adults who engage more often in RNT or more frequently have the goal of speaking fluently or not stuttering may be more likely to experience anticipation and react negatively. It was also predicted that adolescents and adults who engage less often in RNT or less frequently have the goal of speaking fluently or not stuttering may be less likely to experience anticipation and react negatively. Data collected confirmed the hypotheses associated with these aims—that these differences in engagement in RNT and in *goal when speaking* can explain how stutterers experience and respond to anticipation.

556 How Common is Anticipation?

557 Data collected for this study significantly expand prior research findings on the 558 commonality of anticipation. Almost all adults and a majority of adolescents in this study reported experiencing anticipation *sometimes*, often, or always (adults = 97.4%, n = 416; 559 560 adolescents = 69.9%, n = 68). Six of the 11 adolescents (54.5%) who reported never to experience anticipation were the youngest in our sample, just 10 years of age, lending some 561 562 credence to the view that anticipation may be a learned response (see Bloodstein, 1958, 1972; 563 Bryngelson, 1935; Sheehan, 1953; Van Riper, 1973). In support of this observation, we found a significant effect of age predicting the frequency of anticipation in adolescents. As an adolescent 564 565 ages, their communication experiences and opportunities broaden, increasing the likelihood of experiences which may elicit more negative responses from the adolescent (i.e., learning to 566 avoid). However, given that we sampled adolescents aged 10 and up in this study, the age at 567 568 which a younger child can sense anticipation and report on it remains an open question (see 569 Future Directions and Limitations).

570 **Responses to Anticipation**

571 Although anticipation may reflect negative internalized reactions to stuttering, responses to this sensation are not inherently maladaptive for all stutterers. Our adult data set revealed that 572 573 responses to anticipation fell on two factors, Avoidance and Acceptance, which were moderately 574 negatively correlated. Overall, Avoidance was more common than Acceptance across the 425 adults. The fact that many adults who stutter responded to anticipation with Acceptance suggests 575 that adaptive coping habits are possible for many speakers. This distribution of reactions and 576 coping strategies to anticipation in people who stutter parallels the distribution of RNT reported 577 578 in this sample. The mean PTQ (M = 28.44) and PTQ-C (M = 20.11) Total Scores in this study, or 579 the ones reported in our previous RNT-related work (Mean PTQ-C Total Score = 21.16, see 580 Tichenor, Gerwin, et al., 2023; Mean PTQ Total Score = 27.92, see Tichenor & Yaruss, 2020), are on par with or slightly lower than the published means of the non-clinical validation samples 581 582 for both the PTQ (Mean PTQ Total Score = 28.14 Ehring et al., 2011) and the PTQ-C (Mean PTQ-C Total Score = 27.98, Bijttebier et al., 2015). This suggests that, on average, adults and 583 584 adolescents who stutter do not appear to engage in RNT more frequently than their peers who do 585 not stutter. Instead, we found that those adults who do engage in RNT at higher levels are at 586 increased risk for responding to anticipation with Avoidance (Figure 5). This relationship 587 between greater RNT and more Avoidance was also found in adolescents, but it was not 588 influenced by the adolescent's age (Figure 6). Taken together, these findings indicate that people who stutter can respond to anticipation in different ways-either with more Avoidance or more 589 590 Acceptance. Our findings also show that examining individual difference in the occurrence of 591 RNT can help to identify adults and adolescents who are more likely to respond to anticipation 592 with more or less Avoidance. The likelihood of responding to anticipation with Avoidance cannot be explained solely by age, however. That is, it is not the case that older adolescents more 593

frequently or necessarily respond to anticipation with *Avoidance*, even though a higher
chronological age does make it more likely that an adolescent will experience anticipation itself,
as indicated by data from this study.

597 Both RNT and responses to anticipation are also related to stuttering role identity, particularly goal when speaking. In this study, we found that adolescents and adults who 598 indicated that their goal when speaking was to more often stutter openly were significantly less 599 600 likely to exhibit maladaptive responses to the sensation of anticipation. Specifically, they were 601 less likely to attempt to avoid a moment of stuttering. Stuttering openly, and not trying to hide or 602 avoid it, involves more outwardly accepting the role of a stutterer (Sheehan, 1970, p. 283). 603 Therefore, a person's goal when speaking can be viewed as a fundamental characteristic of who individuals are and who they want themselves to be, which influences how they respond to the 604 605 sensation of anticipation. Importantly, identity is central to the development of RNT. According 606 to Control Theory, RNT arises when a discrepancy exists between a person's goals-how they wish the state of the world to be versus how they perceive it to be (Martin & Tesser, 1996). 607 608 Applying Control Theory to stuttering, individuals who are less likely to have the goal of 609 stuttering openly (i.e., who are more likely to try to not stutter) are vulnerable to developing RNT because they fail to meet their own expectations for themselves and their life when they 610 611 inevitably stutter. Stuttering or being seen as a person who stutters contradicts how they wish to 612 be, increasing the likelihood of engaging in RNT and avoidance behaviors. This hypothesis was 613 confirmed by the results of this study: an adolescent or adult who less often has open stuttering 614 as a *goal when speaking* is more likely to engage in RNT, experience anticipation, respond with avoidance. Similarly, an adolescent or adult who more often has the goal of open stuttering as a 615 616 goal when speaking is less likely to engage in RNT, experience anticipation, and respond with

617 avoidance. Thus, goal when speaking can directly account for variance associated with how 618 stuttering does or does not manifest in the lives of those who stutter and is highly useful for 619 capturing the notion of self-role conflict put forth by Sheehan (see Sheehan, 1968, 1970). 620 In order to visualize the potential relationships among RNT, anticipation/anticipation 621 responses, and *goal when speaking*, we propose a model that highlights these relationships (see Figure 8). The model expresses how the possibility of stuttering might contrast with the ways in 622 which a person wants to be seen or perceived by others. If there is a disparity in role identity, 623 624 then the speaker may be less likely to *stutter openly* (more likely to have the goal of speaking 625 fluently or not stuttering). This, in turn, may increase the likelihood of experiencing anticipation, 626 the development of RNT, the resultant Avoidance responses, and a lower likelihood of Acceptance responses. This is represented in the model by pathway A. In contrast, if the 627 628 possibility of stuttering does not significantly contrast with how a person want to be seen or 629 perceived by others, then the person would be more likely to have the goal of open stuttering (i.e., less likely to develop the goal of trying to be fluent or not wanting to outwardly stutter). 630 631 This, in turn, would decrease the likelihood of RNT and experiencing anticipation, because no 632 significant goal discrepancy exists between how this person wants to be seen vs. how they think 633 they are perceived. In this case, Acceptance responses would be more likely, and Avoidance 634 responses would be less likely. This is represented by pathway B. Thus, this proposed model illustrates how people who stutter may respond differently to anticipation and, subsequently, 635 636 demonstrate different responses based on their role identity related to stuttering and how they wish to be seen. Critically, this model is restricted to how people respond to the sensation that 637 638 they are about to stutter. It does not specify what people who stutter are sensing when they feel

639 like they are about to stutter on a neurophysiological level or what the loss of control may be (see640 *Future Directions and Limitations*).

641 Clinical Applications

642 Research shows that RNT in mental health can be successfully reduced through cognitive-behavioral therapy (CBT) and metacognitive therapy (MCT) (see Monteregge et al., 643 2020; Nordahl et al., 2018; Spinhoven et al., 2018). We recently proposed that RNT in the form 644 of negative thoughts related to speaking, stuttering, or communication, could similarly be 645 646 reduced in people who stutter through CBT and MCT, though further clinical research is needed 647 (see Tichenor, Gerwin, et al., 2023, for discussion). Present findings suggest that RNT influences 648 how stutterers experience and respond to anticipation. Treatments that reduce RNT in mental health contexts may help to reduce the occurrence negative reactions to anticipation, such as 649 650 avoidance, CBT, for instance, has been used to address avoidance behaviors in people with 651 depression, anxiety, and other conditions in which people seek to avoid perceived sources of 652 harm (Beck, 2021). While the strategy of avoidance provides immediate relief (Salkovskis, 653 1996), it may have long-term detrimental effects, as it prevents individuals from challenging 654 negative automatic thoughts, a key step in CBT (Beck, 2021).

Many authors in the field of stuttering have advocated for viewing avoidance of stuttering similarly (Constantino et al., 2017; Gerlach-Houck et al., 2023; Gerlach et al., 2021; Tichenor, Constantino, et al., 2022). For example, if a person anticipates stuttering and has the automatic negative thought, "*If I stutter, my classmates will laugh,*" then they might choose to avoid speaking in that situation. Because of the avoidance, they never find out if they would have *actually* stuttered or been laughed at. As a result, the avoidance serves to confirm the negative thought, because there was no opportunity for disconfirmation to occur. In CBT, challenging 662 negative automatic thoughts with counter-evidence is key to reducing false assumptions (e.g., If I avoid stuttering, I will not be laughed at), diminishing negative attitudes (e.g., It's terrible to 663 stutter), changing intermediate rules (e.g., I should avoid if I feel like I will stutter), and, 664 ultimately, changing core beliefs (e.g., I am less than because I stutter). Exposure to moments of 665 stuttering and to speaking in different communicative situations, rather than avoiding those 666 667 moments of stuttering and speaking situations, is critical for breaking this cycle and either preventing avoidance behaviors from taking root or diminishing them once they exist. 668 Some stutterers may struggle to remain in speaking situations long enough to challenge 669 670 their negative thoughts or their tendency toward avoidance As a result, they may have difficulty 671 reducing their negative thoughts and avoidance behaviors. In such cases, MCT targeting RNT across situations may be effective (see Wells & Papageorgiou, 2004). Clinicians may also use 672 673 techniques such as imaginal exposure, role playing, virtual reality, or desensitization hierarchies to gradually and systematically expose clients to fears, thereby reducing negative automatic 674 675 thoughts and improve coping behaviors (see Beck, 2021; Dobson & Dobson, 2017, for 676 discussion). Decades of research have shown that clinicians can successfully help clients reframe negative thoughts and feelings related to stuttering (Beilby et al., 2012; Beilby & Byrnes, 2012; 677 678 Blood, 1995; Boyle, 2011; Brundage et al., 2016; Byrd et al., 2021, 2022; Cheasman, 2013; Dell, 679 1993; Emerick, 1988; Helgadóttir et al., 2014; Kelman & Wheeler, 2015; Menzies et al., 2008; Murphy et al., 2007; Palasik & Hannan, 2013; Plexico & Sandage, 2011; Reardon-Reeves & 680 681 Yaruss, 2013; Van Riper, 1973, 1982). The current study supports the consensus that effective stuttering therapy can include reframing thoughts and emotions related to speaking and 682 683 stuttering.

684 Limitations and Future Directions

685 Data from this study come from a cross-sectional investigation of anticipation, responses to anticipation, RNT, and goal when speaking. Though we have interpreted the results in 686 687 accordance with broader RNT literature and hypothesized how the constructs under investigation 688 may interact with each other (see Figure 8), readers should be cautious in inferring causal or unidirectional effects of these constructs. There are also several limitations that should be 689 recognized relating to how data were collected and used in this study. We allowed adults to assist 690 691 adolescents in accessing the surveys and explaining questions, if needed. However, adults were 692 required to indicate agreement that they had not answered for their child or influenced their 693 response. Our recent study found that parent-reported and adolescent-reported scores on a child resilience measure were only weakly correlated (Walsh et al., 2023). This provides evidence that, 694 overall, parents are adhering to our directive, although we cannot ensure parents never 695 696 influenced their child's responses. Similarly, data presented in this study come from adults and 697 adolescents who were primarily white and from the United States of America. Extrapolating 698 findings from this study to other cultures or ethnic groups should be done with caution as their 699 experiences may differ. Also, our method of recruitment using a mix of snowball sampling via 700 therapist, support, social media and community partners precludes the accurate calculation of 701 response rates as this method does not allow the tracking of how many adults or adolescents 702 were ultimately contacted but elected not to participate in the study. This study also measured 703 demographics via US-based terms for race and ethnicity required by the National Institutes of 704 Health, which may have impacted why some adult participants may not have provided 705 demographic information if these ethnic or racial categories did not apply to them. In this study, we found that many adolescents aged 10 and older experience anticipation 706

and react negatively to it. Future longitudinal and cross-sectional research should explore

708 anticipation, anticipation responses, and RNT in younger children who stutter to determine how 709 they experience anticipation and respond to it. There is evidence that even preschool children 710 who stutter experience and develop negative affective-cognitive reactions to their speech or 711 stuttering (Boey et al., 2009; Langevin et al., 2010; Tichenor, Walsh, et al., 2022; Vanryckeghem 712 et al., 2005). Therefore, it is likely that a younger child under 10 years who internalizes one or more negative communication experiences may learn to anticipate and respond with maladaptive 713 coping habits. Relatedly, anticipation response options used in this study were created through a 714 715 piloting process in adults that resulted in an imbalance of positively and negatively worded items 716 that may have biased participants in responding more frequently to negatively worded 717 anticipation responses. Future research should replicate these findings with an item bank that is balanced between positively and negatively worded anticipation responses and include 718 719 acceptance-related items in adolescents. Future work should also explore the appropriateness of 720 distinct response items for children and adolescents to more thoroughly explore the development 721 of anticipation responses over time. This could be done through qualitative piloting or other 722 methods.

Future research should investigate and replicate our findings longitudinally—to elucidate the development of personal reactions—even in clinical or therapeutic paradigms to verify that altering RNT adolescents and adults who stutter can change how anticipation and responses to it are experienced. Relatedly, whether adolescents who stutter demonstrate higher rates of anxiety compared to peers has been a perennial question in stuttering research (see Tichenor, Gerwin, et al., 2023, for discussion). Given that two of the three most commonly experienced anticipation responses in adults in this study related to fear and anxiety, future research should explore whether anxiety can be reduced or even prevented in later life by decreasing avoidance reactionsin adolescence.

This study focused on how stutterers respond to the sensation of anticipation and cannot comment or speculate on what that sensation is on a neurophysiological level. In our view, the event-related definition of anticipation put forth by Jackson and colleagues (2020) overlaps considerably with the notion of the loss of control put forth by Perkins (Perkins, 1983, 1990). Future research should directly explore the physiological underpinnings of the loss of control to understand how it influences or overlaps with anticipation.

738 Future research should expand and adapt aspects of this study for replication and 739 extension. For example, the Acceptance Factor items from the adult data set should be adapted and examined in adolescents. As RNT also occurs in various mental health conditions (e.g., 740 741 anxiety and depression), future research should explore anticipation and RNT with respect to co-742 occurring mental health conditions to ascertain if people who stutter with concomitant mental 743 health conditions are at increased risk of anticipation and responding to anticipation with 744 avoidance reactions. Future research should also explore the relationships between anticipation, 745 anticipation responses, RNT, and goal when speaking with respect to treatment history. It is 746 likely that different relationships may be found with people who have undergone different types 747 of therapy.

748 Summary

This study investigated anticipation and responses to anticipation while accounting for individual differences in RNT and *goal when speaking* in adolescents and adults who stutter. Results indicated that anticipation is ubiquitous in adults who stutter and highly common in adolescents who stutter. Though avoidance responses to anticipation were more common than

- acceptance responses, differences in RNT and goal when speaking significantly predicted
- adolescents and adults who experience anticipation more frequently and more commonly
- respond with avoidance reactions. Thus, RNT may be a mechanism of stuttering anticipation and
- a viable therapy target to reduce or prevent avoidance and improve stutterers' communicative
- 757 participation.

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Supplemental files contain the diagnostic plots mentioned in the methods.

Figure Captions

Figure 1 depicts the distribution of Likert responses in adults who stutter for the sense of anticipation and the two factors—*Avoidance* and *Acceptance*. The sense of anticipation was ubiquitous in adults who stutter. Overall, *Avoidance* responses were more common than *Acceptance* responses, but the distributed data suggests that adults who stutter demonstrate a wide range in how they respond to anticipation.

Figure 2 depicts the distribution of Likert responses in adolescents who stutter for the sense of anticipation and the single *Avoidance* factor. The data indicate that the sensation of anticipation and avoidance responses were less common compared to adults.

Figure 3 visualized the predicted probabilities of never, rarely, sometimes, often, or always experiencing anticipation as a function of adolescents' chronological age. There was a significant cross over effect where sensing anticipation becomes more likely as an adolescent ages.

Figure 4 visualizes the predicted probabilities of never, rarely, sometimes, often, or always experiencing anticipation as a function of Repetitive Negative Thinking (RNT), where RNT is measured by PTQ or PTQ-C Total Scores. In both adolescents and adults, more often engaging in RNT (lighter red, orange, and yellow lines) is associated with a higher probability of experiencing anticipation. Similarly, less often engaging in RNT (darker black and purple lines) is associated with a lower likelihood of experiencing anticipation.

Figure 5 visualizes the simple linear regression results of Models 4 and 5. The more often an adult who stutters engages in RNT (as measured by PTQ Total Score), the more often they elect to respond to anticipation with avoidance (Avoidance Total Score) (a). There was no significant prediction of RNT on the frequency an adult responds to anticipation with Acceptance (b).

Figure 6 visualizes the multiple linear regression equation result of Model 6. There was a significant prediction of Avoidance Total Score by RNT (as measured by PTQ-C Total Score) in adolescents who stutter where higher RNT was significantly associated with more frequent Avoidance (a). There was no significant prediction of a adolescent's age in predicting Avoidance Total Score (b).

Figure 7 visualizes the predicted probabilities of never, rarely, sometimes, often, or always having the *goal when speaking* of stuttering openly and not doing anything to try and hide it as a function of an adolescents, or adults Avoidance Total Score. As can be seen in both the adolescent and adult data, a significant cross over effect was found where more frequently having a *goal when speaking* of open stuttering was significantly associated with a decreased probability of responding to anticipation with Avoidance.

Figure 8 illustrates a theoretical model summarizing and combining this study's findings and broader RNT and anticipation theory to illustrate how people who stutter respond to the sense of anticipation. A person's role identity as not a stutterer drives how they respond to anticipation, leading them down "Pathway A" to more likely have a goal of speaking fluently or not stuttering (lower likelihood of open stuttering as a goal), more likely engaging in RNT, more likely responding behaviorally with Avoidance and less likely responding with Acceptance. Alternatively, a person who more closely has the role identity of a stutterer via "Pathway B" is less likely to have speaking fluently or not stuttering as a *goal when speaking* (more likely to have a goal of open stuttering), less likely to engage in RNT, less likely to respond with Avoidance, and more likely to respond with Acceptance. Importantly, a person's goal when speaking and degree they engage in RNT can feedback and influence the frequency of sensing anticipation itself