

Research Note

The Coexistence of Disabling Conditions in Children Who Stutter: Evidence From the National Health Interview Survey

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Purpose: Stuttering is a disorder that has been associated with coexisting developmental disorders. To date, detailed descriptions of the coexistence of such conditions have not consistently emerged in the literature. Identifying and understanding these conditions can be important to the overall management of children who stutter (CWS). The objective of this study was to generate a profile of the existence of disabling developmental conditions among CWS using national data.

Method: Six years of data from the National Health Interview Survey (2010–2015) were analyzed for this project. The sample consisted of children whose respondents clearly indicated the presence or absence of stuttering. Chi-square tests of independence were used for comparing categorical variables; and independent-samples *t* tests, for comparing continuous variables. Multiple logistic regression analyses were used for determining the odds of having a coexisting disabling developmental condition.

Results: This study sample included 62,450 children, of which 1,231 were CWS. Overall, the presence of at least 1 disabling developmental condition was 5.5 times higher in CWS when compared with children who do not stutter. The presence of stuttering was also associated with higher odds of each of the following coexisting developmental conditions: intellectual disability (odds ratio [OR] = 6.67, $p < .001$), learning disability (OR = 5.45, $p < .001$), attention-deficit hyperactivity disorder/attention-deficit disorder (OR = 3.09, $p < .001$), seizures (OR = 7.52, $p < .001$), autism/Asperger's/pervasive developmental disorder (OR = 5.48, $p < .001$), and any other developmental delay (OR = 7.10, $p < .001$).

Conclusion: Evidence from the National Health Interview Survey suggests a higher prevalence of coexisting developmental disabilities in CWS. The existence of coexisting disabling developmental conditions should be considered as part of an overall management plan for CWS.

Stuttering is a communication disorder that typically emerges in early childhood (Yairi & Ambrose, 2013). The incidence of this disabling disorder is generally accepted to be around 5% of the U.S. population (Guitar, 2014), with the lifetime prevalence generally accepted to be approximately 1% of the U.S. population (Guitar, 2014). People who stutter (PWS) oftentimes experience observable behaviors including repetitions, prolongations, and audible and inaudible postural fixations (Perkins, 1990; Yaruss & Quesal, 2004). In addition to the listener observed behaviors, individuals who stutter also experience disabling avoidance behaviors that are only perceived by the speaker

(Murphy, Quesal, & Gulker, 2007; Petrunik & Shearing, 1983; Starkweather, 1987). When stuttering persists into adulthood, the combination of observable and unobservable behaviors may interact individually or simultaneously to negatively impact the lives of PWS. Therefore, many PWS have decreased aspirations as well as altered vocations and relationships (Hayhow, Cray, & Enderby, 2002; Klein & Hood, 2004; Petrunik & Shearing, 1983).

Beyond the difficulties that exist from the experience of stuttering, evidence suggests that many PWS, particularly children, also exhibit co-occurring disorders. Arndt and Healey (2001) found that 44% of over 450 children who stutter (CWS) had other impairments beyond stuttering, such as language and phonological disorders. Blood, Ridenour, Qualls, and Hammer (2003) sampled 2,000 speech-language pathologists employed in public school settings and found that 62.8% of a sample of 2,628 CWS had other impairments such as articulation and phonological disorders, language disorders, learning disabilities, and attention-deficit disorders (ADDs). Finally, Boulet, Boyle, and Schieve

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(2009) found that 50.9% of CWS had a co-occurring developmental delay using data from the National Health Interview Survey (NHIS) over a 9-year period.

Understanding the presence of coexisting disorders among CWS is important because the presence of these conditions can influence how CWS are managed holistically. Yet, large-scale and detailed descriptions of childhood conditions or disorders associated with stuttering using national data have not consistently emerged in the literature. Some suggest that conditions such as stuttering should be profiled using national samples to better understand (a) the overall disease burden, (b) how the condition changes over time, (c) what financial resources are needed to manage the condition, and (d) how financial resources should be allocated and utilized to address the condition (Thacker et al., 2006). To our knowledge, other than Boulet et al. (2009), no previous study has utilized national data to specifically profile the coexistence of disabling developmental conditions among CWS. One previous study has utilized national data to calculate the prevalence of stuttering and other developmental disabilities in U.S. children (Boyle et al., 2011); however, it did not specifically emphasize the coexistence of disorders among CWS. Additionally, because of the coexistence of other disabling developmental conditions, management plans must emphasize the range of disorders collectively rather than the focused management of individual disorders. More comprehensive approaches are better suited to achieve the most optimal outcomes.

The objective of this project was to generate a profile of the coexistence of disabling developmental conditions among CWS using national data. In this study, we utilized merged data from the 2010–2015 NHIS (Centers for Disease Control and Prevention [CDC], National Center for Health Statistics, 2010–2013, 2014, 2015a) to characterize the prevalence of coexisting conditions. We anticipate that the information obtained from this study will assist clinicians in better understanding the complex nature of the condition. It is anticipated that the information will assist with advocacy efforts to ensure the necessary financial resources are available to facilitate optimal management and outcomes. This study was completed utilizing a health services research (HSR) approach. HSR sits at the intersection of health practice patterns, patient outcomes, and health policy (Graham, Middleton, Roberts, Mallinson, & Prvu-Bettger, 2018). HSR is vitally important to speech-language pathologists as it informs them of trends that may impact the type and outcome of care that is provided to patients.

Method

Study Sample

Data from the 2010–2015 NHIS were analyzed for this project. The NHIS is an annual national survey of approximately 35,000–40,000 households conducted by the National Center for Health Statistics. The survey utilizes multistate sampling methods to determine which households will be sampled. Broadly, each state is assigned primary

sampling units, which are either counties or a state's equivalent to a county (Parsons et al., 2014). These primary sampling units are then stratified from which sampling takes place. The intent of stratification was to create dependable statistics for minority groups (Parsons et al., 2014). From each selected household, one sample child is randomly selected if there are any children present under the age of 18 years. This survey samples new participants each year and is designed to monitor the health of U.S. adults and children. The NHIS utilizes a large-scale household interview survey approach of U.S. citizens who are not residents of corrective institutions, mental institutions, or facilities housing older adults. The survey excludes active duty personnel. This sample included data from the 2010–2015 NHIS' sample child file and includes core questions concerning relevant health issues that annually remain consistent. Detailed information regarding data, questionnaires used in the survey, and related documentation can be found on the National Center for Health Statistics website (CDC, National Center for Health Statistics, 2017). Information pertaining to the sample child is collected from a well-informed caregiver or adult who resides in the child's household (CDC, National Center for Health Statistics, 2015b). The sample reported here only included children where the respondents answered "yes" or "no" to the following question: "During the past 12 months, has [child name] had any of the following conditions...stuttering or stammering?" To simplify language, those answering "yes" to the above question will be considered CWS and those answering "no" to the above question will be considered children who do not stutter (CWNS).

Data Description

All data were based on self-report from caregivers or adults residing in the household of the children in the survey. Demographic characteristics are provided in detail for each separate year of the NHIS survey and for the three age categories defined in the following section.

Demographic Characteristics

Gender, race, age, geographical region, highest level of education completed by an adult in the family, family income, and presence/absence of stuttering were reported by the caregivers. For comparisons between CWS and CWNS, age was organized and reported in three age categories: 3–5, 6–10, and 11–17 years.

Coexisting Disabling Developmental Conditions Found in CWS

The presence of other disabling developmental disorders as reported by the caregivers was collected during the survey. Conditions examined and reported in the NHIS include (a) intellectual disability, (b) learning disability, (c) attention-deficit/hyperactivity disorder (ADHD)/ADD, (d) seizures, (e) autism/Asperger's/pervasive developmental disorder (PDD), and (f) any other developmental delay. Specifically, respondents were asked, "Has a doctor or

health professional ever told you that [child name] had (a) an intellectual disability; (b) ADHD or ADD; (c) autism, Asperger's disorder, PDD, or autism spectrum disorder; or (d) any other developmental delay?" For identification of learning disability and seizures, respondents were asked, (a) "Has a representative from a school or a health professional ever told you that [child name] had a learning disability?" and (b) "During the past 12 months, has [child name] had any of the following conditions...seizures?" Those children included in this sample were those whose caregivers answered "yes" or "no" to the questions regarding the presence of each of the coexisting developmental conditions.

Data Analysis

All analyses were conducted with SPSS Version 22 (International Business Machines, 2013), accounting for the complex sampling design of the NHIS. All data were weighted, and the sampling design was specified in SPSS to account for the complex sample design utilized by the NHIS. Gender, race, age, geographical region, highest level of education completed by an adult in the family, family income, and the presence of coexisting disabling developmental conditions were compared between the two groups (CWS and CWNS) and reported in percentages for each variable. Each of these variables was also compared within each of the three age categories: 3–5, 6–10, and 11–17 years. The data analysis approach was chi-square test of independence for comparing categorical variables and independent-samples *t* tests for comparing continuous variables. Multiple logistic regressions were performed, while controlling for gender, race, parent education, and total family income, to determine the odds of having a coexisting condition.

Results

Demographic Characteristics

The 2010–2015 NHIS data included 62,450 children, among whom were 1,231 CWS (2.0%). Males comprised 51.0% of the total sample, and a significant difference was present, $\chi^2(1, N = 62,450) = 141.24, p < .001$, when comparing the percentage of males in the sample of CWNS with that in the sample of CWS (50.7% vs. 67.8%, respectively). The majority of the total sample was composed of White children (74.6%), and significant racial differences were present, $\chi^2(4.83, N = 62,450) = 145.06, p < .001$, in the composition of CWNS and CWS for White children (74.8% vs. 65.2%, respectively), Black children (14.5% vs. 26.1%, respectively), and Asian children (4.9% vs. 2.4%, respectively). The mean age for the total sample was 9.99 ($SD = 4.32$) years. On average, the CWS were younger ($M = 8.84$ years, $SD = 4.09$ years) than the CWNS ($M = 10.01$ years, $SD = 4.32$ years), and this difference was significant, $t(62,448) = 10.18, p < .001$. The makeup of CWNS and CWS differed significantly, $\chi^2(2.93, N = 62,450) = 22.49, p < .001$, according to geographic region in which there was a higher percentage of CWS (42.9%) than CWNS (37.1%)

in the South. Data on the highest level of education of an adult in the family indicated a significant difference between CWS and CWNS, $\chi^2(9.55, N = 62,450) = 179.21, p < .001$, where parents of CWS (18.1%) were more likely to not have graduated from high school than CWNS (11.9%). Parents of CWNS (38.1%) were also more likely to have earned at least a bachelor's degree than parents of CWS (22.4%). Family income differed significantly, $\chi^2(3.94, N = 62,450) = 240.01, p < .001$, between CWNS and CWS. The greatest discrepancy was in the \$0–\$34,999 range, where the percentage of CWNS (29.3%) in this category was lower than the percentage of CWS (49.1%). Those providing information to the survey questions for the 2010–2015 surveys consisted primarily of parents (biological, adoptive, or step; 90.9%) or a grandparent (5.8%). Lastly, there was a significant difference in the presence of stuttering across age groups, $\chi^2(1.97, N = 62,450) = 78.21, p < .001$. The greatest presence of stuttering in the total sample was found in the 3- to 5-year age range (2.6%), compared with those found in the 6- to 10-year (2.3%) and 11- to 17-year (1.4%) age ranges. See Table 1 for a breakdown of demographic information by year, and see Table 2 for a breakdown of demographic information by age group.

Coexisting Disabling Developmental Conditions Found in CWS

The presence of coexisting disabling developmental conditions was significantly higher among CWS when compared with CWNS. Nearly 52% of the CWS reported at least one disabling developmental condition compared with only approximately 15% of the CWNS. Additionally, approximately 29% of the CWS reported at least two disabling developmental conditions compared with approximately 6% of the CWNS. Significant differences were present for each of the coexisting conditions. Specifically, 7.6% of the CWS reported having an intellectual disability, 32.9% reported the presence of a learning disability, and 25.6% indicated the presence of ADHD/ADD. The sample was also composed of 5.3% of CWS indicating the presence of seizures, 8.0% reporting the presence of autism/Asperger's/PDD, and 23.9% reporting any other developmental delay (see Table 3). In logistic models, with CWNS within the previous 12 months as the reference group and controlling for gender, race, parent education, and total family income, CWS were more likely to suffer from each of the coexisting disabling developmental conditions. The odds of having at least one disabling developmental condition were higher among CWS (odds ratio [*OR*] = 5.55, 95% CI [4.72, 6.52]). Additionally, the odds of having specific disabling developmental conditions were higher among CWS, such as intellectual disability (*OR* = 6.67, 95% CI [5.05, 8.82]), learning disability (*OR* = 5.45, 95% CI [4.62, 6.44]), ADHD/ADD (*OR* = 3.09, 95% CI [2.57, 3.71]), seizures (*OR* = 7.52, 95% CI [5.45, 10.38]), autism/Asperger's/PDD (*OR* = 5.48, 95% CI [4.16, 7.22]), and any other developmental delay (*OR* = 7.10, 95% CI [5.92, 8.52]; see Table 4).

Table 1. Demographic characteristics for children who do not stutter (CWNS) and children who stutter (CWS) in the 2010–2015 National Health Interview Survey.

Sample	Total		2010		2011		2012	
Unweighted	CWNS = 61,219	CWS = 1,231	CWNS = 8,998	CWS = 189	CWNS = 10,306	CWS = 217	CWNS = 10,681	CWS = 220
Weighted %	2.0		2.1		2.2		1.9	
Gender								
Male	50.7	67.8	50.7	66.4	50.7	64.5	50.7	70.9
Female	49.3	32.2	49.3	33.6	49.3	35.5	49.3	29.1
	$p < .001$		$p = .001$		$p = .003$		$p < .001$	
Race								
White	74.8	65.2	75.9	64.2	75.0	68.7	74.8	64.5
African American	14.5	26.1	14.5	27.7	14.7	25.7	14.0	25.6
American Indian/ Alaska Native	1.1	1.8	0.9	1.7	1.2	0.5	1.4	1.7
Asian	4.9	2.4	4.5	2.2	4.8	3.0	4.8	1.7
Multiple	4.4	4.4	4.1	3.8	4.1	1.7	4.9	6.5
Not released	0.2	0.2	0.2	0.5	0.2	0.4	0.3	0.0
	$p < .001$		$p < .001$		$p = .002$		$p < .001$	
Age (3–17 years)								
<i>M</i> (<i>SD</i>)	10.01 (4.32)	8.84 (4.09)	9.97 (4.35)	8.72 (3.99)	9.91 (4.36)	9.00 (4.19)	10.08 (4.30)	8.54 (3.96)
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Region								
Northeast	15.9	12.2	15.6	15.0	16.5	10.5	16.8	12.4
Midwest	23.1	21.3	24.2	19.5	23.6	22.5	22.6	18.1
South	37.1	42.9	35.4	39.4	36.1	44.9	36.9	47.2
West	23.9	23.6	24.7	26.0	23.8	22.1	23.7	22.3
	$p = .003$		$p = .669$		$p = .143$		$p = .076$	
Highest education of an adult in the family								
≤ 8th grade	2.9	5.3	2.7	6.2	3.3	3.9	3.0	5.0
9th to 12th grade (no diploma)	7.0	12.8	7.6	14.9	7.1	16.1	7.3	12.2
High school graduate or GED	18.8	23.0	19.8	22.0	19.4	21.6	18.6	23.4
Some college, no degree	18.9	21.7	19.3	22.0	18.7	23.1	19.4	23.0
AA degree, technical or vocational	9.3	9.5	9.2	12.5	9.3	7.0	9.7	10.0
AA degree, academic program	4.8	5.2	4.6	4.6	5.1	6.6	5.1	4.8
Bachelor's degree	21.8	12.5	21.7	9.8	21.5	14.1	21.3	11.3
Master's, professional, or doctoral degree	16.3	9.9	15.0	8.0	15.5	7.5	15.4	10.4
Refused/don't know	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
	$p < .001$		$p = .002$		$p = .002$		$p = .034$	
Total combined family income								
\$0–\$34,999	29.3	49.1	30.9	54.4	30.8	54.5	30.3	50.1
\$35,000–\$74,999	28.1	24.6	29.4	20.1	29.8	19.9	28.4	28.3
\$75,000–\$99,999	12.0	8.0	12.0	12.5	11.7	7.8	12.8	6.8
\$100,000 and over	24.3	14.0	23.2	11.2	22.8	15.7	23.6	12.8
Undefined/unknown	6.3	4.3	4.4	1.7	4.9	2.1	4.8	2.0
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	

Note. AA = Associate of Arts degree; GED = General Educational Development high school equivalency diploma.

Table 1. (Continued).

Sample	2013		2014		2015	
Unweighted	CWNS = 10,436	CWS = 214	CWNS = 10,835	CWS = 205	CWNS = 9,963	CWS = 186
Weighted %	1.9		1.8		1.9	
Gender						
Male	50.6	67.3	50.8	66.5	50.6	71.5
Female	49.4	32.7	49.2	33.5	49.4	28.5
	$p < .001$		$p = .002$		$p < .001$	
Race						
White	74.6	63.3	74.2	67.3	74.2	63.0
African American	14.7	26.8	14.6	25.6	14.5	24.8
American Indian/ Alaska Native	1.0	1.5	1.2	2.3	1.1	3.1
Asian	5.0	2.8	5.2	1.6	5.3	3.0
Multiple	4.5	5.6	4.5	3.2	4.5	6.0
Not released	0.2	0.0	0.3	0.0	0.4	0.0
	$p = .012$		$p = .014$		$p = .013$	
Age (3–17 years)						
<i>M</i> (<i>SD</i>)	10.01 (4.29)	9.12 (4.37)	10.03 (4.31)	8.52 (4.02)	10.04 (4.33)	9.14 (3.92)
	$p < .001$		$p < .001$		$p < .001$	
Region						
Northeast	15.7	11.7	14.9	9.6	15.6	13.8
Midwest	22.8	24.2	22.5	22.2	22.8	21.3
South	38.0	42.4	38.5	43.1	37.8	40.2
West	23.6	21.6	24.1	25.1	23.7	24.7
	$p = .521$		$p = .421$		$p = .897$	
Highest education of an adult in the family						
≤ 8th grade	3.0	5.0	2.8	4.3	2.7	7.4
9th to 12th grade (no diploma)	7.0	9.3	6.9	15.5	6.2	8.5
High school graduate or GED	17.9	24.1	19.0	23.8	18.1	23.5
Some college, no degree	19.1	21.0	18.6	17.4	18.2	23.4
AA degree, technical or vocational	9.6	8.7	9.0	8.7	8.9	10.2
AA degree, academic program	5.0	5.2	4.3	4.9	4.9	4.9
Bachelor's degree	21.6	15.2	22.2	13.1	22.6	11.6
Master's, professional, or doctoral degree	16.6	11.5	17.0	12.2	18.3	10.5
Refused/don't know	0.1	0.0	0.2	0.0	0.1	0.00
	$p = .284$		$p = .013$		$p = .002$	
Total combined family income						
\$0–\$34,999	29.7	48.0	28.3	42.0	26.0	44.0
\$35,000–\$74,999	28.0	27.0	26.5	26.5	26.2	26.6
\$75,000–\$99,999	12.5	5.9	11.4	12.1	11.3	3.1
\$100,000 and over	24.7	13.2	25.4	13.6	26.3	17.6
Undefined/unknown	5.1	5.8	8.4	5.8	10.2	8.7
	$p < .001$		$p = .013$		$p < .001$	

Table 2. Demographic characteristics, sorted by age groups, for children who do not stutter (CWNS) and children who stutter (CWS) in the 2010–2015 National Health Interview Survey.

Sample	Total		Ages 3–5 years		Ages 6–10 years		Ages 11–17 years	
Unweighted	CWNS = 61,219	CWS = 1,231	CWNS = 12,047	CWS = 344	CWNS = 18,910	CWS = 437	CWNS = 30,262	CWS = 450
Weighted %	2.0		2.6		2.3		1.4	
Gender								
Male	50.7	67.8	50.4	62.5	50.4	72.2	51.0	66.8
Female	49.3	32.2	49.6	37.5	49.6	27.8	49.0	33.2
	$p < .001$		$p < .001$		$p < .001$		$p = .001$	
Race								
White	74.8	65.2	73.2	66.2	74.7	67.4	75.5	61.8
African American	14.5	26.1	15.1	24.8	14.3	23.9	14.4	29.5
American Indian/Alaska Native	1.1	1.8	1.0	1.8	1.2	1.7	1.1	1.9
Asian	4.9	2.4	5.1	2.1	4.9	2.7	4.9	2.2
Multiple	4.4	4.4	5.4	4.9	4.5	4.2	3.9	4.3
Not released	0.2	0.2	0.2	0.1	0.3	0.1	0.2	0.3
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Age (3–17 years)								
<i>M</i> (<i>SD</i>)	10.01 (4.32)	8.84 (4.09)	4.01 (0.815)	4.02 (0.797)	8.02 (1.41)	7.88 (1.37)	14.01 (1.99)	13.68 (1.97)
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Region								
Northeast	15.9	12.2	15.6	12.2	15.7	12.1	16.1	12.4
Midwest	23.1	21.3	22.4	15.5	23.3	21.8	23.2	25.3
South	37.1	42.9	37.5	48.9	37.4	42.8	36.8	38.2
West	23.9	23.6	24.5	23.4	23.6	23.3	23.9	24.2
	$p = .003$		$p = .004$		$p = .257$		$p = .366$	
Highest education of an adult in the family								
≤ 8th grade	2.9	5.3	3.0	2.6	3.2	7.1	2.7	5.2
9th to 12th grade (no diploma)	7.0	12.8	7.3	14.7	7.4	12.2	6.7	12.1
High school graduate or GED	18.8	23.0	19.6	21.7	18.5	27.2	18.7	19.1
Some college, no degree	18.9	21.7	18.1	23.7	18.5	19.5	19.7	22.7
AA degree, technical or vocational	9.3	9.4	8.7	11.3	9.3	6.7	9.5	11.4
AA degree, academic program	4.8	5.2	4.8	5.1	4.6	5.0	5.0	5.5
Bachelor's degree	21.8	12.5	21.5	9.3	21.5	12.5	22.2	15.0
Master's, professional, or doctoral degree	16.3	9.9	16.9	11.5	17.1	9.8	15.5	8.9
Refused/don't know	0.1	0.0	0.2	0.0	0.1	0.0	0.1	0.0
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Total combined family income								
\$0–\$34,999	29.3	49.1	33.7	46.9	31.1	52.0	27.0	47.5
\$35,000–\$74,999	28.1	24.6	28.4	22.8	28.6	22.6	28.2	27.4
\$75,000–\$99,999	12.0	8.0	12.4	11.5	11.7	6.5	12.0	8.2
\$100,000 and over	24.3	14.0	21.0	14.1	23.3	14.4	26.0	13.3
Undefined/unknown	6.3	4.3	4.5	4.9	5.4	4.5	6.8	3.7
	$p < .001$		$p = .004$		$p < .001$		$p < .001$	

Table 3. Coexisting disabling developmental conditions found in children who do not stutter (CWNS) and children who stutter (CWS) in the 2010–2015 National Health Interview Survey.

Coexisting developmental conditions	Total		Ages 3–5 years		Ages 6–10 years		Ages 11–17 years	
	CWNS = 61,219	CWS = 1,231	CWNS = 12,047	CWS = 344	CWNS = 18,910	CWS = 437	CWNS = 30,262	CWS = 450
Intellectual disability	1.0	7.6	0.5	2.4	0.8	5.1	1.3	14.4
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Learning disability	7.0	32.9	2.8	15.3	6.7	35.4	9.0	43.5
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
ADHD/ADD	8.6	25.6	1.9	10.5	8.4	29.4	11.6	32.9
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Seizures	0.7	5.3	0.9	6.9	0.5	5.4	0.7	3.9
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Autism/Asperger's/PDD	1.4	8.0	1.3	4.0	1.5	5.4	1.4	14.0
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Any other developmental delay	3.9	23.9	4.0	18.6	4.2	26.7	3.7	24.8
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	
Number of coexisting developmental conditions								
0	85.5	48.3	92.6	66.7	85.8	42.2	82.2	41.3
1	9.0	22.4	5.0	19.6	8.8	26.7	10.8	19.3
2 or more	5.5	29.3	2.4	13.7	5.4	31.1	7.0	39.4
	$p < .001$		$p < .001$		$p < .001$		$p < .001$	

Note. ADHD = attention-deficit/hyperactivity disorder; ADD = attention-deficit disorder; PDD = pervasive developmental disorder.

Table 4. Measures of odds ratio between stuttering and coexisting disabling conditions in children who stutter^a from the 2010–2015 National Health Interview Survey.

Coexisting developmental conditions	Total	Ages 3–5 years	Ages 6–10 years	Ages 11–17 years
	OR [95% CI] ^b			
Intellectual disability	6.67* [5.05, 8.82]	3.91* [1.73, 8.82]	5.57* [3.25, 9.53]	10.50* [7.45, 14.79]
Learning disability	5.45* [4.62, 6.44]	5.41* [3.79, 7.74]	6.15* [4.61, 8.19]	6.67* [5.15, 8.63]
ADHD/ADD	3.09* [2.57, 3.71]	4.97* [2.94, 8.39]	3.62* [2.76, 4.75]	3.28* [2.49, 4.33]
Seizures	7.52* [5.45, 10.38]	7.10* [3.89, 12.96]	11.08* [6.05, 20.27]	5.64* [3.40, 9.36]
Autism/Asperger's/PDD	5.48* [4.16, 7.22]	2.90* [1.66, 5.06]	3.35* [2.00, 5.61]	11.06* [7.43, 16.48]
Any other developmental delay	7.10* [5.92, 8.52]	5.34* [3.78, 7.56]	7.30* [5.41, 9.86]	8.20* [6.06, 11.10]
Number of coexisting developmental conditions				
1	2.58* [2.10, 3.16]	4.20* [2.81, 6.26]	3.25* [2.35, 4.48]	1.76** [1.28, 2.42]
2 or more	6.00* [4.99, 7.12]	5.62* [3.83, 8.25]	6.31* [4.66, 8.54]	7.64* [5.84, 9.99]

Note. ADHD = attention-deficit/hyperactivity disorder; ADD = attention-deficit disorder; PDD = pervasive developmental disorder.

^aChildren who did not stutter within the previous 12 months is the reference group. ^bOdds ratio adjusted for gender, race, parent education, and total family income.

* $p < .001$. ** $p = .001$.

Discussion

The objective of this study was to explore the coexistence of disabling developmental conditions among CWS using national data. The findings reported here indicate that the CWS frequently have coexisting disabling developmental conditions, generally at a higher rate, than CWNS. Similar to previous reports, higher rates of stuttering were present among males compared with females (Blood et al., 2003; Boulet et al., 2009). Household incomes and educational levels were lower among the respondents of CWS relative to those of CWNS. The findings related to educational level are similar to Boyle et al. (2011), who reported increased prevalence of stuttering associated with lower maternal education. They are, however, in contrast to Richels, Johnson, Walden, and Conture (2013), who found increased frequency and severity of overt stuttering to be associated with higher maternal education. Finally, the findings reported here coincide with those of Yairi and Ambrose (2013) and Boyle et al.—that the presence of stuttering diminishes with age. In the total sample, rates receded when comparing the presence of stuttering in 3- to 5-year-olds, 6- to 10-year-olds, and 11- to 17-year-olds. The remainder of the discussion will emphasize observations related to coexisting disabling developmental conditions.

Coexisting Disabling Developmental Conditions Found in CWS

Intellectual Disability

Although other studies of intellectual disability reported in CWS are limited, the present findings are in agreement with Boulet et al.'s (2009) report of 15.1% of CWS also having an intellectual disability or mental retardation. The literature suggests that both CWS and children with intellectual disabilities are prone to bullying in schools (Blood & Blood, 2004; Maïano, Aimé, Salvas, Morin, & Normand, 2016). This presents a management consideration, especially for

those children experiencing both of these conditions concurrently. These collective findings provide a rationale for further exploration to verify, refute, or clarify the relationship between stuttering and intellectual disability.

Learning Disability

The presence of a learning disability among CWS was within the wide range (11%–58%) previously reported. The presence of learning disability among CWS has not been consistent in previous studies, ranging from 11.4% (Blood et al., 2003) to 58% (Boulet et al., 2009). Consequently, the approaches utilized to calculate the reported rates should be considered. It is possible that the variability of approaches as well as data utilized may account for the variability in reports of learning disability. Regardless, the likelihood of CWS having a coexisting learning disability is greater than that found in CWNS.

ADHD/ADD

The reported presence of ADHD/ADD in the current sample of CWS was substantially higher than Arndt and Healey's (2001) previous report of CWS with ADHD/ADD (3.6%) and lower than Boulet et al.'s (2009; 43.1%). The coexistence of ADHD/ADD and stuttering is not entirely a surprise. A recent review by Alm (2014) concluded that certain characteristics are more present in CWS, namely, inattention and hyperactivity/impulsivity. Similar to observations with learning and intellectual disability, Polanczyk, Willcutt, Salum, Kieling, and Rohde (2014) noted that high variability exists in ADHD rates due to significant differences in data collection practices. Another possibility for this variability is the increased diagnosis of ADHD/ADD as compared with what was seen in the early 2000s (Visser et al., 2014).

Seizures

The reported presence of seizures in the sample of CWS is lower than Boulet et al.'s (2009) previous report

of 13.7%. Currently, there is limited evidence in the stuttering literature clarifying the relationship between stuttering and seizures. However, there is some evidence in the seizure literature that offers more detailed evidence. For example, Steinberg, Ratner, Gaillard, and Berl (2013) found that children with epilepsy exhibited a higher proportion of stutter-like symptoms than typical peers, when speaking in a narrative format, and Selassie, Hedström, Viggedal, Jennische, and Kyllerman (2010) observed stuttering behaviors among four of their study's 19 participants who also had seizure disorders. Despite this interesting and novel evidence, the relationship between stuttering and seizures is unclear and requires substantial study.

Autism/Asperger's/PDD

Similar to all other disabling developmental conditions, CWS exhibited a higher rate of autism/Asperger's/PDD. These findings are of significant interest because disfluent speech is a common characteristic of school-age children with autism (Scaler Scott, Tetnowski, Flaitz, & Yaruss, 2014). Yet, the relationship between the two conditions is unclear. The disfluency patterns that exist among CWS and children with autism differ both quantitatively and qualitatively (Scaler Scott et al., 2014). Consequently, careful consideration must be given to disfluency patterns among CWS and children with autism to ensure that evidence-based diagnostic decisions are being made. Similarly, avoidance behaviors that are common among CWS must be considered carefully and distinguished from commonly observed pragmatic issues among children with autism/Asperger's/PDD (Scaler Scott, 2017). Regardless, the established overlap between stuttering-related disfluencies and autism-related disfluencies requires further exploration.

Any Other Developmental Delay

Finally, the percentage of CWS who had been told that they had "any other developmental delay" is substantially lower than the 3.9% of "any other developmental delay" reported in CWNS. It is possible that this 23.9% does not include those children who belong in any of the previously listed categories, yet the wording of this question does not make this issue clear. Other developmental delays have been reported in the literature among CWS. For example, Blood et al. (2003) reported that 62.8% of the 2,628 CWS exhibited other speech-language and non-speech-language issues beyond stuttering. Arndt and Healey (2001) reported 44% of the included 467 children as having a phonological or language disorder in addition to stuttering. In Arndt and Healey's study, of the 262 children who did not have other verified conditions beyond stuttering, 42% were suspected as having other disorders. Although a significant percentage of CWS appear to have other developmental delays, the impact of these conditions on the presence of stuttering is not entirely clear.

The existence of comorbid conditions among CWS is present at a far higher rate than that among CWNS.

Determining the exact nature of the relationship between stuttering and other conditions is well beyond the scope of this article. However, there is some theoretical evidence offering a preliminary link between the conditions. Packman (2012) proposed the Packman and Attanasio three-factor model of moments of stuttering. The first factor of this model emphasizes impaired neural processes, which may include both neuroanatomical and neurophysiological irregularities. Therefore, it is possible that the high coexistence of conditions reported here is related to shared impaired neural processes across developmental conditions. This notion is supported by several works that suggest that stuttering is a condition with an underlying neurological etiology (Chang, Zhu, Choo, & Angstadt, 2015; Ingham, Ingham, Euler, & Neumann, 2017; Smith & Weber, 2016). Additionally, the coexistence of disorders may further indicate that stuttering is not caused by a disturbance of a distinct area of the brain. Rather, in some instances, stuttering may develop from disturbances along the extensive neural pathways used for speech production and overlaps with skills that are disrupted in other coexisting conditions (Smith & Weber, 2016). To adequately address these hypotheses, a systematic and programmatic line of research is required to better explain the relationships. Future studies should be designed to explore common neural substrates among these coexisting disorders. For example, studies should attempt to elucidate neurological differences among CWS with seizures and CWNS with seizures, and CWS with autism and CWNS with autism, as well as other coexisting disorders identified in this work. This work also has clinical implications that should be considered in future studies. For example, are CWS with coexisting disorders more likely to experience issues with behavioral, emotional, and social well-being, and if so, what is the impact of stuttering on those measures of well-being in CWS without coexisting conditions? More detailed investigations may identify differing factors contributing to worsened behavioral, emotional, and social well-being between CWS with and without coexisting disorders. In the end, more detailed information is needed to determine what approaches are most clinically beneficial to CWS given the impact of coexisting conditions.

Limitations

Although the results of this study are informative, they are not free of limitations. First, the data were gathered via self-report, so caution is advised when reports cannot be definitively confirmed. Second, relative to the U.S. population, this is a relatively small sample of CWS, limiting the generalizability of these results to other CWS. Third, this sample included children from 3 to 17 years old. Therefore, one may expect that manifestations of all coexisting developmental conditions would not be fully observable in the 3- to 5-year-old range, which would result in a potential underestimation of the presence of those conditions. Fourth, the likelihood of responses not adhering to an operational definition means that there were no universal diagnostic criteria across all studies to specifically point to the conditions

referenced. It is unclear in this type of work whether a respondent's ability to discriminate accurately between the characteristics of CWS and other coexisting conditions was a factor. Fifth, there were substantial differences in previous reports using NHIS data. It is unclear if these differences represent a true decline in the conditions among CWS or if they represent a better specification of disorder types. This trend should be continually monitored in future investigations. Sixth, it is tenable that the coexistence of conditions in CWS may vary by other demographic factors such as race, socioeconomic status, and so forth. Further exploration of these factors is needed. Finally, there is concern that the children identified as CWS in this study and in similar studies are only those who exhibit primarily overt symptoms or those behaviors that are observable to listeners.

Conclusions

Despite these limitations, the data reported here offer compelling evidence of the complexity of issues among CWS. Many CWS experience a range of coexisting disabling developmental conditions, and it is currently unclear how the coexisting conditions are interrelated or how they should be managed collectively. The findings, although from a health services approach, may provide clinicians insights into nonclinical factors that can influence the receipt of optimal treatment for CWS with coexisting conditions. Systematic and programmatic research is required to adequately answer a range of questions regarding the management of CWS who also have coexisting disabling developmental conditions.

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