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Article

Prevalence, severity and risk factors for speech disorders in US children: the National Survey of Children's Health

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Abstract

Data from the US National Survey of Children's Health for years 2007, 2011–2012, 2016 and 2017, based on parent report, were analysed to determine the prevalence, severity and specific risk factors (bilingualism, comorbidity, age, sex) for speech disorders. The prevalence of speech disorders was lower for children who are bilingual, without comorbidity, older and females. Parents of children who are bilingual, with comorbidity and in the youngest and oldest age groups were more likely to report moderate or severe symptoms. Unlike prior reports based on smaller samples, findings indicate that bilingual children are not at higher risk for speech disorders.

KEYWORDS: SPEECH DISORDERS, PREVALENCE, SEVERITY, PREDICTORS, BILINGUAL, MONOLINGUAL, CHILDREN

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Introduction

Speech disorders include a broad range of symptoms such as difficulty in articulation, voice problems and stuttering, and are often reported by parents as problems in talking, unintelligible speech, difficulty in producing correct sounds, loudness, hoarseness, or disfluencies (ASHA, 2020; Keating, Turrell & Ozanne, 2001). The reported prevalence of speech disorders is wide-ranging (e.g. 1%, 25%), varying across types (e.g. speech sound disorders: ~3%, stuttering: ~1%) and age groups, with higher rates in younger children (e.g. Broomfield & Dodd, 2004; Keating et al., 2001; Law, Boyle, Harris, Harkness & Nye, 2000; McKinnon, McLeod & Reilly, 2007; Wren, Miller, Peters, Emond & Roulstone, 2016). A majority of affected children recover, although rates vary across the different speech disorders (e.g. Ambrose, Cox & Yairi, 1997). Children who do not recover could experience profound short- and long-term social, academic and mental health consequences (McCormack, McLeod, McAllister & Harrison, 2009). Consequently, the ability to identify children who are at higher risk for speech disorders is paramount to guide referral.

The aetiologies of speech disorders are varied and in some cases unclear (ASHA, 2020). However, there is consensus that genetics and being male are risk factors (e.g. Fox, Dodd & Howard, 2002; Harrison & McLeod, 2010; McKinnon et al., 2007). Age has also been reported as a risk factor; the prevalence of speech disorders decreases with age (McKinnon et al., 2007). With increasing rates of bilingualism in the US, there is also a significant interest in the role of dual language experience. Bilingualism has been perceived as a risk for speech disorders (Byrd, Haque & Johnson, 2016). However, research findings have been equivocal (Hambly, Wren, McLeod & Roulstone, 2013). While some studies report higher rates of speech disorders for children who are exposed to or speak another home language (e.g. Firozjaei, 2013; National Clearinghouse for English Language Acquisition, 2020), others report the opposite (e.g. Arshad, Ghayas, Ghyas & Shabbir, 2013; Harrison & McLeod, 2010). A recent systematic review of bilingualism and stuttering in children revealed gaps and inconsistencies within the literature (Choo & Smith, 2020). It should be noted that some children identified as bilingual in these studies may effectively be multilingual (i.e. exposed to more than two languages). The contribution of comorbid conditions (i.e. the presence of more than one disorder) is also of interest as speech disorders, neurodevelopmental disorders and health conditions commonly co-occur (Choo, Smith & Li, 2020; Silva, Couto & Molini-Avejonas, 2013). It is also unclear if these factors are correlated with symptom severity. The purpose of the present study was to describe the prevalence and severity of speech disorders and the relationship between bilingualism, comorbidity, age, sex and speech disorders in a national cohort of children between 3 and 17 years old.

Methods

Sample

Data were assessed from the National Survey of Children's Health (NSCH), a nationally administered survey in the US to monitor trends in a range of children's health topics and well-being (Child and Adolescent Health Measurement Initiative, 2007–2017), for years 2007, 2011–2012, 2016 and 2017. The cross-sectional, quadrennial survey has been conducted since 2003, providing a nationally representative sample of non-institutionalized children between 0 and 17 years in all 50 states and the District of Columbia. Since 2016, the survey has been administered annually. Surveys were sent via mail to households inviting an adult familiar with the health of a child in their household to complete a paper or online screener questionnaire. If the household consisted of multiple children, only one child was selected by the adult to be the focus of the survey. As speech disorders may be less apparent before age 3 years (i.e. when a majority of children are able to produce intelligible speech; Sharp & Hillenbrand, 2008), children between 0 and 2 years (n = 37,558) were excluded leaving 221,572 children in the sample.

Measures

Speech disorders

Using the NSCH codebook, children with and without speech disorders were identified based on parent responses to the following questions: (1) 'Has a doctor or other health care provider ever told you that [CHILD's NAME] has any of the following conditions? - Stuttering, stammering, or other speech problems?' for 2007, (2) 'Does [child] have any stuttering, stammering, or other speech problems (age 2–17)?' for 2011–2012, and (3) 'Children who currently have any stuttering, stammering or speech problems, age 3–17 years' for 2016 and 2017. For 2007, children were identified with a speech disorder if the response was 'Yes'. For 2011–2012, 2016 and 2017, children were identified with a speech disorder if parents selected: 'Ever told, but do not currently have condition' and 'Currently have condition'. Children were identified without a speech disorder if 'No' (for 2007) or 'Do not have condition' (for 2011–2012, 2016 and 2017) were selected.

The severity of speech disorders was based on parent responses to the following questions: 'Would you describe [his/her] speech problems as mild, moderate, or severe?' for 2007; 'Would you describe [his/her] speech or other language problems as mild, moderate, or severe?' for 2011–2012 and 'How severe are this child's conditions, if the child currently has conditions, from a list of 24 conditions?' for 2016–2017. Possible responses were 'mild', 'moderate', 'severe' for 2007 and 2011–2012; and 'Does not currently have condition', 'Current condition, rated mild' and 'Current condition, rated moderate/severe' for 2016–2017.

Language status

Bilingualism was defined as speaking more than one language. Given the English-speaking national context (US) children were identified as bilingual if parents selected 'Other than English' and monolingual if 'English' was selected when asked 'What is the primary language spoken in the household?'

Comorbid conditions

Using the NSCH codebook, the presence of comorbid conditions was determined based on parental responses, 'Yes' or 'No', for the following conditions: 'Attention Deficit Disorder or Attention Deficit Hyperactive Disorder, that is, ADD or ADHD', 'depression', 'anxiety problems', 'behavioral or conduct problems, such as Oppositional Defiant Disorder or Conduct Disorder', 'Autism, Asperger's Disorder, Pervasive Developmental Disorder, or other Autism Spectrum Disorder', 'developmental delay', 'asthma', 'diabetes', 'Tourette Syndrome', 'epilepsy or seizure disorder', 'hearing problems' or 'deafness', 'vision problems that cannot be corrected with glasses or contact lenses' or 'blindness or problems with seeing, even when wearing glasses', 'brain injury or concussion' and 'learning disability'. Parents were queried about these conditions for all years (2007, 2011–2012, 2016 and 2017).

Data analysis

To combine the NSCH data from 2007, 2011–2012, 2016 and 2017, weights and stratum were adjusted according to the NSCH guidelines. Analyses for prevalence for the three NSCH age aggregates: 3–5 years, 6–11 years and 12–17 years were performed with SPSS (version 25; IBM Corp., 2017). SPSS was utilized because it is the most widely used software for data management and statistical analysis in social sciences (Masuadi et al., 2021). These age aggregates coincide with the age ranges at which speech disorders typically become apparent or at its peak (3–5 years; Keating et al., 2001), when recovery commonly occurs (6–11 years; Ambrose et al., 1997), and when speech disorders are less likely to manifest (> 12 years; Guitar, 2014). The prevalence of speech disorders was estimated from the proportion of children reported to have 'stuttering, stammering, or other speech problems' in the sample. Differences in prevalence and severity between groups were evaluated using χ^2 tests. Logistic regression was used to examine the association between variables (bilingualism, comorbidity, age and sex assigned at birth) for speech disorders. All the logistic regression analyses were conducted with Mplus 8.0, a statistical modelling program (Muthén & Muthén, 1998–2017), accounting for complex sampling design of the NSCH so that results are representative of the US population. Mplus was used because it is a comprehensive statistical software and has particular strengths in handling categorical variables (Maydeu-Olivares, 2000).

In the logistic regression analyses, the predictors included language status (0 if monolingual, 1 if bilingual), comorbid status (0 without comorbidity, 1 with comorbidity), age measured in months and sex (0 if male, 1 if female). Language status was entered first in the model, followed by language status and one other predictor in the next models, and finally language status with all other predictors. All the reported regression coefficients (i.e. the estimates of the population parameters) were log odds, which indicates the natural log of the odds of whether children had a speech disorder. Except for age, all the other predictors (e.g. language status, comorbid status and sex) were categorical. Therefore, only the unstandardized regression results were reported using the natural scale of the predictors to allow easy, straightforward interpretations.

Results

Prevalence of speech disorders

The sample included 15,582 children with and 213,592 without speech disorders, respectively. Table 1 shows the prevalence rates. The overall prevalence

Table 1. Prevalence of speech disorders by language status, comorbidity, age and sex.

	With speech disorders (*n*)	Without speech disorders (*n*)	Prevalence of speech disorders (%)	$\chi2$	df	*p*-value
Language status						
Bilingual	789	15,058	5.0	89.658	1	< 0.001
Monolingual	14,772	198,003	6.9			
Comorbidity						
With	10,830	62,566	14.8	11073.358	1	< 0.001
Without	3,924	139,619	2.7			
Age						
3–5 years	3,408	37,174	8.4	740.659	2	< 0.001
6–11 years	6,499	73,765	8.1			
12–17 years	5,283	95,043	5.3*			
Sex						
Male	10,500	107,752	8.9	1667.459	1	< 0.001
Female	5,071	105,645	4.6			

* Significantly different from ages 3–5 years and 6–11 years.

Table 2. Reports of severity of speech disorders by language status, comorbidity, age and sex.

	Mild (*n*)	Moderate/severe (*n*)	χ2	df	*p*-value
Language status					
Bilingual	252 (52.50%)	228 (47.50%)	27.799	1	< 0.001
Monolingual	4,851 (64.43%)	2,672 (35.575%)			
Comorbidity					
With	3,936 (59.50%)	2,499 (40.50%)	281.907	1	< 0.001
Without	1,090 (84.17%)	205 (15.83%)			
Age					
3–5 years	1,413 (61.76%)	875 (38.24%)	25.240	2	< 0.001
6–11 years	2,276 (66.69%)	1,137 (33.31%)			
12–17 years	1,254 (60.64%)	814 (39.36%)			
Sex					
Male	3,446 (63.52%)	1,979 (36.48%)	0.430	1	> 0.05
Female	1,657 (64.27%)	921 (35.73%)			

* Numbers in parentheses denote the percentage of children from that group identified as mild or moderate/severe.

of speech disorders was 6.8%, within the range of previous reports. There were significant associations between speech disorders, and language status, comorbidity, age and sex. The prevalence of speech disorders was *lower* for bilingual compared to monolingual children (χ^2 [1, n = 228,622] = 89.658, $p < 0.001$), children without comorbidity compared to children with comorbidity (χ^2 [1, n = 216,939] = 11073.358, $p < 0.001$), children aged 12–17 compared to the other age groups (χ^2 [2, n = 221,172] = 740.659 , $p < 0.001$), and females compared to males (χ^2 [1, n = 228,968] = 1667.459, $p < 0.001$).

Severity of speech disorders

Overall, 5,106 (32.77%) children were identified as 'mild' and 2,904 (18.64%) were identified as 'moderate' or 'severe'. Table 2 shows severity rates. Severity data was not available for 48.59% of children identified with speech disorders. The likelihood of being identified with moderate or severe symptoms was higher for bilingual children (47.50%, n = 228; monolingual: 35.57%, n = 2,672; χ^2 [1, n = 7,993] = 27.799, $p < 0.001$), and children with comorbidity (40.50%, n = 2,499; without comorbidity: 15.83%, n = 205; χ^2 [1, n = 7,466] = 281.907 $p < 0.001$) compared to their counterparts. Children aged 3–5 years (38.24%, n = 875) and 12–17 years (39.36%, n = 814) were more likely than children aged 6–11 years (33.31%, n = 1,137) to be rated as moderate or severe (χ^2 [2, n = 7,769] = 25.240, $p < 0.001$). There were no differences between males (36.48%, n = 1,979) and females (35.73%, n = 921) in severity (χ^2 [1, n = 8,003] = 0.430, $p > 0.05$).

Language status

Parents of bilingual children ≥ 12 years were less likely to report a speech disorder compared to parents of their monolingual peers ($B = -0.401$, $p > 0.05$; Table 3, Model 5). When comorbidity, age and sex were controlled for, the log odds of developing a speech disorder was lower by 0.401 for 12–17 years old bilingual children compared to their monolingual peers. There were no differences in parent reports between bilingual and monolingual children age < 12 years (3–5 years: $B = -0.136$, $p > 0.05$; 6–11 years: $B = -0.219$, $p > 0.05$; Table 3, Model 5).

Comorbidity

Parents of children with comorbidity were more likely to report a speech disorder compared to parents of children without comorbidity (3–5 years: $B = 2.367$, $p < 0.001$; 6–11 years: $B = 1.753$, $p < 0.001$; 12–17 years: $B = 1.809$, $p < 0.001$; Table 3, Model 5). When language status, age and sex were controlled for, the log odds of developing a speech disorder was higher for children with comorbidity compared to children without comorbidity by 2.367 in the 3–5 years age group, higher by 1.753 in the 6–11 years age group, and higher by 1.809 in the 12–17 years age group.

Age

Age was not a significant factor for children ages 3–5 years. However, for children aged 6–17 years old, parents of those who were older were less likely to report a speech disorder (6–11 years: $B = -0.107$, $p < 0.001$; 12–17 years: $B = -0.123$, $p < 0.001$; Table 3, Model 5) compared to parents of younger children. When language status, comorbidity and sex were controlled for, the log odds of developing a speech disorder was lowered by at least 0.1 when age increased by 1 year, for children aged 6–17 years old.

Sex

At all age levels, parents of males were more likely to report a speech disorder compared to females (3–5 years: $B = -0.623$, $p < 0.001$; 6–11 years: $B = -0.596$, $p < 0.001$; 12–17 years: $B = -0.523$, $p < 0.001$; Table 3, Model 5). When language status, comorbidity and age were controlled for, the log odds of developing a speech disorder increased by at least 0.5 for males.

Discussion

Prevalence of speech disorders

The overall rate of speech disorders in the present study was lower than studies using clinical assessments (e.g. 24.6%; Goulart & Chiari, 2007) but higher than some estimates from studies using parent (e.g. 1.7%; Keating et al., 2001) and teacher reports (e.g. 1.51%; McKinnon et al., 2007). Present findings are contrary to previous reports of higher prevalence of speech disorders in bilingual children (National Clearinghouse for English Language Acquisition, 2020) but consistent with studies that have not found a higher prevalence or increased risk of speech disorders for bilingual children (Harrison & McLeod, 2010). The lower prevalence of speech disorders in bilingual children is also in agreement with present findings of a lower risk for speech disorders for older bilingual children (see 'Bilingualism' section below). However, it is plausible that the lower prevalence of speech disorders in bilingual children is due to underreporting. A study examining treatment referral patterns in bilingual and monolingual children found that parents of bilingual children were more likely to report expressive language concerns compared to speech concerns while the reverse was true for monolingual children (Stow & Dodd, 2005). The prevalence of speech disorders in the present study is consistent with previous studies reporting higher rates of speech disorders in children with comorbidity and males, and decreasing rates with age (Choo, Smith & Li, 2020).

Severity of speech disorders

Bilingual children were more likely to be identified as having moderate or severe symptoms compared to monolingual children. Bilingual speech patterns may impact perceptions of severity. Studies examining speech patterns of typically fluent Spanish–English bilingual speakers report higher rates of disfluencies that are characteristic of a speech disorder (specifically stuttering) compared to monolingual English speakers (Byrd, Bedore & Ramos, 2015; Smith, Choo & Seitz, 2022). Relatedly, typically fluent Spanish-English bilingual children are more likely to be misdiagnosed with stuttering (Byrd, Werle, Coalson & Eggers, 2020). Symptoms were also more likely to be moderate or severe in children with comorbidity in the current study. Other neurodevelopmental disorders (e.g. ADHD, autism spectrum disorders [ASD]) show a similar phenomenon (Hurtig et al., 2007; Jang & Matson, 2015; Newcorn et al., 2001). For example, associated symptoms are more severe in children with ADHD with co-occurring oppositional defiant disorder (Hurtig et al., 2007; Newcorn et al., 2001). It is plausible that the presence of comorbid conditions represents increased susceptibility, and accordingly, speech disorders may manifest more severely (Choo, Smith & Li, 2020).

Parents of children aged 3–5 years and 12–17 years old were more likely to report moderate or severe symptoms compared to parents of children aged 6–11 years. The underlying reason for this trend is unclear, however, it is possible that greater severity results in earlier identification, accordingly, higher rates of moderate or severe symptoms in children aged 3–5 years. Although

Table 3. Summary of logistic regression analysis predicting odds of developing speech disorders.

Models	Predictors	3–5 years old		6–11 years old		12–17 years old	
		B	SE	*B*	SE	*B*	SE
Model 1	Intercept	2.272***	0.046	2.269***	0.032	2.670***	0.034
	Language status	−0.275	0.165	−0.409*	0.162	−0.644**	0.195
Model 2	Intercept	3.300***	0.075	3.217***	0.062	3.285***	0.071
	Language status	−0.099	0.184	−0.211	0.165	−0.373	0.196
	Comorbidity	2.427***	0.100	1.779***	0.076	1.844***	0.080
Model 3	Intercept	3.177***	0.240	1.804***	0.165	1.273***	0.275
	Language status	−0.292	0.165	−0.414*	0.161	−0.651**	0.194
	Age	0.223***	0.058	−0.055**	0.019	−0.097***	0.019
Model 4	Intercept	1.951***	0.058	1.945***	0.041	2.376***	0.044
	Bilingual status	−0.288	0.165	−0.415*	0.163	−0.667**	0.196
	Sex	−0.783***	0.091	−0.789***	0.071	−0.700***	0.072
Model 5	Intercept	3.474***	0.263	2.053***	0.174	1.813***	0.287
	Language status	−0.136	0.185	−0.219	0.165	−0.401*	0.197
	Comorbidity	2.367***	0.100	1.753***	0.078	1.809***	0.082
	Age	0.112	0.061	−0.107***	0.020	−0.123***	0.020
	Sex	−0.623***	0.099	−0.596***	0.074	−0.523***	0.074

B = unstandardized regression coefficient in log odds and represents the change in the dependent variable due to a unit of change in the independent variable. SE = standard error and is an estimate of the standard deviation of the sampling distribution.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

there is some heterogeneity across disorders, recovery typically occurs in early school age (Kefalianos et al., 2017; Peterson, Pennington, Shriberg & Boada, 2009; Shriberg, Kwiatkowski & Gruber, 1994). Greater severity has also been linked to lower possibility of recovery (Howell & Davis, 2011). If so, children past the age of recovery, including those between 12 and 17, would be more likely to show greater severity. There were no differences in severity reports between sexes. Studies in ADHD and ASD offer a possible explanation, that is, gender stereotypes may impact the perception of severity (Geelhand, Bernard, Klein, van Tiel & Kissine, 2019; Lord et al., 2000; Lord, Rutter & Le Couteur, 1994). For example, although school-age boys with ADHD scored higher on impulsivity on objective, task-based assessments compared to girls, parents and teachers reported no differences between sexes (Slobodin & Davidovitch, 2019). Further, the putative female protective effect observed in some neurodevelopmental disorders (e.g. ASD) may also be present in speech disorders (see Loomes, Hull & Mandy, 2017). For girls, greater aetiological overload may be required for symptoms to manifest (Loomes, Hull & Mandy, 2017). Greater aetiologic overload may also be associated with greater severity; consequently, girls would be expected to show more severe symptoms. Nonetheless, girls may be better able to adapt or compensate, attenuating symptoms (Dworzynski, Ronald, Bolton & Happé, 2012; Robinson et al., 2013).

Risk of developing speech disorders

Bilingualism

Bilingual children were not at higher risk for speech disorders compared to monolingual children. In fact, bilingual children aged 12–17 were less likely to be identified with a speech disorder compared to their monolingual peers. Although the present study did not examine executive function (EF), reports of improved EF due to managing multiple languages may offer some insights into this finding (Bialystok, Craik & Luk, 2012). EF is a set of cognitive processes including working memory, attention and inhibitory control that are crucial for planning, monitoring and revising goal-directed behaviours including speech (Diamond, 2013). The constant need to select, attend to and maintain representation of the target language is thought to enhance EF at specific developmental time points (Bialystok et al., 2012; however, see Paap, Johnson & Sawi, 2015), and stronger EF is correlated with increased fluency (Felsenfeld, van Beijsterveldt & Boomsma, 2010). As such, older bilingual children with robust dual language development histories may have enhanced cognitive capacity for speech processes, lowering the risk of speech disorders.

Differential interpretation of speech disorders related to linguistic or cultural background may influence when a parent or healthcare provider reports a child's speech to be atypical. For example, Ratto and colleagues (2016) reported that Latina mothers who speak Spanish as their primary language have later age expectations of developmental milestones (e.g. first words), these expectations may impact if and when a parent views their child's speech with concern. Similarly, nurses have been reported to simplify screening procedures and postpone speech-language referrals for bilingual children due to a belief that their language development is slower (Nayeb et al., 2015). These expectations and beliefs could result in lower reports of speech disorders for bilingual children.

Comorbidity

Children with comorbidity were at higher risk for speech disorders compared to children without comorbidity, which is consistent with previous studies (e.g. Strom & Silverberg, 2016). Reports of weaker EF in children with comorbidity compared to those without comorbidity (Choo, Smith & Li, 2020), and the role of EF in speech processes may inform these findings. Children with weaker EF show higher levels of speech disruptions compared to their peers with stronger EF (Felsenfeld et al., 2010). Further, children who stutter have also been found to show weaker EF relative to children who do not stutter

(Choo, Smith & Li, 2020). Collectively, these findings suggest that weaker EF, as previously reported in children with comorbidity, would increase the risk of speech disruptions, and probably constrain the ability of the cognitive system to compensate for speech deficits.

Age

Older children in the 6–11 and 12–17 age groups were at lower risk for speech disorders compared to their younger peers which aligns with reports of decreased risk of speech disorders with increasing age (Keating et al., 2001). Increased speech and cognitive demands for younger children when they enter school at an age when some cognitive capacities have not fully matured (Casey, Giedd & Thomas, 2000) may magnify the risk of speech disruptions. Alternatively, younger children may not be at higher risk, but existing speech deficits become more apparent as speech and cognitive demands grow, resulting in higher parental concern and reports.

Maturation of neuroanatomy and physiology with age may also offer insights into risk for speech disorders. In general, children with speech disorders show weaker motor skills and atypical neuroanatomical development compared to typically developing children (Newmeyer et al., 2007; Redle et al., 2015). For example, children with speech sound disorders show weaker oral and fine motor skills (Newmeyer et al., 2007), and treatment focused on improving oral motor skills has been found to improve speech intelligibility (Dale & Hayden, 2013). Further, relative to typically developing children, children with persistent speech disorders show increased activity in the cerebellum, a region involved in fine motor control, during finger tapping (Redle et al., 2015). This increased activity may indicate greater allocation of resources needed to perform the motor task or reduced efficiency of the motor system (Redle et al., 2015). It is likely that the need for greater resources or reduced motor efficiency also extends to speech motor control. The speech motor control system, including neural regions, undergoes protracted development and reorganization continuing into the late teens (Ohashi & Ostry, 2021; Smith & Zelaznik, 2004). Conceivably, maturation of the speech motor system and related neurofunctional and motor skills with age could increase the efficiency of the speech motor system and decrease the risk for speech disorders.

Sex

The lower risk of speech disorders for females is in agreement with the sex bias reported in communication and neurodevelopmental disorders (Nowak & Jacquemont, 2020). In early childhood, boys show slower speech motor maturation compared to girls (Smith & Zelaznik, 2004), this slower rate of maturation may place boys at higher risk for speech disorders compared to girls. Other putative sex-related differences in cognition could provide some insights (Nowak & Jacquemont, 2020). Across the lifespan, females generally outperform males in EF tasks (Gur et al., 2012), and EF is strongly linked to speech performance (Felsenfeld et al., 2010). Differences in EF between sexes may not be large, but a slight advantage in females may offer some level of protection against speech disorders. Alternatively, both sexes may be equally at risk but females are under-identified as symptoms may present differentially or less severely relative to males (Skuse, 2007). For example, males show more impairment on cognitive assessments following cerebral insults compared to females despite similar injury severity and age of insult (Donders & Woodward, 2003). The exact mechanism underlying this differential vulnerability is unclear but an earlier maturing brain in females may mean greater capacity to achieve age-appropriate gains that facilitate attenuation of symptoms or adaptive behaviours that mask symptoms (De Bellis et al., 2001).

Limitations

While there are advantages to population-based studies (e.g. large sample size, reduced regional biases; Raghavan et al., 2018) findings from the present study should be interpreted taking into account some limitations. The presence of speech disorders, severity and comorbidity were based on parent reports. It is unclear whether disorders were formally diagnosed, or whether parent recall was accurate. The heterogeneity and variability of speech symptoms may increase the risk of misidentification. Further, parents' recall of their child's speech disorders or comorbid conditions may not be accurate and as such, children may be disproportionately (over- or under-) identified in this study. Children were identified as bilingual or monolingual based on the parent report of a non-English home language. However, the total number of languages children were exposed to and their degree of proficiency were not determined in the survey. Although bilingual education is uncommon in the US, it is possible that there are some emergent bilingual children who use English at home and are attending language immersion schooling in another language. These children would be considered monolingual in the current study but would likely have some degree of second language exposure.

Further, 'third variables' in the US context which may have affected the rates of speech 'diagnosis' were not determined in the present study. Differences in cultural background related to perceptions of stigmatizing attitudes towards speech disorders, and parental values were not ascertained in the survey. For example, parents from cultures where disabilities are highly stigmatized may be less likely to identify their child with a disorder while parents who place a higher value on verbal ability may be more likely to report speech disorders as a concern and seek treatment for their child. Speech disorders were not operationally defined in the NSCH survey, consequently, it is plausible that children with other developmental disorders including language disorders were misidentified with a speech disorder. For children with comorbidity, it is unknown if the speech disorder was the primary concern. Although a recent study suggests that the prevalence of children with co-occurring speech disorders is low (Unicomb et al., 2020) it is unclear whether children presented with more than one type of speech disorder. In general, estimates of speech and language disorders from population-based studies using parent reports have been found to be lower compared to prevalence estimates obtained through studies using clinical screenings (Goulart & Chiari, 2007), similarly, rates of speech disorders may be underestimated in the present study. Although present findings point to the contributions of bilingualism, comorbidity, age and sex to the development of speech disorders, other candidate factors such as familial history, the severity of comorbid conditions, language and cognitive ability, speech motor development, and socioeconomic status were not examined.

Conclusions

This is the first study to examine bilingualism as a risk factor for speech disorders using the NSCH data. Our findings do not substantiate prior reports, based on smaller samples, pointing to elevated risk of developing speech disorders for bilingual children. Conversely, our findings suggest that bilingualism attenuated the risk of developing speech disorders in older bilingual children compared to their monolingual peers (12–17 years). However, it would be premature to recommend exposure to an additional language as a strategy to reduce the risk of developing a speech disorder without a clear understanding of how bilingualism could interact with other factors such as family history. Across all ages, children with comorbidity face a greater risk of developing speech disorders. Future studies examining the heterogeneity and severity of comorbid conditions may reveal subgroups with differentiated risk. Present findings also confirm the impact of sex and age on the development of speech disorders.

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