



## **THE INFLUENCE OF ETHNICITY AND RESIDENCE ON PRESENCE OF STUTTERING IN CHILDREN**

**Patrick M. Briley, PhD CCC-SLP**

Department of Communication Sciences & Disorders, East Carolina University, Greenville, NC

**Charles Ellis, Jr., PhD CCC-SLP**

Department of Communication Sciences & Disorders, East Carolina University, Greenville, NC

### **— ABSTRACT —**

Stuttering can be a debilitating disorder that impacts all races and cultures, though there have been few reports that have focused specifically on the influence of race/ethnicity on stuttering. While research in other disciplines suggest regional variability in the presence of health-related conditions, this consideration has been limited in the field of stuttering. Therefore, the purpose of this study was to use population data to compare the presence of stuttering between racial/ethnic groups, as a whole, and between geographical regions. This study utilized data from the National Health Interview Survey, which showed that African American children were at greater odds of experiencing stuttering than white children, while Hispanic children were not. Additionally, odds of stuttering were greater for African American children in all regions, with the exception of the Northeast. Current findings of racial and regional differences in the presence of stuttering are discussed, along with potential avenues for future research.

**Key words:** stuttering, race, residence

## INTRODUCTION

Stuttering is a neurodevelopmental, communication disorder impacting the sensorimotor processes of speech (Smith & Weber, 2017). As stuttering persists, negative impact can be seen in the behavioral, emotional, and social well-being of the individual (Yaruss, 2010). The prevalence of stuttering is roughly 1% of the United States (US) population and occurs more frequently in males than females (Guitar, 2014). Stuttering is believed to impact all racial/ethnic groups (Yairi & Ambrose, 2013) and all cultures (Van Riper, 1982). However, recent evidence suggests that differences might be present in the rate of stuttering across racial and ethnic groups. In Briley and Ellis' (2018) investigation of coexisting disabilities among children who stutter (CWS), rates of stuttering were found to be greater among African American CWS when compared to white CWS. This report of racial differences in the presence of stuttering is similar to other reports of differences among disability groups found in the literature.

Overall, there have been few recent studies that have explored the influence of race/ethnicity on rates of stuttering, though Boyle et al. (2011) reported racial/ethnic differences in rates of parent reported stuttering. Using merged data from 1997-2008 NHISs, they found rate of stuttering to be significantly greater among non-Hispanic African American children than among non-Hispanic white children. In contrast, Proctor, Yairi, Duff, and Zhang (2008) reported no significant difference in prevalence of stuttering between 2,223 African American children and 941 European American children between the ages of 2 and 5 years. Proctor et al. (2008) reported on studies of prevalence and incidence of stuttering among African American children. However, over half of the nine studies were published prior to 1960. The earlier studies have methodological issues that should be considered, particularly how African American US residents were defined. These issues along with dramatic demographic changes in the African American US population must be taken into consideration when interpreting the findings (Rastogi, Johnson, Hoefel, & Drewery Jr, 2011). Taken together, current data is needed to clarify the influence of race on stuttering.

Beyond the influence of race, region is a factor that has been found to contribute towards the prevalence of some disabling conditions. In a study by Shin et al (2009), where an overall difference in rate of down syndrome (DS) at birth differed as a function of race/ethnicity, differences by racial/ethnic group were present in some regions, while other regions exhibited no differences. In a study on estimated prevalence of Autism Spectrum Disorder (ASD), Zablotsky,

Black, Maenner, Schieve, and Blumberg (2015) found regional trends in ASD with the highest prevalence in the Northeast (3.17%) and the lowest in the South (1.81%). More recent reports have provided evidence that rate of ASD varies between region and state (Zablotsky, Maenner, & Blumberg, 2019; Xu et al., 2016). Additionally, using adult data from the 2012 National Health Interview Survey (NHIS), Morris, Meier, Griffin, Branda, and Phelan (2016) found geographical variance in the survey item that questioned the presence of a speech, language, and/or voice issue within the past 12 months. These studies point to the possibility of environmental factors influential to the development of disabling conditions.

To our knowledge, there has been limited evidence of regional influence on stuttering. Briley and Ellis (2018) and Merlo and Briley (2019) found regional differences in the percentage breakdown of the total sample of children who do not stutter (CWNS) as compared to CWS. The percentage breakdown for each geographical region showed that the South represented the largest difference between the two groups, with the percentage of CWS in the South contributing greatest to this difference. However, we are unaware of any reports considering the presence of stuttering as influenced by race and region. Therefore, the purpose of this project is to explore the rate of stuttering, as a function of race and geographical region.

## METHOD

### Study Sample

The current project utilized the same data and analytical approach as previous studies (Briley & Ellis, 2018; Briley, O'Brien, & Ellis, 2019, Merlo & Briley, 2019). In each, the source of the data was the National Health Interview Survey (NHIS). Detailed information on the NHIS and related documentation can be found on the National Center for Health Statistics' website (Center for Disease Control, 2019). In short, the NHIS is a survey that is completed annually by the National Center for Health Statistics to monitor the health of United States citizens. Included in this survey are roughly 35,000-40,000 households, which excludes those actively serving in the military and those residing in corrective institutions, mental institutions, or elderly homes. The NHIS utilizes a multistate sampling method to ensure accurate statistics for those in minority groups (Parsons et al., 2014). From the selected households, one sample child is randomly selected, of which questions are asked by a parent or caregiver (Center for Disease Control, 2018).

The sample for the current project was taken from merged data from 2010-2015 NHIS (Center for Disease Control, 2010-2013; Center for Disease Control, 2014; & Center for Disease Control, 2015) and included those children whose parent/caregiver answered a definitive “yes” or “no” to the following question: “During the past 12 months, has [child name] had any of the following conditions...stuttering or stammering?” For consistency throughout this paper, those children whose parents answered “yes” will be referred to as CWS and those children whose parents answered “no” will be referred to as children who do not stutter (CWNS). Additionally, the sample reported here only included those children identified as either non-Hispanic white, non-Hispanic African American, or Hispanic.

### Data Description

**Demographic characteristics.** Gender, age, geographical region, highest level of education completed by an adult in the family, and total combined family income were reported by the respondents. Baseline data was completed for the total sample and comparisons were made as a function of racial/ethnic group. For racial/ethnic group comparisons, the sample was analyzed between white, African American, and Hispanic CWS.

**Reported rates of stuttering as a function of racial/ethnic groups.** The overall reported rates of stuttering were reported for the total sample and for white, African American, and Hispanic children. Children within each racial/ethnic group were then categorized into three age groups, and rate of stuttering was reported for children ages 3-5, 6-10, and 11-17 years. Rate of stuttering was also reported within each region of the United States. Specifically, rate of stuttering for each racial/ethnic group was reported for the Northeast, Midwest, South, and West. Lastly, rate of stuttering within each geographical region was subdivided by previously used age groups. These rates were again reported for the total sample and for each racial/ethnic group.

### Data Analysis

Data were analyzed using SPSS Version 24 (IBM, 2016), which allows for adequate analysis of the NHIS' complex sampling design. By properly utilizing SPSS' complex samples function, results are able to be generalized to the US population. Gender, geographical region, highest level of education completed by an adult in the family, and total combined family income were reported in percentages and compared across racial/ethnic group. Mean age and standard deviations were reported for all groups. Rate of stuttering was reported using percentages and compared

across all racial/ethnic groups, and the same procedure was used for reporting rate of stuttering within categorical age ranges, geographical regions, and age ranges within each geographical region. Categorical variables were analyzed using chi-square tests of independence and continuous variables were analyzed using Analysis of Variance (ANOVA). Lastly, odds of reporting stuttering were generated for both African American and Hispanic children, with white children used as the reference group. Multiple logistic regressions were performed to determine the odds of reporting the presence of stuttering, while controlling for parent education and total family income.

## RESULTS

### Demographic Characteristics

The total number of white, African American, and Hispanic children in the 2010-2015 NHIS whose parent/caregivers answered definitively about the presence of stuttering were 46,851. Of those, there were a total of 978 (2.1%) children identified as CWS. The majority of the total sample of CWS were comprised by males (68.2%), and analysis showed no differences in percentage of males across racial/ethnic groups,  $X^2(1.99, N = 978) = 3.22, p = .317$ . The mean age for the total sample of CWS was just under 9 years,  $M = 8.88, SD = 4.27$ , and no differences were found in mean age across racial/ethnic groups,  $F(2, 975) = 1.74, p = .176$ . Significant differences were found in breakdown of racial/ethnic group within geographical region,  $X^2(4.89, N = 978) = 123.40, p < .001$ . Specifically, the South was the geographical region with the largest percentage of white CWS (39.3%) and African American CWS (62.8%). The majority of Hispanic CWS resided in either the South (37.0%) or the West (40.2%). Significant differences were found between racial/ethnic groups as a function of highest education of adult in families of CWS,  $X^2(14.34, N = 978) = 179.33, p < .001$ . Families of white CWS had the highest percentage of master's, professional, or doctoral degrees (16.6%) and families of Hispanic CWS had the largest percentage of completing 8th grade or less only (11.9%) and some high school with no diploma (25.7%). Lastly, total combined income of families of CWS was found to differ across racial/ethnic groups,  $X^2(9.17, N = 978) = 123.40, p < .001$ . The majority of combined incomes were under \$35,000 for families of African American (60.6%) and Hispanic CWS (58.7%), as compared to 38.0% for white CWS. See Table 1 for a breakdown of demographic data by racial/ethnic group.

**Table 1. Demographics of non-Hispanic white, non-Hispanic African American, and Hispanic children who stutter in 2010-2015 National Health Interview Surveys**

	Total CWS 978	White CWS 328	African American CWS 272	Hispanic CWS 378	p
<b>Gender (Male)</b>	68.2	71.1	67.9	68.2	.368
Age (4-17 years)					
Mean (standard deviation)	8.88 (4.27)	9.03 (4.37)	9.13 (4.32)	8.56 (4.14)	.176
<b>Region</b>					
Northeast	11.7	13.3	9.1	11.8	
Midwest	20.5	28.0	20.4	11.0	< .001
South	44.8	39.3	62.8	37.0	
West	23.0	19.4	7.6	40.2	
<b>Highest Education of Adult in Family</b>					
≤ 8th grade	4.9	1.4	1.8	11.9	
9-12th grade (no diploma)	13.8	4.9	13.0	25.7	
High School Grad. or GED	24.0	20.3	28.7	24.6	
Some college, no degree	21.1	23.7	21.7	17.4	< .001
AA degree, technical or vocational	9.7	9.5	11.9	8.2	
AA degree, Academic program	4.7	6.1	5.1	2.8	
Bachelor's degree	12.7	17.5	12.8	6.4	
Master's, professional or doctoral degree	9.0	16.6	4.9	2.9	
<b>Total Combined Family Income</b>					
\$0 - \$34,999	50.7	38.0	60.6	58.7	
\$35,000 - \$74,999	23.9	22.9	22.6	26.2	< .001
\$75,000 - \$99,999	9.1	13.2	7.7	5.0	
\$100,000 and over	12.9	24.4	5.3	4.8	
Undefined/unknown	3.3	1.4	3.7	5.3	

CWS – Children Who Stutter

GED – General Educational Development high school equivalency diploma

AA degree – Associate of Arts degree

### Rate of Reported Stuttering as a Function of Racial/Ethnic Group

Differences were found in the rate of reported stuttering when analyzed across racial/ethnic group,  $X^2(1.97, N = 46,581) = 155.83, p < .001$ . Reported rates of stuttering were greatest among African American children (3.6%) and least among white children (1.4%). Differences remained present when racial/ethnic groups were compared within each categorized age range. Specifically, African American children had a significantly greater percentage of

reported rate of stuttering in the 3-5 year old range (4.8%),  $X^2(1.93, N = 9,228) = 34.43, p < .001$ ; the 6-10 year old range (3.9%),  $X^2(1.97, N = 14,420) = 44.13, p < .001$ ; and the 11-17 year old range (2.9%),  $X^2(1.96, N = 23,203) = 74.20, p < .001$ . Baseline racial/ethnic differences were present when comparing rate of stuttering within each geographical region. Most notable were differences in rate of stuttering in the Midwest between African American children (3.7%) and white children (1.3%),  $X^2(1.82, N = 9,429) = 40.82, p < .001$ , and differences in rate of stuttering in the South between African American chil-

dren (4.0%) and white children (1.7%),  $X^2(1.92, N = 17,581) = 64.69, p < .001$ . When analyzing racial/ethnic groups' rate of stuttering among age groups and within in region, differences were most notable in the South. Within this region, African American children had a significantly higher rate of stuttering in the 3-5-year age group (6.3%) than white children (2.9%),  $X^2(1.94, N = 3,519) = 17.34, p = .003$ . Within

the South, significant differences were also seen in the 6-10-year age group,  $X^2(1.98, N = 5,428) = 23.98, p = .001$  and the 11-17-year age group  $X^2(1.98, N = 8,634) = 23.36, p < .001$ , with African American children exhibiting the greatest percentage of stuttering in each age group (4.7% and 2.4%, respectively). See Table 2 for a breakdown of rates of stuttering across racial/ethnic group.

**Table 2. Reported rates of stuttering among non-Hispanic white, non-Hispanic African American, and Hispanic children in 2010-2015 National Health Interview Survey**

	Total Children = 46,851	White = 23,242	African American = 8,066	Hispanic = 15,543	p
Total number of children who stutter (unweighted count)	978	328	272	378	--
Overall rate of stuttering (weighted %)	2.1	1.4	3.6	2.6	< .001
Age Ranges (in years)					
3-5 (n = 9,228)	2.9	2.1	4.8	3.4	< .001
6-10 (n = 14,420)	2.4	1.7	3.9	3.0	< .001
11-17 (n = 23,203)	1.5	1.0	2.9	1.9	< .001
Rate of stuttering within in each region (weighted %)					
Northeast (n = 7,288)	1.5	1.1	2.1	2.5	.001
Midwest (n = 9,429)	1.8	1.3	3.7	2.9	< .001
South (n = 17,581)	2.4	1.7	4.0	2.7	< .001
West (n = 12,553)	2.1	1.5	3.6	2.5	.002
Rate of stuttering within in region, by age groups in years (weighted %)					
Northeast					
3-5 (n = 1,386)	1.9	1.4	1.0	3.8	.032
6-10 (n = 2,213)	1.9	1.6	1.2	3.4	.070
11-17 (n = 3,689)	1.1	0.6	3.2	1.3	< .001
Midwest					
3-5 (n = 1,800)	1.9	1.2	4.4	3.0	.010
6-10 (n = 2,908)	1.9	1.6	3.3	2.2	.197
11-17 (n = 4,721)	1.7	1.1	3.7	3.3	.002
South					
3-5 (n = 3,519)	3.9	2.9	6.3	3.5	.003
6-10 (n = 5,428)	2.8	1.9	4.7	3.0	.001
11-17 (n = 8,634)	1.5	1.0	2.4	2.0	< .001
West					
3-5 (n = 2,523)	2.9	2.4	3.1	3.3	.573
6-10 (n = 3,871)	2.5	1.6	4.9	3.2	.016
11-17 (n = 6,159)	1.5	1.1	3.0	1.5	.053

In logistic models, with white children serving as the reference group and controlling for baseline differences in parent education and total family income, African American children were at greater odds of experiencing stuttering (OR = 1.79, 95% CI 1.40, 2.30), while Hispanic children were not (OR = 1.18, 95% CI .932, 1.50). Using this same analytical approach, Hispanic children did not show increased odds in any of the geographical regions. However, African American children showed greater odds in three of the four geographical regions: the Midwest (OR = 2.18, 95% CI 1.25, 3.77); the South (OR = 1.64, 95% CI 1.13, 2.38); and the West (OR = 2.06, 95% CI 1.21, 3.51). Odds of stuttering were not greater for African American children in the Northeast (OR = 1.23, 95% CI .588, 2.57) (See Table 3).

**Table 3. Weighted measures of stuttering among non-Hispanic white, non-Hispanic African American, and Hispanic children in the 2010-2015 National Health Interview Surveys**

	African American Children			Hispanic Children		
	OR	(95% CI)	p	OR	(95% CI)	p
<b>Total</b>	1.79	(1.40-2.30)	< .001	1.18	(.932-1.50)	.167
Northeast	1.23	(.588-2.57)	.578	1.09	(.738-1.62)	.654
Midwest	2.18	(1.25-3.77)	.006	1.14	(.694-1.87)	.603
South	1.64	(1.13-2.38)	.010	1.19	(.865-.631)	.289
West	2.06	(1.21-3.51)	.008	1.13	(.825-1.57)	.431

White children represent the reference group.

Odds ratio adjusted for parent education and total family income.

## DISCUSSION

The purpose of this study was two-fold: to explore rates of stuttering as a function of race and to explore rates of stuttering as a function of race within geographical regions. As stated previously, prevalence of stuttering is generally accepted to be around 1% of the population with an incidence of 5% (Guitar, 2014). The variation in these rates is due to natural recovery in some children who stutter (Yairi & Ambrose, 2013). Therefore, rates of stuttering in a sample of diverse ages, such as the present sample, would generally be expected to fall within this 1% - 5% range.

The primary findings of this project were the heightened odds of stuttering among African American children and regional differences in odds of stuttering among African American children in the

2010-2015 NHIS sample. The overall rate of stuttering in white children was 1.4%, compared to 2.6% among Hispanic children and 3.6% among African American children. To our knowledge, data on race differences in rate of stuttering has been relatively scarce, and most recent reports were highlighted by Yairi and Ambrose (2013). Contrary to current findings, Proctor et al. (2008) reported no significant difference in prevalence of stuttering between 2,223 African American children (2.6%) and 942 European American children (2.44%) between the ages of 2 and 5 years. The prevalence figure reported by Proctor et al. (2008) was specifically for African American children aged 2-5 years, which was considerably smaller than that reported among the 3-5-year-old African American children in the current sample (2.6% vs. 4.8%). Similar in methodology to the current study, Boyle et al. (2011) used NHIS data from 1997-2008 where they reported an overall prevalence of 1.27% for non-Hispanic white children compared to 2.63% for non-Hispanic African American children

and 1.96% for Hispanic children, aged 3-17 years. In comparison, rates of stuttering were higher for all racial/ethnic groups in the current sample, though rate of stuttering among African American children remained the greatest. In addition to the prevalence of the overall current sample being significantly greater among African American children, differences between groups in each segmented age demarcation were also significant. For each age range, rates of stuttering among African American children remained greatest. Also, and as expected, rate of stuttering for each racial/ethnic group decreased as a function of age group, where the rates for the 11-17-year old children settled highest for African American children (2.9%) as compared to white children (1.0%) and Hispanic children (1.9%).

For the total sample, after controlling for parent education and total family income, African American

children were at greater odds of experiencing stuttering than white children. In contrast, significant differences were not found in odds of stuttering between white and Hispanic children. Increased odds of stuttering among African American children were found in the Midwest, the South, and the West. Interestingly, African American children were not at greater odds of stuttering in the Northeast, when controlling for parent education and total family income. While other health-related differences as a function of region have been previously reported, this is the first examination of such, to our knowledge, in the study of stuttering.

The effect of region on the presence of stuttering prompts speculation into influences that would heighten the odds for African American children in certain regions of the US. Current data does not offer explanation for these findings, but a programmatic line of research could potentially provide evidence to these unknown contributors. Smith and Weber's (2017) multifactorial, dynamic pathways (MDP) theory of stuttering is one that could be useful in helping to understand current findings. The MDP proposes that stuttering, at its core, is a sensorimotor disorder, where the influence of faulty neuronal signals, controlling the system of speech, are the source of observable and unobservable deviations (Smith & Weber, 2017). Further, deviations to the system (i.e., symptoms of stuttering) are positively associated with increased linguistic, emotional, and cognitive demands; each undergoing development during the time period of stuttering onset and natural recovery (Smith & Weber, 2017). Influenced by the developmental course of each, sufficient or insufficient systems for fluent speech would emerge. Contributing to the trajectory of development are genes, the child's environment, and epigenetics (Smith & Weber, 2017).

Briefly, epigenetics is change in gene expression, induced by a plethora of variables, while DNA sequence remains unchanged (Weinhold, 2006). Strong evidence of environmental factors playing a role in the presence of stuttering comes from twin studies, where concordance of stuttering between monozygotic and dizygotic twins suggests genetic and environmental influences (Felsenfeld, Kirk, Zhu, Statham, Neale, & Martin, 2000). Broadly, suspected environmental influences critical to epigenetic changes include hazardous materials/chemicals (Baccarelli, & Bollati, 2009), diet (Schagdarsurengin & Steger, 2016), sleep (Masri, & Sassone-Corsi, 2013), and familial interactions related to emotional and behavioral well-being (McGowan & Szyf, 2010). One example of an interaction specific to environmental influences on stuttering is the finding that increased duration of breastfeeding led to a decrease in odds of stutter-

ing persistence. The authors hypothesized that the benefits of breastfeeding were facilitation of proper brain maturation and expression of genes, conducive for fluent speech (Mahurin-Smith, & Ambrose, 2013). In addition to stuttering (Starkweather, 2002), other communication disorders such as autism and specific language impairment have been considered through the lens of epigenetics (Rice, 2013; Wayne & Cheng, 2018). The possibility of identifying variables that lead to increased odds of stuttering among a specific racial group within specific regions, would begin to unravel the conjectured interplay of genetics and culture on the presence and persistence of stuttering (Starkweather, 2002). Recently, epigenetics has been proposed as a possible contributor towards racial differences in other diseases and conditions, including: cardiovascular disease (Kuzawa, & Sweet, 2009); cancer and preterm birth (Vick & Burris, 2017); and chronic pain (Aroke et al., 2019); possibly induced by such things as inequities, inequalities, or distress during developmental years. Therefore, investigation is warranted in those characteristics, specific to certain geographical regions of the United States, that lead to increased likelihood of a neurologically based disorder, such as stuttering, among African American children.

While present findings are informative, several limitations should be considered when interpreting current results. First, data is acquired via parental report. Therefore, novel studies should be designed to provide data where diagnosis can be verified by a licensed speech-language pathologist. Second, parents may not be fully in tune with the full range of symptoms that comprise the disorder of stuttering. Therefore, it might be stated that current estimates are more likely an underestimate than an overestimate. Third, while the overall sample constitutes a relatively large representation of children who stutter, analysis of age breakdowns within region resulted in smaller samples for individual analyses. Specifically, the smallest samples for each region were for 3-5-year-old African American children, and while relatively small, their unweighted counts still included the following: 228 children in the Northeast; 283 children in the Midwest; 915 children in the South; and 141 children in the West. Lastly, the NHIS does ask the question if speech therapy was provided in the school setting. However, along with the inquiry of school-based speech therapy is the inclusion of occupational and physical therapy within the same survey question. Still, from the current sample, only 79 of the 978 CWS answered this question. Similar questions were asked about speech services in other settings, but data remained insufficient to confidently infer meaning from results. Recent evidence

has indicated that minorities in US public schools are less likely to be identified as having a speech or language impairment (Morgan et al., 2015; Morgan et al., 2017; Robinson & Norton, 2019). Regarding this disproportionately of service provision, it is not clear the extent of impacts on current findings. However, if service provision is disproportionate at the school-age years, it is reasonable to assume that a similar trend would be found in the pre-school-age years. The potential exists, then, that lack of service provision in the area of speech and language for minority children may have an influence on eventual increased prevalence rates of stuttering. Further research is needed to clarify this issue.

In summary, results from the current study suggest that, when compared to white children, African American children are at greater odds of experiencing stuttering, and regional differences are present in African American children's odds of experiencing stuttering. Data from the current study do not provide explanation of these findings, though they do support inquiry into what brings about increased odds of stuttering among African American children in all geographical regions except for the Northeast. Future successes in this regard will be needed to improve outcomes for those African American children susceptible to the disorder of stuttering and will likely contribute to better understanding of the etiology of stuttering as a whole.

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## ABOUT THE AUTHORS

**Patrick Briley, PhD, CCC-SLP** is a Clinical Researcher in the Department of Communication Sciences and Disorders at East Carolina University. Dr. Briley is a licensed and certified speech-language pathologist. He specializes in the area of stuttering where his research is designed to understand contributors to overall impact of stuttering and differences in those factors based on a variety of demographic variables. Email: [brileypa@ecu.edu](mailto:brileypa@ecu.edu)

**Charles Ellis Jr., Ph.D, CCC-SLP** is a Professor in the Department of Communication Sciences and Disorders and Director of the Communication Equity and Outcomes Laboratory at East Carolina University in Greenville, North Carolina. His research is designed to understand outcomes associated with adult neurologically based disorders of communication and factors that contribute to the lack of equity in service provision and outcome disparities that exist among some population groups. Email: [ellisc14@ecu.edu](mailto:ellisc14@ecu.edu)