

Variability of stuttering severity and emotions in daily life: An ecological momentary assessment (EMA)

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1. Introduction

Growing research has found that adults who stutter (AWS) relative to those who do not stutter (AWNS) are at a higher risk for a range of emotional disorders such as trait anxiety disorders (Craig et al., 2003; Craig & Tran, 2014), social anxiety disorders (Blumgart, Tran, & Craig, 2010; Iverach, O’Brian, et al., 2009), and elevated depression symptoms (Briley et al., 2021). Social anxiety symptoms, such as a fear of negative evaluation, are thought to be maintained among AWS through maladaptive cognitive behavioral processes such as an attentional bias towards threat information (Lowe et al., 2015; Brundage et al., 2017; Rodgers et al., 2020) and avoidance of positive social cues (e.g., eye gaze, Lowe et al., 2012). A high Negative Affect (NA) and a deficit in Positive Affect (PA) are central symptoms of social anxiety disorders (Mennin et al., 2007), the former of which was observed specifically among AWS relative to controls (Tran et al., 2011). Nevertheless, AWS with higher stuttering severity as perceived by an experienced speech language pathologist did not necessarily experience heightened depressive moods and anxiety (Craig et al., 2015).

Most of the prior research in this area has either investigated the association between stuttering severity and negative emotions, such as anxiety, with a between-person approach, by comparing person to person (e.g., trait anxiety, Craig et al., 2014), or investigated the association from a within-person approach, by comparing the momentary measures in different situations within each participant (Alameer et al., 2017). However, none of the prior studies took both analyses into consideration, which can potentially reveal a more complex association between stuttering severity and emotions. In addition, most of the prior studies exhibited methodological limitations (e.g., events were often reported retrospectively, only a few types of events were sampled, the same events were sampled for different participants). Therefore, the overall aim of the current pilot study was to address some of the methodological limitations by using ecological momentary assessment (EMA) to investigate: (a) whether AWS’ self-reported emotions (NA/PA) during social interactions were associated with self-reported momentary stuttering severity both within- and between-individuals, and (b) whether within- and between-person associations between stuttering severity and emotions (NA/PA) differed in magnitude and/or direction.

2. Method

2.1. Participants

Nine adults who self-identified as AWS were recruited through the National Stuttering Association and snowball sampling. Table 1 shows the demographic characteristics of the participants. All participants spoke English as their native language and had a job that involved daily interactions with other people. All participants had a bachelor’s degree and 2 out of 9 (22%) had a doctoral degree.

2.2. Procedure

Participants attended a preliminary interview session via Zoom to provide speech samples to confirm stuttering and completed the initial set of questionnaires that measured personality, trait and social anxiety, etc. During this session, AWS were also trained to answer the ecological momentary assessment (EMA) survey with their smartphones 3 times per day and for 21 days. The same Qualtrics survey was texted to participants’ smartphones 3 times between 8 am – 12 pm, 12pm – 4 pm, and 4 pm – 8 pm. Participants were instructed to fill out each survey based on the most recent social interaction. If they did not interact with anyone since they last received a survey, they were instructed to answer how they felt (NA/PA) in the last 5 minutes, so that participants were routinely asked to respond each time they received a text message. The link to the survey did not expire if the participants activated the link but did not finish the survey to allow more times for them to complete the surveys during the day.

Table 1. Demographic data.

Demographic variable	Number (%) or M(SD)
Age	32.6 (11.18)
Gender	
Woman	4 out of 9 (44%)
Man	5 out of 9 (56%)
Ethnicity	
White/European descent	8 out of 9 (89%)
Hispanic/Latin American descent	1 out of 9 (11%)
History of stuttering therapy	
Yes	9 out of 9 (100%)
No	0 out of 9 (0%)
History of self-help participation	
Yes	9 out of 9 (100%)
No	0 out of 9 (0%)
History of psychological conditions (such as anxiety disorders or depression)	
Yes	2 out of 9 (22%)
No	7 out of 9 (88%)
Higher levels of formal education experiences (having college or postgraduate degree)	
Yes	9 out of 9 (100%)
No	0 out of 9 (0%)

2.3. Selected questions on the EMA survey

Questions were adapted from existing instruments, and the items that were relevant for the current pilot study were:

Self-Reported Stuttering Severity Scale (SRSS; O’Brian et al., 2004, 2020). A single item was used for participants to self-report their stuttering severity on a 9-point Likert scale (0 = no stuttering to 8 = extremely severe): “Please rate your stuttering severity during the social interaction.” The scale has high construct validity, as it correlates strongly with percentage of syllables stuttered (Pearson $r = .91$), and strong intra- and inter-rater reliability has been observed ($r = 0.92, 0.84$; O’Brian et al., 2004).

International Positive and Negative Affect Schedule Short Form (PANAS-SF; Thompson, 2007). Negative Affect (NA) was measured with 5 items (afraid, nervous, upset, hostile, and ashamed), and Positive Affect (PA) with 5 items (active, determined, attentive, inspired, and alert), both on a 5-point Likert scale (1 = not at all to 5 = extremely): “Please indicate the extent you felt _____ during the social interaction.” The PANAS-SF PA and NA subscales have been shown to exhibit adequate reliability (Cronbach’s alphas $>.75$, Thompson, 2007).

2.4. EMA data cleaning and compliance

Participants (N=9) contributed a total of 375 responses over 21 days, representing 66% of the total possible responses (567 responses = 9 participants * 3 times per day * 21 days). The 375 responses consisted of 259 Yes-responses (69%) and 116 No-responses (31%) regarding whether they have had a social interaction since the previous survey. The No-responses were not relevant for the current research questions and were removed from further analysis. The response duration was right-skewed by visual inspection, and the slowest 3% of the responses were removed ($n = 8$); these had an average response duration of 19.24 minutes (SD = 18.22 mins). For the remaining responses, each participant, on average, contributed 28 responses (SD = 11, range 9-45) and spent 2.95 minutes (SD = 1.14) to fill out each survey.

2.5. Statistical analysis

Data were analyzed using R studio. The current EMA data had a hierarchical structure in which repeated assessments (251 momentary reports; Level 1) were nested within persons (9 participants; Level 2). Empirically, there was considerable between-person variation indicated by intraclass correlation (ICC; the ratio of the between-cluster variance to the total variance) for NA (0.29), PA (0.54), and self-reported stuttering severity (0.55).

Therefore, data were analyzed separately at the within- and between-person levels to account for dependency in the data (Peugh, 2010). The within-person associations between stuttering, NA, and PA were calculated individually for each participant using Pearson correlation. A common within-person regression slope shared among individuals was also calculated using the *rmcorr* package in R (Bakdash & Marusich, 2017). Between-person associations were calculated with the trait NA, PA, and self-reported stuttering severity, which were indexed by each individual's average rating for up to 21 days of measurement.

For all analyses, the dependent variables were NA and PA, which were derived by the averaging the rating of five items for each observation (NA: afraid, nervous, upset, hostile, and ashamed; PA: active, determined, attentive, inspired, and alert). NA was log transformed to correct for skewness (*iskew* = 0.57). Self-reported stuttering severity was the independent variable, and it was person-mean centered for better interpretation. Data collected on the global surveys (e.g., personality, anxiety levels) were not relevant to the research questions and were not analyzed as a part of the pilot study.

3. Results

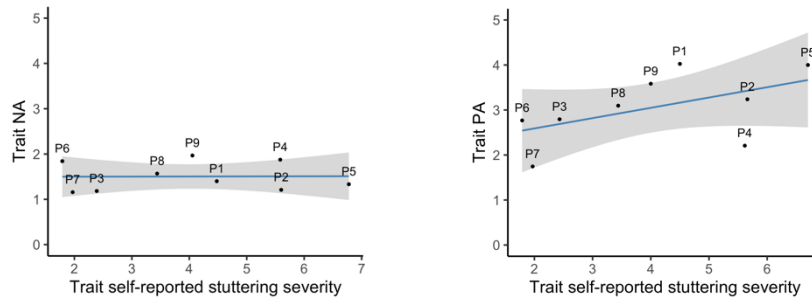
Within-person associations. The Pearson correlation between self-reported stuttering severity and NA was statistically significant for 6 out of 9 participants, whereas the Pearson correlation between self-reported stuttering severity and PA was statistically significant for 2 out of 9 participants (Table 2). The repeated measures correlation analysis indicated that, on average, self-report of stuttering more than usual was associated with a significant increase in NA ($r = 0.53$, CI [0.43, 0.61]) and an increase in PA ($r = 0.25$, CI [0.13, 0.37]) compared to individuals' usual level.

Table 2. Within-person associations between self-reported stuttering severity and NA/PA.

Participants	NA			PA		
	Pearson r	t - value	p-value	Pearson r	t - value	p-value
P1	0.51	t (21) = 2.71	0.013	0.51	t (21) = 2.74	0.012
P2	0.38	t (43) = 2.70	0.010	0.02	t (43) = 0.13	0.894
P3	0.56	t (34) = 3.89	<0.001	0.20	t (34) = 1.22	0.232
P4	0.83	t (22) = 6.85	<0.001	0.28	t (22) = 1.36	0.188
P5	-0.46	t (7) = -1.38	0.211	0.00	t (7) = 1.68	>0.99
P6	0.26	t (17) = 1.13	0.274	0.08	t (17) = 0.32	0.757
P7	0.76	t (31) = 6.61	<0.001	0.85	t (31) = 8.89	<0.001
P8	0.27	t (23) = 1.37	0.185	0.07	t (23) = 0.33	0.748
P9	0.70	t (35) = 5.81	<0.001	0.22	t (35) = 1.31	0.200

Between-person associations. Higher trait self-reported stuttering severity was not associated with higher trait NA ($r = -0.01$, $p > .05$) nor was it associated with higher trait PA ($r = 0.53$, $p > .05$; Figure 1).

Figure 1. Association between trait self-reported stuttering severity and trait NA/PA.



4. Discussion

We used ecological momentary assessment to investigate the association between self-reported stuttering severity and emotions (NA/PA) in daily life. We provided empirical evidence that the method and the study protocol were sensitive to within-person fluctuations in stuttering severity, NA, and PA. Overall, the results indicated that, on average, when someone stuttered more than usual, they not only experienced higher-than-usual NA (e.g., afraid, nervous, upset, hostile, and ashamed) but also higher-than-usual PA (e.g., active, determined, attentive, inspired, and alert), even though the former ($r = 0.53$) was stronger than the latter ($r = 0.25$). Several factors could have contributed to the positive within-person association between momentary NA and stuttering severity, such as type and quality of social interaction, perceived momentary negative listener feedback, and avoidance behaviors. Some studies found NA and PA to be independent emotions (Diener & Emmons, 1985), so it is not unexpected for individuals to experience an increase in both in a span of time. The current study found 2 participants to experience a significant increase in both NA and PA when they stuttered more than they usually do, which attested to the complexity of the emotions experienced in the stuttering moment (Tichenor & Yaruss, 2018). The experience of higher PA when someone stutters more than usual is not inconsistent with the idea of stuttering gain (i.e., such as increased connection and intimacy with others; Constantino et al., 2016, 2020).

However, the null between-person associations suggested that AWS with higher trait stuttering severity did not necessarily tend to have higher trait NA nor PA. This finding was consistent with previous studies with a between-person approach, which did not find an association between trait stuttering severity and trait emotions (Manning & Beck, 2013; Craig et al., 2015). Trait NA and PA were typically related to negative temperament and aspects of personality such as neuroticism or extraversion (Lonigan & Philips, 2001; Bijttebier et al., 2009). The current finding could suggest that having higher or lower stuttering severity did not necessarily point to a certain temperament or personality. Instead, at the within-person level of analysis, a momentary increase in stuttering could momentarily elevate NA and PA among AWS. However, the causal direction and mechanism of the associations require further investigation.

5. Limitations

This study investigated the association between self-perceived stuttering severity and emotions (PA/NA) in daily life. The sample of AWS for the current pilot study was a convenient sample recruited through the National Stuttering Association and through snowball sampling. Therefore, it is unknown whether the findings generalize to the entire diverse population of people who stutter. Future studies with a bigger sample size can help us determine whether the strength of within- and between-person associations differs by the type of occupations and by participants' therapy history. In addition, future studies can investigate stuttering and affect variation within the context of the emotion dysregulation model (Hofmann et al., 2012). The model suggests that AWS who experience higher trait social anxiety and depressive symptoms would exhibit greater emotion dysregulation in daily social interactions, experiencing higher NA and lower PA during social interactions.

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