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Disability and Exposure to High Levels of Adverse Childhood Experiences (ACEs) in North Carolina: The Effect on Health and Risk Behavior

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Abstract

Objective: To date, there has been comparatively little research on the effect that adverse childhood experiences (ACEs) have on the health of adults with disabilities. However, a substantial body of research shows that persons with disabilities, at any age, are significantly more likely to be sexually or physically abused than persons without disabilities. Using questions from the ACE module on the 2012 N.C. BRFSS (Behavioral Risk Factor Surveillance System) Survey, this study examines the effect of high ACE exposure, i.e., self-report of three or more ACEs, on the health and disease status of adults with disabilities.

Methods: Based on data from the 2012 N.C. BRFSS Survey, there were 743 respondents who met the study-definition for having a disability and high ACE exposure. The comparison group consisted of 1,304 respondents with high ACE exposure who did not have a disability. The prevalence of each item on the ACE module was calculated for those with and without a disability. The prevalence and relative risk (disability vs. no disability) of health risk behaviors, perceived poor health, and chronic disease were also calculated.

Results: A key finding is that an estimated one-in-four North Carolina adults with a disability and high ACE exposure reported being forced to have sex with an adult before age 18. Secondly, both the prevalence (38.2%) and the relative risk (adjusted for gender, age and education) of current smoking were significantly higher for those with a disability compared to those without a disability. In conjunction with this finding, the risk of chronic obstructive pulmonary disease (COPD) was 3.7 times higher for the disability group. Moreover, for all five study measures of perceived poor health, the model-adjusted risk ratios were at least 2.4 times higher for those with a disability.

Conclusion: ACEs, particularly childhood sexual abuse, among North Carolina adults with a disability are an important public health issue. Strategies are needed to help improve both the physical and mental well-being of persons with disability who have been exposed to multiple types of childhood abuse and trauma. Future studies are needed to determine the directionality of childhood abuse and disability onset.

Introduction

Both national and state agency publications including the Centers for Disease Control and Prevention (CDC)'s 2011 *CDC Health Disparities and Inequalities Report*, the 2005 *Surgeon General's Call to Action to Improve the Health and Wellness of Persons with Disabilities*, Healthy People 2020, and the North Carolina Office on Disability and Health 2011 *Plan to Promote the Health of People with Disabilities* have stressed the need for a greater focus on the health of persons with disabilities. Emphasis has been placed on the need for improved access to preventive and health promotion services among persons with disabilities as well as the need for more surveillance and research specific to persons with disabilities, particularly with regard to how their health exposures, risks and outcomes differ as compared to persons without disabilities.[1–4]

Previous research has documented health disparities among persons with disabilities. An analysis of the 2010 U.S. BRFSS found that adults with disabilities, defined as those who reported having activity limitations due to poor physical, mental or emotional health and/or those who require use of special equipment, to be at greater risk for certain adverse health behaviors and outcomes compared to persons without disabilities. After adjustment for demographic factors, results from this study revealed adults with disabilities had higher odds of physical inactivity, obesity, smoking, binge drinking, diabetes, asthma, cancer, coronary artery disease and stroke as compared to those without disabilities.[5]

To date, the topic of adverse childhood experiences among persons with disabilities has received relatively little attention. Two recent studies have begun to explore the association between ACEs and disability in adulthood and to compare health risk behaviors among persons with and without disabilities exposed to ACEs.[6,7] Of the eight categories of ACEs assessed, including indicators of household dysfunction and childhood abuse, disability was shown to have the strongest association with exposure to sexual abuse during childhood. Those who reported having been touched sexually by an adult, having sexually touched an adult or being forced to have sex with an adult as a child were three times as likely to also report having a disability as those who did not report these exposures. In addition, a strong, graded association between the number of ACEs an individual reported and disability status in adulthood was demonstrated even after adjustment for demographic factors and physical health conditions.[6] Associations also exist between disability, ACEs and health risk behaviors. Persons with disabilities who reported one or more ACEs were found to have a higher prevalence of smoking and HIV risk behaviors than persons with disabilities who reported no ACE exposure and persons without disabilities who reported one or more ACEs.[7]

In this study, we focus on respondents who reported experiencing at least *three* ACEs, such as verbal abuse, domestic violence or physical abuse, before the age of 18. This definition of high ACE exposure for adults complies with the Association of Maternal and Child Health Programs (AMCHP) Life Course Metrics Indicator for states in assessing their efforts to take a life course approach to maternal and child health.[8] Furthermore, a recent State Center for Health Statistics (State Center) study on the effect of ACEs on the health of all adults in North Carolina found that those with three or more ACEs (high ACE exposure) were significantly more likely to report sexual or physical abuse than those with one to two ACEs (low ACE exposure).[9]

The purpose of this study is to compare the prevalence of 11 ACE survey items between adults with and without disabilities who meet the definition for high ACE exposure. A second purpose is to analyze the prevalence and relative risk of health risk behaviors, perceived poor health and chronic disease for these two study groups.

Methods

Data for this study were obtained from the North Carolina 2012 BRFSS Survey. The BRFSS Survey is a random-digit-dial telephone survey of the health and health practices of resident adults ages 18 years and older. The BRFSS sample includes both landline and cell phone interviews; in 2012, about 24 percent of completed interviews were obtained from cell-phone-only households. The BRFSS Survey is sponsored and funded, in part, by the CDC in Atlanta.

The ACE Module and ACE Score

The CDC ACE module was first introduced in North Carolina's 2012 BRFSS Survey. The wording for these questions can be found in the online 2012 Questionnaire. The ACE module includes 11 questions that measure both household dysfunction and childhood abuse experienced before age 18. Six questions capture household dysfunction including child exposure to adult depression, alcoholism, drug abuse, divorce, incarceration and domestic violence. The remaining five questions focus on childhood abuse including physical abuse, emotional abuse, and having been touched sexually by an adult,

forced to touch an adult sexually or forced to have sex with an adult.

The ACE score is a standardized, calculated score based on responses to the ACE module and is intended to measure cumulative exposure to ACEs. It is not a measure of the intensity or severity of the adverse event(s). The ACE score is the sum of a YES response to one or more of the three questions assessing sexual abuse, a YES response to one or more of the two questions assessing exposure to adult substance abuse and a YES response to the remaining six questions. Thus, the final ACE score has a possible range of zero to eight.

Study Groups

A person with a disability is defined as someone who reported he/she was limited in activities because of physical, mental or emotional problems and/or had any health problem requiring the use of special equipment such as wheelchair. No disability was assigned to those who responded NO to both screener questions. To delineate the study groups, we then computed the ACE score for those with and without a disability. The score results were used to define three ACE study groups: (1) No ACE (zero ACEs), (2) Low ACE (one to two ACEs) and (3) High ACE (three or more ACEs)—see Figure 1. Among eligible study members, the disability group consisted of 743 respondents with high ACE exposure, and the no-disability group consisted of 1,304 respondents with high ACE exposure.

Study Outcomes/Dependent Variables

Study outcomes were broken into three domains consisting of health risk behaviors, perceived poor health and chronic disease conditions. Health risk behaviors included self-reports of (1) current smoking, (2) heavy drinking (three or more drinks per day for males; two or more drinks per day for females), (3) binge drinking (five or more drinks on one occasion for males; four or more drinks on one occasion for females), (4) obesity (Body Mass Index greater than 29.9), (5) no exercise in past 30 days and (6) at least one of four HIV risk factors, e.g., used intravenous drugs in the past year.

Perceived poor physical/mental health consisted of five self-reported indicators: (1) fair or poor overall health, (2) 14 or more days of poor physical health in the past 30 days, (3) 14 or more days of poor mental health in the past 30 days, (4) 14 or more days in the past 30 days with an activity limitation due to poor physical or mental health and (5) doctor-diagnosed depression.

Chronic disease conditions consisted of (1) doctor-diagnosed chronic obstructive pulmonary disease (COPD), (2) current asthma, (3) diabetes, (4) arthritis, (5) kidney disease and (6) cancer (other than skin).

Analysis

The percent distribution of the ACE score for all respondents by disability status is shown in Figure 1. Selected demographic characteristics of the High ACE study groups are shown in Table 1. For each ACE module question, the crude prevalence and unadjusted risk ratios were calculated for the disability group compared to the no-disability group (Table 2).

For each of the study outcomes pertaining to health risk behaviors, perceived poor health and chronic disease, the crude prevalence and model-adjusted risk ratios were calculated, using logistic regression. Two sets of logistic models were developed for the study. When modeling the probability for risk behaviors and chronic disease, the model covariates included gender, age and education. When modeling the probability of perceived poor health, history of chronic disease and not being able to work were added as covariates or control variables. The need to control for these factors was due to the preponderance of chronic disease in the disability group, and the fact that bivariate analyses revealed that not being able to work was highly associated with all study measures of perceived poor health. These model adjusted risk ratios were derived from the calculation of predicted marginals, or adjusted rates. Predicted marginals (PM) are analogous to least square means when using a multiple linear regression model. (For a more detailed discussion of PM, see *The Association of Housing Stress, Health, Chronic Disease and Health Care Resources,*[10] a recent State Center publication.)

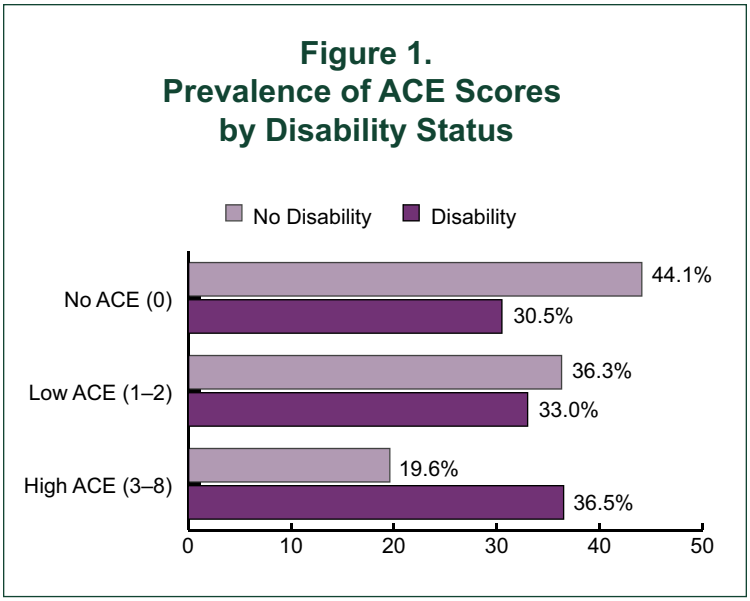
All percentages shown in this study are weighted percentages. The terms, "risk ratio" and "relative risk" in this report refer to the same statistic. All analyses were conducted with the SAS-callable SUDAAN software (SUDAAN Release 11.0.0).

Results

ACE Score Distribution

Figure 1 shows the distribution of the ACE study groups for all respondents in the 2012 BRFSS Survey who

reported a disability compared to all respondents who did not report a disability. In the disability group, about one in three respondents reported three or more ACEs compared to approximately one in five in the no disability group. Similarly, a significantly higher percentage (44.1%) of no-disability respondents reported no ACEs compared to those with disabilities (30.5%).



Demographic Characteristics

Table 1 shows selected demographics of those with and without a disability in the High ACE group (three or more ACEs). Females were more likely to be represented among both the no-disability and disability groups. The percentage of white and black respondents was fairly similar across groups; however, there was a noticeable difference in age between the no-disability and disability groups. Respondents in the no-disability group constituted a significantly younger population. More than 65 percent of respondents with no disability were between the ages of 18 and 44, compared to about 39 percent of respondents with a disability. Low education was also more prevalent among the disability group; about 26 percent had less than a high school education versus 18 percent of those in the no-disability group. Regarding employment status, 34 percent of respondents with a disability reported being unable to work, while the corresponding no-disability rate was only 2 percent. The unemployment rate was about the same for both groups. Being employed, however, was significantly lower in the disability group: 30 percent were employed, as compared to 65 percent for those with no disability.

Table 1. Selected Characteristics of North Carolina Adults with High ACE Exposure (3+ ACEs), by Disability Status: 2012 N.C. BRFSS Survey

	No Disability		Disability	
Characteristics	N	%	N	%
Sex				
Males	458	42.3	250	39.5
Females	846	57.7	493	60.5
Race				
White	889	67.0	547	73.1
Black	260	22.1	118	20.4
Other	146	10.9	72	6.5
Age				
18–34	388	42.2	76	19.1
35–44	281	23.1	109	17.7
45–54	260	17.5	190	26.4
55–64	212	10.9	209	23.9
65+	159	6.3	156	12.8
Education				
Less than high school	152	17.9	130	26.3
High school	336	28.5	221	24.4
Post high school/some college	391	33.4	248	34.7
College	395	20.2	144	14.6
Employment				
Employed	842	65.1	194	30.2
Unemployed	152	13.6	86	14.0
Unable to work	25	1.9	280	34.1
Retired	144	6.4	135	12.5
Other	138	13.0	46	9.2

Table 2 shows the results for each of the 11 questions that comprise the ACE module for those with and without a disability and high ACE exposure. Beginning with household dysfunction, a high percentage of both the disability group (72.3%) and the no-disability group (64.2%) reported living with an alcoholic adult. Living with a depressed adult in the household was also commonly reported (57.5%) in the disability group; and the likelihood of this experience was 30 percent higher for the disability group compared to the no-disability group (RR=1.30; [95% C.I., 1.16–1.45]). The percentage of those who reported living with a drug abuser or an incarcerated adult or who witnessed domestic violence was roughly equivalent across groups. Non-disabled respondents were significantly more likely to

Table 2. Prevalence and Unadjusted Risk Ratios of ACE[a] Survey Items for North Carolina Adults with High ACE Exposure (3+ ACEs), by Disability Status: N.C. BRFSS 2012 Survey

ACE Survey Items	No Disability %	Disability %	Risk Ratios* RRs (95% C.I.)
Household dysfunction			
Depressed adult in HH[a]	44.3	57.5	1.30 (1.16, 1.45)
Alcoholic adult in HH	64.2	72.3	1.13 (1.04, 1.22)
Drug abuser adult in HH	34.5	37.5	1.08 (0.92, 1.27)
Incarcerated adult in HH	28.3	24.6	0.87 (0.72, 1.06)
Parent separation/divorce	62.5	52.9	0.85 (0.76, 0.94)
Parent/adult domestic violence	56.3	58.2	1.03 (0.94, 1.14)
Child Abuse			
Physical abuse	47.5	57.2	1.20 (1.08, 1.34)
Verbal abuse	70.0	77.9	1.11 (1.04, 1.19)
Touched sexually by adult	25.0	38.9	1.55 (1.32, 1.83)
Forced to touch adult sexually	19.1	32.1	1.68 (1.39, 2.03)
Forced to have sex with adult	13.2	23.7	1.79 (1.41, 2.27)

*Risk ratios calculated for disability versus no disability.
[a]Abbreviations: ACE—adverse childhood experience; HH—household.

report experiencing parental divorce or separation (62.5%) than their counterparts (52.9%).

For all three sexual abuse questions, the results show a substantially higher prevalence for the disability group (Table 2). The prevalence of being touched sexually by an adult was 38.9 percent, almost 14 percentage points higher than the rate for the no-disability group. The rates of being forced to touch an adult sexually or forced to have sex with an adult were 13 and 10.5 percentage points higher for the disability group than the no-disability group. All three associated relative risks were statistically significant. In addition, 60 percent of those in the disability group reported being physically hurt by an adult.

Table 3 shows the crude prevalence and model-adjusted risk ratios for risk behaviors, perceived poor health and chronic disease for those with and without a disability and high ACE exposure. Regarding risk behaviors, 38.2 percent of respondents with a disability reported being current smokers as compared to 30.7 percent of non-disabled respondents. After controlling for gender, age and education, the risk of being a current smoker remained statistically significantly higher for the disability group (RR=1.29; [95% C.I., 1.10, 1.51]). There were no statistical differences between groups with regard to the risk of binge drinking or heavy drinking. Both obesity and no recent exercise were found to be far more prevalent in the disability group compared to the no-disability group. For the report of HIV risk behavior(s) there was little difference in the crude rates; however, the corresponding model-adjusted risk ratio for the disability group was significantly higher (RR=1.56; [95% C.I., 1.06–2.31]).

For all five indicators of perceived poor health, the crude prevalence for the disability group exceeded that of the non-disability group by 30 percentage points or more (Table 2). All model-adjusted risk ratios for perceived poor health were significantly elevated for the disability group compared to the no-disability group. Most notably, the results show that the risk of 14 or more days of poor physical health or 14 or more days of having an activity limitation were at least 4 times higher in the disability group after controlling for gender, age, education, not being able to work and history of chronic disease. Furthermore, the report of doctor-diagnosed depression was highly prevalent in the disability group: six in 10 respondents reported depression.

As expected, the prevalence and associated risk of chronic disease was higher for respondents with disabilities compared to respondents with no disabilities (Table 2). After adjusting for gender, age and education, the risk of current asthma was 2.9 times higher, COPD was almost 4 times higher, diabetes was 1.7 times higher, arthritis was 3 times higher, kidney disease was 2.6 times higher, and cancer (other than skin) was 2.3 times higher, for the disability group compared to the no-disability group.

Discussion

A significant finding of this study is that an estimated one in four North Carolina adults with a disability and high ACE exposure (three or more ACEs) reported being forced to have sex with an adult before age 18. In addition, almost

Table 3. Prevalence and Model-adjusted Risk Ratios of Selected Health Indicators for North Carolina Adults with High ACE[a] Exposure (3+ ACEs), by Disability Status: N.C. BRFSS 2012 Survey.

Health indicators	No Disability %	Disability %	Adj. Risk Ratios* RRs (95% C.I.)
Health risks behaviors[1]			
Current smoker	30.7	38.2	1.29 (1.10, 1.51)
Heavy drinking	8.3	5.7	0.77 (0.49, 1.20)
Binge drinking	20.3	12.6	0.87 (0.65, 1.17)
Obesity	30.8	44.1	1.36 (1.16, 1.59)
No recent exercise	18.7	45.3	1.63 (1.32, 2.01)
HIV risk behavior(s)	9.0	9.7	1.56 (1.06, 2.31)
Poor physical/mental health[2]			
Fair or poor general health	14.6	58.2	2.40 (1.96, 2.95)
14+ days of poor physical health	5.3	46.5	4.34 (3.08, 6.11)
14+ days of poor mental health	14.7	44.3	2.58 (2.05, 3.25)
14+ days of activity limitation	4.1	35.6	4.69 (3.19, 6.87)
Doctor-diagnosed depression	21.2	60.7	2.16 (1.82, 2.56)
Chronic disease conditions[1]			
Current asthma	6.3	18.6	2.94 (2.09, 4.14)
COPD[a]	5.1	23.7	3.71 (2.63, 5.25)
Diabetes	7.6	19.4	1.73 (1.29, 2.32)
Arthritis	15.0	60.0	3.00 (2.55, 3.54)
Kidney disease	2.2	5.7	2.61 (1.64, 4.16)
Cancer (other than skin)	4.0	11.7	2.29 (1.55, 3.39)

* Risk ratios calculated for disability versus no disability.
[1] RRs adjusted for gender, age, and education.
[2] RRs adjusted for gender, age, education, unable to work, and history of chronic disease.
[a] Abbreviations: ACE — adverse childhood experience; COPD — chronic obstructive pulmonary disease.

40 percent reported being touched sexually by an adult. For all three indicators of sexual abuse, the associated (unadjusted) relative risks were statistically significantly higher for persons with disabilities and high ACE exposure compared to those with no disability and high ACE exposure. Specifically, for those with disabilities, the risk of forced sexual intercourse was close to 80 percent higher, the risk of being forced to touch an adult sexually was close to 70 percent higher and the risk of being touched sexually by an adult was at least 50 percent higher compared to those without disabilities. These statistics are both alarming and regrettably not unexpected as similar findings have been reported elsewhere.

An analysis of experiences of persons with disabilities using data from the National Crime Victimization Survey found that persons with disabilities experienced rape and sexual assault at higher rates than persons without disabilities.[11] A study of physical and sexual abuse among women with and without disabilities found women with disabilities to be 4 times as likely to have experienced a sexual assault as women without disabilities.[12] Finally, a recent systematic review intended to quantify violence against adults with disabilities found that across multiple scientific studies, adults with disabilities had a higher prevalence of physical and sexual abuse than adults without disabilities.[13] Results from these studies and many others highlight the importance of sexual abuse among adults with disabilities as a public health concern.

As with disabled adults, research has also shown that sexual abuse occurs more frequently among children with disabilities than children without disabilities. A recent meta-analysis found children with disabilities to be 2.9 times as likely as children without disabilities to be sexually abused, with the risk being particularly high among children with intellectual and mental health disabilities.[14] The 2000 N.C. BRFSS Survey included a question asking respondents the age at which their disability began. An examination of these data, in which disability was defined as persons who reported activity limitations due to any impairment or health problem and/or reported the use of special equipment or help from others to get around (similar to the definition in this study), revealed that 20 percent of persons with disabilities had disability onset before the age of 20. Thus, we can conservatively estimate that 10 to 15 percent of persons with disabilities in this study incurred their disability before age 20. Some respondents, therefore, may have experienced sexual abuse concurrently with their disability rather than developing

disability during adulthood, or years after the sexual abuse occurred.

We found that both the prevalence and adjusted relative risk of current smoking were significantly elevated among the disability group compared to the no-disability group after taking into account differences in gender, age and education, which can potentially mediate smoking frequency. This is a particularly disturbing finding given that the smoking rate was not only high (30.7%) among non-disabled respondents, but these respondents were also younger in age than their counterparts, when smoking prevalence tends to be higher. Further analysis of the data revealed that in each of the five age groups, as defined in Table 1, the rate of smoking was higher for persons with disabilities. In particular, the rate of current smoking among 45 to 55 year olds was 53 percent for the disability group versus 26 percent for the no-disability group (results not shown). In this study of disability and high ACE exposure, nearly one in four persons with disability were current smokers. Along with smoking, the results also revealed that rates of obesity and lack of exercise were significantly higher in the disability group. Numerous other scientific studies of adults with disabilities have yielded similar results.[15–18]

We found an exceptionally high prevalence of perceived poor health among persons with disabilities. For all five study measures, the model-adjusted relative risks were at least 2.4 times higher for the disability group. These high levels of perceived poor health were confounded (made worse) by three significant differences between the study groups. The prevalence of persons 65 and older for the disability group was twice that of the no-disability group; thus, the potential for advancing age to influence health status was greater. Also, more than one-third of the disability group reported not being able to work; thus, the proportion with a disability resulting in work-related impairment was substantially greater. Lastly, the likelihood of comorbidity of disease was substantially higher in the disability group: 46 percent of the disability group reported having two or more chronic diseases as compared to 12 percent of the no-disability group. By controlling for these factors, the model-adjusted relative risks were significantly lower than what would have been obtained from calculating the unadjusted relative risk (for example, the unadjusted relative risk of 14 or more days of poor physical health was 8.7, while the model-adjusted risk was 4.3). We conclude that these model-adjusted risks offer a more reasonable approximation of the true excess risk of perceived poor health among persons with disabilities and high ACE exposure.

Conclusion

Overall, the findings from this study demonstrate that persons with disability and high ACE exposure are at an increased risk for health risk behaviors, perceived poor health and chronic conditions compared to persons without disability and high ACE exposure. While the finding of an increased risk for chronic conditions among the disability group was not unexpected, the finding of an increased risk for perceived poor health even after adjustment for factors related to disability and likely to affect this perception, such as age, history of chronic conditions and being unable to work, is noteworthy. Perceptions of poor health may not only be related to and affected by physical health, but mental well-being as well. Strategies to improve mental health and well-being of persons with disability who have been exposed to multiple types of childhood abuse and trauma may be particularly important to overall quality of life. Finally, we were not able to determine the exact proportion of participants with disability who incurred disability during childhood and the proportion who developed disability in adulthood. Future studies would benefit from this designation as the directionality of the association between disability and ACEs, particularly sexual abuse, is unclear.

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