Co-Occurring Conditions among Young Adults who Stutter

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which conditions take divergent paths and resolve during childhood. Additional insights are possible through utilization of patient reported data, particularly when inferences can be made to the population based on analyses of that data [26]. To our knowledge, few studies have targeted young adults in the 24-to-32-year age range using a nationally representative sample of self-reported data. Gerlach et al. (2018) reported on elevated ADHD and learning disability among PWS in the same dataset as being used for the current project. However, their analysis focused on labor market outcomes among PWS and did not extend beyond the descriptive level for those two variables. is study lls a gap in the existing literature by exploring the incidence of co-existing conditions, self-reported by PWS and people who do not stutter (PWNS). is analysis will add to previous ndings, which showed increased incidence of non-speech related conditions primarily via secondary reports, by examining self-reported data of young adults with stuttering. Self-reported data decreases interpretation bias introduced in secondhand reports and incorporates a comprehensive individual perspective that is missing in electronic health records (EHR) [27,28]. Addressing these issues, using self-reported measures, among a sample of young adults precludes the possibility that the presence of coexisting conditions is in uenced by secondhand reports.

Method

Study sample

To appropriately address the incidence of stuttering and other conditions in self-reports from young adults, this study utilized data from the National Longitudinal Study of Adolescent to Adult Health (ADD Health)-a nationally-representative, longitudinal panel of the US population containing self-reported information on social, economic, psychological, and physical well-being as well as contextual information on the family, neighborhood, community, school, friendships, peer groups, and romantic relationships. ADD Health followed a sample of 12,105 adolescents in 7th to 12th grade during the 1994-1995 school years (ages 12 to 17) with four in-home interviews occurring at irregular intervals. Wave I was collected in 1994/95 when participants were 12 to 17 years old. Waves II and III were collected in 1996 and 2001/02, respectively. is study utilizes Wave IV which was collected in 2008 when respondents were 24 to 32 years old. While each wave consisted of a slightly di erent questionnaire with a di erent focus, Wave IV Section 6: Illness, Medications, and Physical Disabilities included detailed information on participants' medical diagnoses and condition status. For additional information on the ADD Health survey and sampling process, see http://www.cpc.unc.edu/projects/addhealth/design.

ADD Health has been used extensively to study a variety of topics related to stuttering and characteristics of PWS. Studies concerning labor market outcomes [29,30], aggressive behavior [31], sleep patterns [32,25], depression and suicidal ideation [24], and esophagus-muscularis tissue variation [33] among PWS used these data to generate robust ndings and unique di erences between those who do and do not stutter. However, to date, no research has used ADD Health to evaluate di erences in the prevalence of asthma, ADD/ADHD, anxiety, depression, and epilepsy.

Identi cation of stuttering

e survey item regarding stuttering was only included in ADD Health Waves III and IV. In these waves, respondents were asked the question 'Do you have a problem with stuttering or stammering?' To identify individuals with stuttering and to ensure that individuals did not misidentify themselves as a PWS, individuals in this study were only classi ed as a PWS if they reported 'yes' to the survey question regarding stuttering in both waves. is classi cation scheme resulted in 261 PWS (unweighted), which represents 1.8 percent of the sample. Descriptive statistics for key variables of PWS and PWNS are provided in Table 1.

Demographic characteristics

Demographic characteristics include respondents' sex, age, race, and ethnicity. e sample was 47% male and over 25% minority race/ethnicity. Di erences were present in the composition of people who do and do not stutter as a function of race. Speci cally, Hispanics and African Americans, comprised roughly 14% and 29% of PWS, respectively, compared to comprising roughly 11% and 14% of PWNS, (African American: χ^2=18.66, p<0.0001; Hispanic: χ^2=4.88, p=0.003), respectively. Stuttering was also more prevalent among males than females who made up 60% of PWS, (χ^2=19.44, p=0.002). Average age was 28 (sd=0.12) years with little di erence between PWS and PWNS, (t=0.94, p=0.35).

Income

Respondents provided an estimate of their personal, pre-tax earnings which included wages or salaries, including tips, bonuses, and overtime pay, and income from self-employment. Average earnings were $35,766.34 (sd=$45,526.51) per year for PWNS. PWS earned signi cantly less with annual earnings reported at $29,182.14 (sd=$65,168.91) (t=15.47, p<0.0001). In the regression model, income was included in logarithmic form to account for potential socioeconomic di erences.

Parental characteristics

Nearly all parents of PWNS (96%) were married compared to only 90% of parents of PWS-a statistically signi cant di erence (χ^2= 9.6, p=0.002). Education is represented by a set of discrete values ranging from one to nine. ese values represent the number of years of post-secondary education. On average, parents of PWNS (5.6, sd=0.10) had greater educational attainment than parents of PWS (4.7, sd=0.26), a statistically signi cant di erence (χ^2= 20.8, p=0.013).

Co-Occurring conditions

Section 6 of the Wave IV ask respondents whether a doctor, nurse, or other health care provider has ever diagnosed him/her with a condition, which included the following ve conditions: asthma, ADD/ADHD, anxiety, depression, and epilepsy. Conditions in this section were selected since they were self-reported, maintained a uniform questioning framework, and presented clear criteria for diagnosis.

Analysis

All analyses were performed using SAS 9.4 (Cary, NC) proc survey logistic. e ADD Health study design used a clustered sample in which the clusters were sampled with unequal probability. While reducing the cost of data collection, this design complicates the statistical analysis because the observations are no longer independent and identically distributed. To analyze the data correctly requires the use of special survey so ware packages speci cally designed to handle observations that are not independent and identically distributed.

e proc survey logistic procedure estimated the logistic regression model taking the survey design and data collection methods into account. In addition to survey procedures that accounted for

sampling variation, estimates were also weighted. e ADD Health sampling weights were designed to turn the sample of adolescents interviewed into the representative population we intended to study. Unless appropriate adjustments are made for sample selection and participation, estimates from analyses using the ADD Health data can be biased when any factor used as a basis for selection as a participant in the study also in uences the outcome of interest. To obtain unbiased estimates, it is important to account for the sampling design by using analytical methods designed to handle clustered data collected from respondents with unequal probability of selection.

By using these sampling weights and model speci cations that account for regional strati cation and the clustering of adolescents within schools, analysis produced unbiased estimates of population parameters and standard errors. Regression analysis tested for di erences in the incidence of co-occurring conditions in PWS and PWNS, controlling for age, race, sex, parental attributes, and income. Five logistic regressions (one for each condition) were run using the same empirical speci cation to evaluate each condition individually. e regression modeled a binomial outcome coded as 0 or 1 to indicate whether each respondent reported the condition of interest. e model was used to obtain the odds ratio which indicates the relative likelihood of the dependent variables, adjusting for the independent variables.

Results

PWS had a higher proportion of asthma (15.7% vs. 14.3%), ADD/ADHD (10% vs. 4.5%), anxiety (16.1% vs 11.2%), depression (25.3% vs. 14.6%), and epilepsy (2.3% vs. 1.2%) compared to PWNS (Table 1). However, di erences in the portion of the populations with these conditions were only statistically signi cant for ADD/ADHD (χ^2=2.5, p<0.001), anxiety (χ^2=6.1, p=0.01), and depression (χ^2=23.3, p<0.001) (Table 2). e disparity in anxiety incidence between PWS and PWNS is depicted in Figure 1.

Table 1:

	N	Mean	Std Dev			
Age		28.30001				
logIncome		10.16558				
Parent Education	8997	5.517258				
	N	**Percent**				
Male		0.467087				
Stutter		0.018332				
Hispanic						
African American						
Parent Married		0.959855				
Asthma						
Depression						
Anxiety						
Epilepsy	180					
	N	**Mean**	**Std Dev**	**N**	**Mean**	**Std Dev**
Age		28.30024	0.118645		28.6287	
logIncome	8547		0.024855		9.862164	0.133098
Parent Education	8271	5.574082				
	N	**Percent**		**N**	**Percent**	
Mal		0.45818			0.598926	
Hispanic		0.106683			0.143098	
African American					0.283934	
Parent Married	8302	0.963178			0.898188	
Asthma		14.28				
Depression	2098	14.58				
Anxiety						
Epilepsy						
ADD/ADHD						

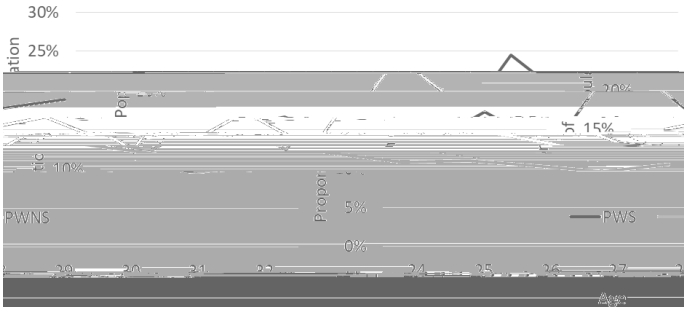

Figure 1:

Table 2: Chi-square test of differential between young adults who do and do not

	Chi-Square	*p*-Value
ADD/ADHD		

Logistic regression results modeled the probability of reporting the condition accounting for demographic and parental di erences (Table 3). In the results from these regression models, a positive coe cient represented a higher log-odds ratio of the given characteristic for the respective parameter. For ease of interpretation, odds ratios were provided which quantify the relative probability of the condition given the independent characteristic. Income was signi cant for asthma, ADD/ADHD, anxiety, depression, and epilepsy. While there were some small di erences in the racial/ethnic probability of these conditions, most demographic and parental characteristics were insigni cant.

Stuttering had a statistically signi cant association with asthma (OR=2.1, CI= 1.04-4.27), ADD/ADHD (OR=2.3, CI=0.94-5.77), anxiety (OR=1.7, CI=0.90-3.34), and depression (OR=2.2, CI=1.19-3.9) at the 95% level. Odds ratios represented the likelihood of PWS having been diagnosed with a given condition relative to PWNS. Ratios less than one indicated that PWS had a lower probability of having the condition. Odds ratios in Table 3 indicated that PWS had a higher likelihood of having asthma, ADD/ADHD, anxiety, and depression compared to PWNS.

Discussion

is study examined the incidence of ve self-reported conditions among PWS and PWNS. Findings suggest that PWS have increased odds of experiencing asthma, ADD/ADHD, anxiety, and depression. Previous analyses have examined similar conditions among CWS; however, this study extends those ndings by examining co-occurrences that were self-reported by those in young adulthood.

Conditions with a signi cantly di erent representation between people who do and do not stutter

Asthma

Previous studies have helped to uncover a relationship between the

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system, which is also involved in ADHD [43]. Additionally, stuttering and ADHD share characteristics of occurring more frequently in males and being exacerbated by stress [20]. Of interest are questions related to the neurobiological similarities and di erences in all combinations of male and female children, including those who do and do not stutter and those with and without ADHD. Future studies addressing these questions might provide critical pathophysiological evidence, contributing to etiological research.

Clinically, identi cation of co-occurring ADHD in PWS prompts additional considerations for SLPs since over two-thirds of individuals with ADHD su er from at least one co-existing condition and up to half of children with ADHD also su er from a learning disorder [44]. For example, in the presence of a suspected learning disorder rooted in reading di culty, it should be determined if de cits in reading outcomes are a result of a true delay or if stuttering behaviors are mirroring di culties in decoding (Blood et al., 2003). at is, are breaks in speech resulting from reduced reading uency or in stuttering induced breaks in the forward ow of speech. Determination of the presence of ADHD may also result in divergent clinical approaches. For example, de cits in reading ability may prompt usage of sentence formulation tasks over reading passages as stimuli used in therapy when learning/practicing behavioral techniques. If the determination is that the reader's behaviors are resulting from stuttering and not reading di culty, then a clinical approach may be to use passages with increased linguistic complexity as the PWS' work towards implement motoric adaptations while taxing the system with complex stimuli. e complex interactions of symptoms described above are not limited to stuttering and reading di culty and the association between stuttering and the common coexisting conditions of ADHD should be considered in this context. Clinical awareness of high rates of co-occurring ADHD among PWS is imperative given that di erences in attributes of ADHD call for varying clinical approaches [20], and the presence of ADHD symptoms may necessitate longer durations of intervention when reduction of observable behaviors of stuttering is included as an outcome measure [19]. Ultimately, any behavioral adaptation (e.g., cancellations, prolonged speech, preparatory sets, etc.) [45] can be negatively in uenced by ADHD, where distractibility or lack of attention creates a barrier to learning and implementation of these behavioral changes. While ADD/ADHD among PWS is biological in nature, the higher incidence of anxiety among young AWS in the present sample is more likely a result of stuttering instead of being a true co-occurring disorder [46].

Anxiety/panic disorders and depression

Findings of increased anxiety among those in the current sample were consistent with other studies indicating that anxiety is more prevalent among all ages of PWS [46-50]. Previous ndings merged with current results suggest that PWS are at risk of developing anxiety early in life and potentially having it persist into adulthood. e anxiety experienced by both children and young AWS is likely generated from both internal and external contributors and relates to both the reaction they receive from others and the feelings they experience when communicating [51,52]. Anxiety may be undue and a result of false perceptions of how others would perceive or respond stuttering. Additionally, anticipation of stuttering can lead to anxiety [2, 49,53]. In both children and adults who stutter, anxiety can be a precursor to avoidance behaviors [54,55].

Importantly, anxiety in PWS is not dependent on severity of stuttering's observable behaviors [48]. Furthermore, evidence that anxiety exists in childhood and adulthood among PWS indicates that these common di culties o en go unnoticed or untreated, increasing the likelihood that these issues worsen in severity, impede social development, negatively impact labor market outcomes, and interfere with social function [56-58]. e current ndings concerning adults echo ndings from studies showing issues of social and emotional well-being among CWS [59]. erefore, early identi cation and treatment of anxiety among PWS is critical. While unhealthy thoughts, feelings, and/or reactions to stuttering may, at times, not receive equal consideration to more overt symptomatology, these unobservable behaviors could potentially be detrimental to long-term social, emotional, and behavioral well-being. Fear of social situations and negative peer evaluation contribute to social anxieties [60,61], and comprehensive treatment during the developmental years could reduce these negative impacts in young adults, thus improving long term quality of life for PWS. Treating SLPs should consider the full range of impact of stuttering on the individual [62], and healthcare providers treating young PWS should carefully screen for and address all pertinent issues to prevent persistence and/or exacerbation as PWS age. is type of comprehensive treatment goes beyond traditional behavioral therapies and aids in addressing the full impact of stuttering [63]. Once a client has learned to modify speech patterns to work through moments of stuttering, an approach to directly work towards reducing anxiety is exposure therapy [64]. Another critical aspect of treatment in CWS or young AWS who still live with their parents is parental involvement [65], and this is especially important for PWS who are susceptible to feelings of anxiety in social situations.

While commonly co-occurring, anxiety and depression represent two separate constructs [66]. Anxiety includes negative cognitive, behavioral, and physiological reactions in response to a threat [67]. Depression involves a range of symptomatology that impacts feelings, thoughts; lasts at least two weeks; and results in a change in prior functioning [68]. Stein et al. (2001) reported that social anxiety disorder early in life is a predictor of depression later in life [69]. While data cannot be used to determine causality of reported depression in the current sample, it is not di cult to imagine a scenario where the anxieties induced by the ubiquitous nature of stuttering (not fEs n5y o pattth wohoodi includes n market Anxiety While6anxiety am thr

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