

## **Adverse Childhood Experiences Negatively Impact Health Behaviors and Chronic Disease Risk Among Adults Residing in Delaware**

Caprice A. Torrance, MHA,<sup>1</sup> Kimberly Williams, MPH,<sup>1</sup> Elizabeth Brown, MD,<sup>1</sup> Kirsten Olson,<sup>2</sup> Andrea Miller,<sup>2</sup> Leslie Newman,<sup>2</sup> Mia A Papas, PhD<sup>1</sup>

1. Value Institute, Christiana Care Health System

2. Children and Families First

Adverse childhood experiences (ACEs), which include factors such as being a victim of violence, emotional or physical neglect, or growing up under a caregiver struggling with serious mental illness or substance abuse, interfere with a child's social, emotional, and behavioral development.<sup>1</sup> A sobering array of diminished adulthood outcomes associated with ACEs are well-documented and include poorer academic and professional achievement; more mental health conditions like PTSD, anxiety, depression, and suicide; and serious diseases that shorten lives by twenty years.<sup>2,3</sup>

ACEs are pervasive in our community: more than two-thirds of the United States population has experienced at least one, and there is a dose-response relationship between ACEs and adverse health outcomes,<sup>4</sup> making toxic childhood stress a major public health concern. Although ACEs are associated with negative health outcomes, recent neuroscience research has demonstrated that brains are malleable well into adulthood<sup>5</sup> and there is research suggesting that those impacted by toxic stress can recover through interventions that build skills and resilience.<sup>4</sup>

National ACE data has demonstrated differences in the prevalence of ACE severity (as measured by having 4 or more ACEs), as well as differences in the distribution of specific ACEs across socio-demographic groups.<sup>6</sup> For example, older populations (aged 55 years or greater) experience fewer ACEs when compared to younger populations (aged 18 to 54). The low prevalence in older age groups is an indication of an increased risk for premature mortality among those who experience ACEs. Understanding the distribution of ACEs within communities is critical for the implementation of effective primary and secondary prevention efforts aimed at improving the health and wellbeing of adults and families.

The current investigation examines the prevalence of adverse childhood experiences in Delaware among adults aged 18 years or greater. We hypothesize that: 1) ACEs will be common in Delaware, especially among women, and those with low-income, low education and race/ethnic minorities and 2) ACEs will be associated with an increased prevalence of chronic disease and poor health behaviors.

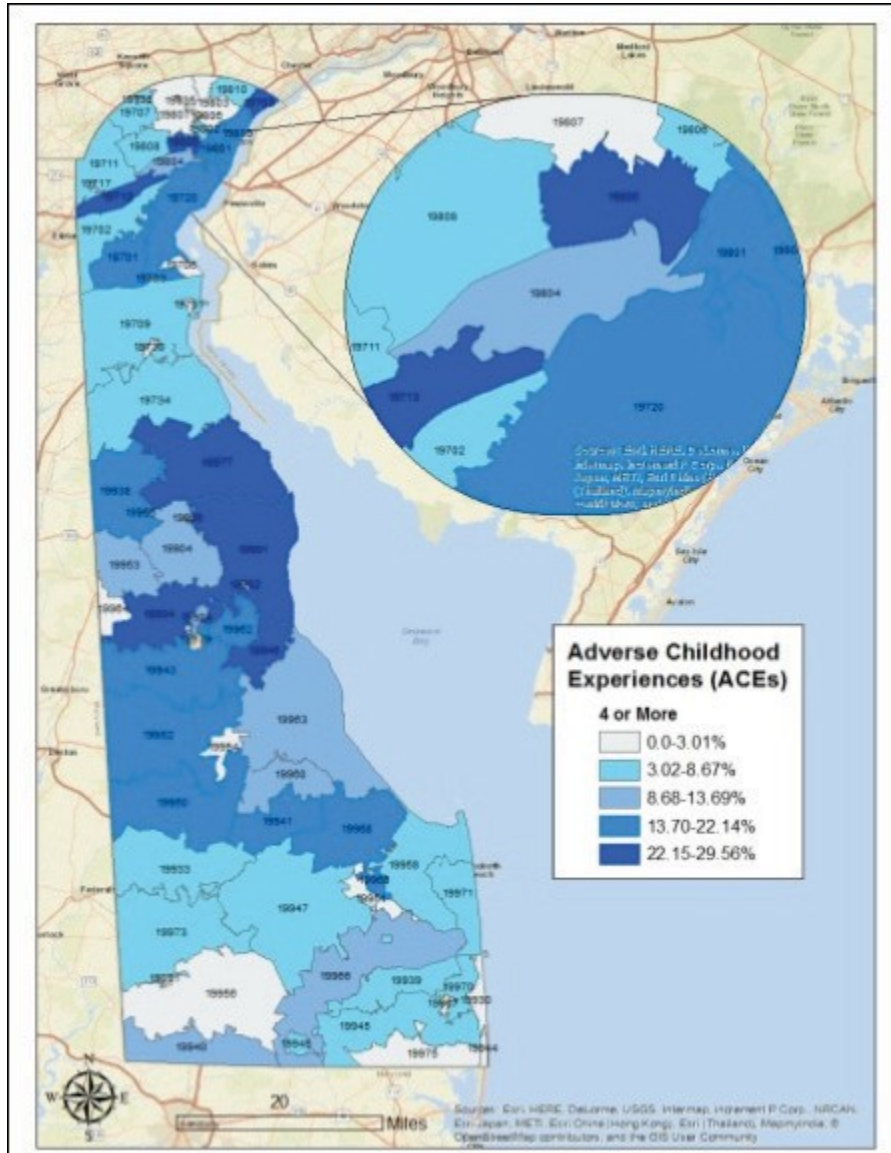
## **METHODS**

### **Survey Methods**

The 2015 Delaware Household Health Survey (DHHS) was conducted using a representative, random sample of 2,609 households located in all three counties within the state of Delaware. Landline and cellular telephone interviews were completed with a household member who was at least 18 years of age. Interviews were administered in both English and Spanish. The overall response rate was 27.8%. Survey data collected included demographic characteristics, personal

health behaviors, health outcomes, access to care, preventive screenings, and adverse childhood experiences.

Figure 1. Prevalence of having four or more adverse childhood experiences by zip code in Delaware.



## MEASURES

### Demographic Characteristics

Within the current investigation, demographic characteristics examined included age, sex, race/ethnicity, and education. Age was categorized into four groups: 18-34, 35-49, 50-64, and 65 years or older. Sex was categorized as female or male. Race was categorized into White, Black, Hispanic, Asian, and Other (including Pacific Islander, American Indian or Alaska Native, Biracial or Multiracial, and something else). Education was categorized into no high school

diploma, high school graduate, any college (including technical, trade or vocational school after high school and some college (includes Associate's degree)), and college graduate (including college graduate (B.S., B.A., or other four-year degree), post-graduate, or professional schooling after college).

### **Adverse Childhood Experiences**

The adverse childhood experiences survey included ten questions that deal with psychological abuse, physical abuse, contact sexual abuse, exposure to substance abuse, mental illness, violent treatment of mother or stepmother, criminal behavior in the household, parental separation or divorce, physical neglect, and emotional neglect. Respondents that answered "yes" to any of these questions were defined as exposed to that adverse childhood experience. The 2015 DHHS also included two additional questions on discrimination and being bullied by a peer. For the discrimination question, any respondent that answered "Very often" or "Often" was defined as experiencing discrimination. For the bullied by a peer question, any respondent that answered "All of the time" or "Most of the time" was defined as being bullied.

### **Health Behaviors**

Health behaviors examined included cigarette smoking, other tobacco products, e-cigarettes (vapor), obesity, physical inactivity, sugar sweetened beverage intake, screen time, substance abuse and self-harm. We defined current cigarette smoker as a respondent who answered "Every day" or "Some days" to "How often do you currently smoke cigarettes?" current other tobacco product smoker was defined as a respondent that answered "Yes" to "Other than cigarettes, do you currently use any tobacco products, such as cigars, cigarillos, pipes, chew tobacco, bidis, kreteks, or any other tobacco product." We defined current vaper as a respondent that answered "Once", "A few times", "Once per week", "A few times per week", and "Every day" to "In the past month, how many times have you used an e-cigarette (also known as vape pipes, vape pens, e-hookah, e-cigars)." Self-reported height and weight information were used to define obesity as having a Body Mass Index (BMI) greater than or equal to 30 kg/m<sup>2</sup>. Physical inactivity was defined as no participation in physical activity or exercise that makes you sweat or increases your heart rate for at least a half an hour. Soda/processed juice drinkers were those who reported consuming 1 or more soda and/or processed juices a day. Excessive television and/or computer time was defined as an average of 2 or more hours a day on their computer or television. Substance abuse was defined as being told by a doctor, other health professional, peer, a friend, or a loved one that they have or had a substance abuse problem. Finally, commit self-harm was defined as anyone who answered "Yes" to "During the past 12 months, was there ever a time you felt so sad or hopeless that you wanted to do something to purposely hurt yourself or end your life."

### **Chronic Disease**

Six measures of chronic disease including both physical and mental health were examined. Individuals were classified as having asthma, diabetes, heart disease or hypertension if they responded yes to the question, "Have you EVER been told by a doctor or other health professional that you have or had the following conditions: Asthma, Diabetes (includes both gestational and non-gestational diabetes), Heart Disease, High Blood Pressure or Hypertension (includes both pregnancy and non-pregnancy induced hypertension)." Mental health and self-rated health status were also included in this investigation. Any respondents that answered "Yes"

to “Have you ever been diagnosed with any mental health condition, including clinical depression, anxiety disorder or bipolar disorder” was classified as having a mental health condition and respondents that answered “Fair” or “Poor” to “Would you say that in general your health is excellent, very good, good, fair or poor” were classified as having poor self-rated health.

## Statistical Analysis

Descriptive statistics (including frequencies, means, standard deviations and ranges) were used to describe demographic characteristics of the population as well as adverse childhood experiences, health behaviors, and chronic disease. The bivariate association between ACE scores and demographic characteristics, health behaviors, and chronic disease were examined with the Pearson chi-square test. A series of logistic regression models were then fit to assess the odds of each outcome (health behaviors or chronic diseases) comparing those with no ACE exposure to those with 1, 2, 3 and 4 or more ACEs. ACE was included as a categorical variable and a test for trend was examined to investigate any dose-response effects between ACE and health behaviors or chronic disease. Race/ethnicity, gender, age, and educational attainment were all included as covariates in the model. All analyses were run using IBM Statistical Package for the Social Sciences (SPSS) version 22. Complex survey analytic methods were employed in order to weight the results based on the overall adult population weight.

## RESULTS

Of the 2,609 survey respondents, we excluded 194 respondents with missing data for the adverse childhood experiences survey leaving an analytic dataset of 2,415 respondents (92.6%). The mean age of the respondents was 48.6 years (range from 18 to 100 years old); 53.1% of the respondents were female; 71.3% were white; and 35.1% of respondents graduated from college with at least a four-year degree whereas 7.2% did not graduate high school.

### Adverse Childhood Experiences (ACEs)

The prevalence of adverse childhood experiences ranged from 4.6% to 31.8% depending on the particular experience as shown in Table 1. Parental separation or divorce (31.8%) and substance abuse (20.4%) were the most prevalent adverse childhood experiences whereas criminal behavior in the household (7.6%) and physical neglect (4.6%) were the least prevalent. Over half of the adults in Delaware, 55.1%, have been exposed to at least one adverse childhood experience and 13.2% have been exposed to severe adverse childhood experiences (4 or more). Additionally, when discrimination and bullying during childhood were examined, it was found that about 13.7% of the population experienced some form of discrimination and 6.6% had reported being bullied.

Table 1. Prevalence of adverse childhood experiences, bullying, and discrimination among adults over the age of 18 years residing in Delaware

Adverse Childhood Exposure	Prevalence (%)
Psychological Abuse: Did a parent or other adult in the household often or very often swear at you, insult you, put you down, humiliate you; OR act in a way that made you afraid that you might be physically hurt?	14.4

Physical Abuse: Did a parent or other adult in the household often or very often push, grab, slap, throw something at you; OR ever hit you so hard that you had marks or were injured?	14.1
Sexual Abuse: Did an adult or person at least 5 years older than you ever touch or fondle you, have you touch their body in a sexual way; OR attempt or actually have oral, anal, or vaginal intercourse with you?	9.1
Substance Abuse: Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?	20.4
Mental Illness: Was a household member depressed or mentally ill, or did a household member attempt suicide?	12.1
Mother Treated Violently: Was your mother or stepmother often or very often pushed, grabbed, slapped, kicked, bitten, hit with a fist, hit with something hard, had something thrown at her; OR ever repeatedly hit for at least a few minutes or threatened with a knife or gun?	8.2
Criminal Behavior in Household: Did a household member go to prison?	7.6
Parental Separation or Divorce: Were your parents ever separated or divorced?	31.8
Physical Neglect: Did you often or very often feel that you didn't have enough to eat, had to wear dirty clothes, and had no one to protect you; OR your parents were too drunk or high to take care of you or take you to the doctor if you needed it?	4.6
Emotional Neglect: Did you often or very often feel that no one in your family loved you, thought you were important or special; OR your family didn't look out for each other, feel close to each other, or support each other?	14.4
Discrimination and Bullying	
Discrimination: While you were growing up, how often did you feel that you were treated differently, badly or unfairly because of your race or ethnicity? (included responses: "often" and "very often")	13.7
Bullying: While you were growing up, how often were you bullied by a peer or classmate? (included responses "most of the time" and "all of the time")	6.6

### Geographical Distribution of ACEs

We next examined the geographical distribution of those Delawareans who experienced severe adverse childhood experiences defined as reporting four or more ACEs. Although thirteen percent of all Delawareans reported 4 or more ACEs, the prevalence of severe ACEs differed by county. Within Kent County, 20.4% of the population experienced severe ACEs whereas the prevalence of severe ACEs was 13.0% for New Castle County and 7.7% for Sussex County. To examine the influence of Wilmington, a major urban area, within New Castle County, the "Greater Wilmington Area", defined by the Delaware Public Health Institute as encompassing 12 zip codes, was extracted from the New Castle County variable and categorized into its own variable. The prevalence of four or more ACEs was slightly higher in the Greater Wilmington Area (13.8%) when compared to the rest of New Castle County (12.3%).

Finally, we utilized Esri ArcGIS 10.4 software to create a visual map of the distribution of severe ACE prevalence by zip code, normalized to the population density within each zip code (see Figure 1). Seven zip codes emerged as containing the highest prevalence of 4 or more ACEs:

19703, 19805, 19713, 19977, 19901, 19934, and 19946 with prevalence estimates ranging from 22.2% to 29.6%.

### Demographic Differences by ACEs

We assessed the difference in the prevalence of adverse childhood experiences by age, gender, race, and educational attainment (Table 2). There was a statistically significant association between all demographic characteristics and ACEs (all p-values < 0.01). The highest prevalence of ACEs was found among females, aged 18 to 34 years, Blacks, and those not having a high school diploma.

Table 2. Associations between demographic characteristics and the prevalence (%) of adverse childhood experiences among adults aged 18 years or older residing in Delaware

<b>Demographic</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4+</b>
Age (years)***					
18-34	23.0	32.0	29.9	41.4	36.5
35-49	18.5	20.5	21.9	20.0	26.1
50-64	28.4	25.9	32.5	24.6	26.2
65+	30.1	21.6	15.6	14.0	11.2
Gender***					
Female	50.9	53.6	57.1	48.5	58.9
Male	49.1	46.4	42.9	51.5	41.1
Race***					
White	72.6	69.7	75.6	69.9	66.6
Black	17.6	21.2	14.7	22.9	24.8
Hispanic	1.8	1.8	1.7	3.0	0.4
Asian	4.9	3.1	3.3	1.1	0.1
Other	3.0	4.1	4.8	3.1	8.1
Education***					
No HS Diploma	5.7	5.5	9.5	9.1	12.6
HS Graduate	25.2	36.0	29.3	34.4	35.7
Any College	23.7	26.2	35.1	33.3	31.4
College Graduate	45.4	32.3	26.1	23.2	20.3
<b>All Respondents</b>	<b>44.9</b>	<b>23.5</b>	<b>10.8</b>	<b>7.6</b>	<b>13.2</b>

\*\*\*Significant at p<0.01

### Association between Adverse Childhood Experiences and Health Behaviors

After adjusting for age, gender, race/ethnicity and educational attainment, adverse childhood experiences were statistically significantly associated with all of the health behaviors examined (see Table 3). ACEs were moderately associated with obesity, physical inactivity, soda consumption, and tv and/or computer use, with the majority of odds ratios less than 2.0. There was a clear, strong, dose response association between ACEs and cigarette smoking, vapor use, and tobacco products as well as substance use and committing self-harm.

Table 3. Associations (prevalence, adjusted odds ratios and 95% confidence intervals) between number of adverse childhood experiences and health behaviors among adults aged 18 years or older in Delaware

Health Behavior	Number of ACEs	Prevalence (%)	Adjusted Odds Ratio <sup>b</sup>	95% Confidence Interval
Current Cigarette Smoker	0	10.8	1.00	Reference
	1	14.3	1.20	(1.18-1.23)***
	2	23.9	2.03	(1.99-2.08)***
	3	29.7	2.63	(2.57-2.61)***
	4+	36.0	3.22	(3.16-3.28)***
	Total	17.8	-	-
Current Other Tobacco Product Smoker	0	2.4	1.00	Reference
	1	2.6	0.84	(0.81-0.88)***
	2	9.6	3.82	(3.68-3.96)***
	3	8.8	2.49	(2.39-2.60)***
	4+	6.6	1.93	(1.86-2.00)***
	Total	4.3	-	-
Current Vaper	0	3.0	1.00	Reference
	1	6.0	1.68	(1.63-1.73)***
	2	7.2	1.97	(1.89-2.04)***
	3	10.5	2.62	(2.53-2.72)***
	4+	13.1	3.35	(3.25-3.46)***
	Total	6.1	-	-
Obesity	0	29.9	1.00	Reference
	1	31.9	1.08	(1.07-1.10)***
	2	33.0	1.03	(1.01-1.05)***
	3	36.8	1.34	(1.31-1.36)***
	4+	37.3	1.18	(1.16-1.20)***
	Total	32.2	-	-
Physical Inactivity	0	12.9	1.00	Reference
	1	16.0	1.26	(1.24-1.28)***
	2	16.2	1.35	(1.31-1.38)***
	3	20.6	2.19	(2.14-2.25)***
	4+	13.4	1.16	(1.13-1.19)***
Soda/Processed Juice	Total	14.6	-	-
Drinker	0	56.0	1.00	Reference
	1	56.6	0.91	(0.90-0.92)***
	2	62.9	1.29	(1.26-1.31)***
	3	66.3	1.15	(1.13-1.18)***
	4+	56.4	0.81	(0.79-0.82)***
	Total	57.7	-	-
Excessive TV & Computer Time	0	80.6	1.00	Reference
	1	80.0	1.09	(1.07-1.11)***
	2	86.4	1.79	(1.75-1.84)***
	3	80.5	1.08	(1.05-1.10)***

	4+	81.9	1.19	(1.17-1.22)***
	Total	81.3	-	-
Substance Abuser	0	4.0	1.00	Reference
	1	8.4	2.00	(1.95-2.05)***
	2	13.7	3.41	(3.31-3.51)***
	3	26.0	7.21	(7.01-7.41)***
	4+	22.1	5.72	(5.58-5.87)***
	Total	10.2	-	-
Commit Self-Harm <sup>a</sup>	0	1.3	1.00	Reference
	1	2.5	1.64	(1.57-1.72)***
	2	6.8	4.76	(4.55-4.97)***
	3	8.3	5.18	(4.96-5.44)***
	4+	17.5	13.17	(12.68-13.68)***
	Total	4.9	-	-

<sup>a</sup>Includes wanting to do something to purposely hurt yourself or end your life

<sup>b</sup>Odds ratios adjusted for age, gender, race, and educational attainment.

\*\*Significant at  $p < 0.05$

\*\*\*Significant at  $p < 0.01$

To assess if discrimination or bullying were associated with these health behaviors beyond the impact of adverse childhood experiences, we included discrimination and bullying in the model after adjusting for ACEs, race, gender, educational attainment, and age.

Discrimination increased the odds of being a current cigarette smoker, substance abuser, and committing self-harm. Those who experienced discrimination were 1.41 times more likely to be current cigarette smokers (95% confidence interval (CI): 1.4, 1.5), 1.55 times more likely to be substance abusers (95% CI: 1.51, 1.6), and 1.94 times more times likely to commit self-harm (95% CI: 1.87, 2.0) when compared to those not experiencing discrimination.

When bullying was examined, after adjusting for ACEs as well as race, gender, educational attainment, and age, there was a statistically significant increase in the odds of obesity (OR = 1.71; 95% CI: 1.67, 1.76); physical inactivity (OR = 1.37; 95% CI: 1.33, 1.41); and committing self-harm (OR = 2.96; 95% CI: 2.85, 3.07) for those reporting bullying as a child compared to those who did not report bullying.

### **Associations between Adverse Childhood Experiences and Chronic Diseases**

There were strong, statistically significant, dose-response associations between adverse childhood experiences and each chronic health condition examined including asthma, diabetes, heart disease, hypertension, mental health, and fair/poor self-rated health (see Table 4). The odds of reporting a diabetes diagnosis were 2 times greater (OR = 2.2; 95% CI: 2.17, 2.27) for those experiencing four or more ACEs compared to those experiencing no ACEs. Those reporting four or more ACEs were also 4.15 times more likely to report fair or poor rated self- health (95% CI: 4.07, 4.23) and 6.9 times more likely to report a mental health condition (95% CI: 6.75, 7.03) compared to those reporting no ACEs.



Table 4. Associations (prevalence, adjusted odds ratios and 95% confidence intervals) between number of adverse childhood experiences and chronic health conditions among adults aged 18 years or older in Delaware

Chronic Diseases	Number of ACEs	Prevalence (%)	Adjusted Odds Ratio <sup>b</sup>	95% Confidence Interval
Asthma	0	12.0	1.00	Reference
	1	12.8	1.03	(1.01-1.05)***
	2	15.4	1.19	(1.17-1.22)***
	3	14.2	1.14	(1.11-1.17)***
	4+	17.8	1.39	(1.36-1.42)***
	Total	13.5	-	-
Diabetes	0	12.2	1.00	Reference
	1	11.5	1.08	(1.06-1.10)***
	2	17.2	1.87	(1.82-1.91)***
	3	12.8	1.47	(1.42-1.51)***
	4+	17.9	2.22	(2.17-2.27)***
	Total	13.4	-	-
Heart Disease	0	9.7	1.00	Reference
	1	9.1	1.23	(1.21-1.26)***
	2	9.1	1.37	(1.33-1.41)***
	3	9.3	1.74	(1.68-1.80)***
	4+	9.2	1.90	(1.85-1.96)***
	Total	9.4	-	-
High Blood Pressure or Hypertension	0	33.2	1.00	Reference
	1	30.6	1.08	(1.07-1.10)***
	2	33.0	1.37	(1.34-1.39)***
	3	28.6	1.19	(1.17-1.22)***
	4+	35.6	1.71	(1.68-1.74)***
	Total	32.5	-	-
Mental Health Condition <sup>a</sup>	0	7.7	1.00	Reference
	1	11.9	1.50	(1.47-1.53)***
	2	22.8	2.99	(2.92-3.06)***
	3	33.1	5.68	(5.55-5.82)***
	4+	40.8	6.89	(6.75-7.03)***
	Total	16.6	-	-
Fair or Poor Self-Rated Health	0	10.4	1.00	Reference
	1	14.9	1.54	(1.51-1.57)***
	2	23.3	2.57	(2.51-2.63)***
	3	19.3	2.11	(2.06-2.17)***
	4+	32.6	4.15	(4.07-4.23)***
	Total	16.5	-	-

<sup>a</sup>Includes clinical depression, anxiety disorder, and bipolar disorder

<sup>b</sup>Odds ratios adjusted for age, gender, race, and educational attainment.

\*\*Significant at  $p < 0.05$

\*\*\*Significant at  $p < 0.01$

To evaluate whether discrimination or bullying provided additional explanation for these chronic diseases, we examined associations between these two factors and chronic health conditions after adjusting for ACEs as well as race, gender, educational attainment, and age.

Discrimination increased the odds for each health outcome examined. Those who felt discriminated against often or very often were more likely to report having asthma (OR = 1.22; 95% CI: 1.2, 1.28), diabetes (OR = 1.37 (95% CI: 1.33, 1.4), heart disease (OR = 1.85; 95% CI: 1.8, 1.91), hypertension (OR = 1.95; 95% CI: 1.91, 1.99), a mental health condition (OR = 1.2; 95% CI: 1.16, 1.22) and fair/poor self-rated health (OR = 1.85; 95% CI: 1.81, 1.89) compared to those who never felt discrimination (all  $p$ -values  $< 0.01$ ).

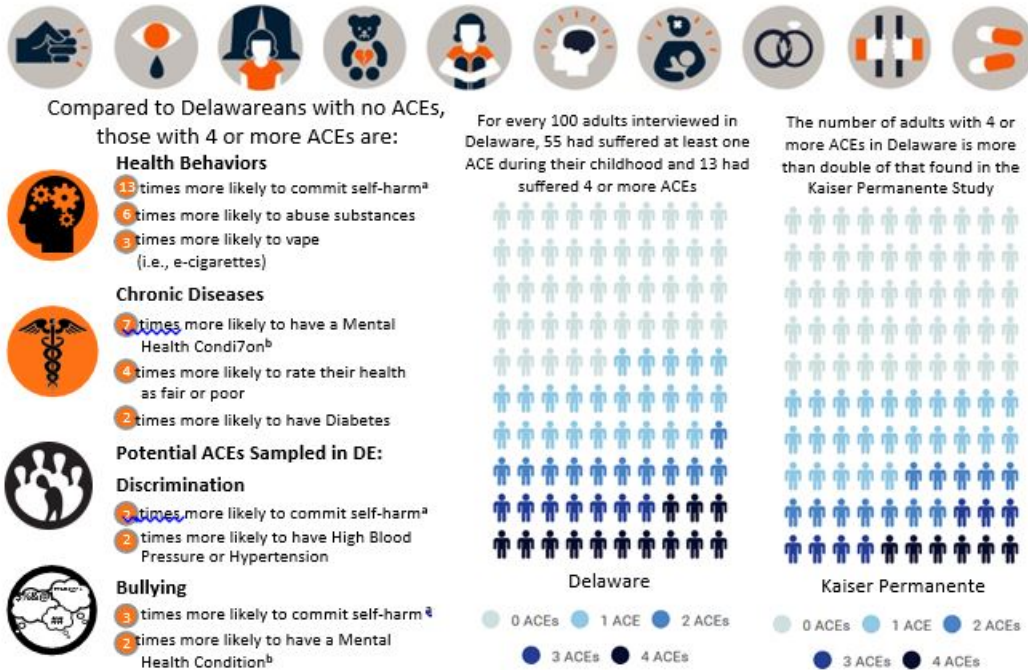
Bullying was also statistically significantly associated with an increase in the odds of chronic disease after adjusting for ACEs, race/ethnicity, gender, age and educational attainment.

Respondents who were bullied by a peer during childhood all or most of the time were more likely to report having asthma (OR = 2.21; 95% CI: 2.15, 2.27), diabetes (OR = 1.92 (95% CI: 1.86, 1.97), heart disease (OR = 1.19; 95% CI: 1.14, 1.25), a mental health condition (OR = 2.3; 95% CI: 2.24, 2.36) and fair/poor self-rated health (OR = 1.63; 95% CI: 1.59, 1.68) compared to those who were never bullied (all  $p$ -values  $< 0.01$ ).

The results of the analysis examining the associations among adverse childhood experiences, bullying, discrimination and health behaviors as well as chronic health conditions are summarized in the infographic displayed in figure 2.

Figure 2. Impact of adverse childhood experiences, discrimination and bullying on health behaviors, chronic disease, discrimination and bullying in Delaware

## Adverse Childhood Experiences affect Delawareans for the Rest of their Life...



## Discussion

Over half of the population in Delaware reported experiencing at least one adverse childhood experience. The most common ACE reported was divorce followed by substance abuse (either alcohol or illicit drug use). This is consistent with National trends indicating that half of the population residing in approximately 16 states in the U.S. have experienced at least one adverse childhood experience, the most common being divorce.<sup>7</sup>

It is troubling that in this population sample more than one in ten (13%) members of the population reported experiencing severe adversity defined as four or more adverse childhood experiences. There is clear evidence of a dose response association between number of ACEs experienced and worse health outcomes including premature mortality.<sup>2</sup> The high number of individuals reporting multiple ACEs speaks to the need for increased focus on prevention and early intervention in order to minimize the negative impact in adulthood.

Psychological abuse, physical abuse and emotional neglect were also commonly reported with nearly 14% of the population experiencing some form of abuse and/or neglect. Child maltreatment has both short and long-term consequences for individuals ranging from attention problems, emotional disorders, poor relationships, aggressive or violent behaviors and negative health outcomes. These consequences place an individual on a trajectory that can result in limited education, poverty, substance abuse, unemployment and a continued intergenerational cycle of maltreatment.<sup>8,9</sup>

Within Delaware there was a pattern to the geographical distribution of adverse childhood experiences. This geographical pattern can assist in the development of targeted prevention and intervention programs focused in high-risk areas. For example, ACEs were high in and around the city of Wilmington, an area that has one of the highest violent crime rates in the Nation.

Somewhat unexpected, though, was that the prevalence of ACEs in areas of Kent County, especially around Smyrna and Dover, were just as high as some of the Wilmington areas. Given differences in the built and social environments between Wilmington and Smyrna, for example, prevention and intervention efforts will need to be tailored to the population and take into consideration the critical components of the environments as well as unique challenges faced by residents in more rural areas compared to those residing in larger cities.

The demographic pattern of adverse childhood experiences reported was similar to the National pattern. Those experiencing more ACEs tended to be female, Black, have less education, and were of younger age (18 to 34 years). Adverse childhood experiences are disproportionately represented among those segments of the population that also experience health disparities. There is emerging evidence that ACEs make a unique contribution to the disparities evident in many physical and mental health outcomes.<sup>10</sup>

Adverse childhood experiences were associated with many negative health behaviors including obesity, physical inactivity, increased soda consumption, increased screen time, smoking, substance use and self-harm. This is consistent with a wealth of data documenting the increased likelihood of risk behaviors such as obesity,<sup>11</sup> smoking,<sup>12</sup> substance abuse,<sup>13</sup> attempted suicide,<sup>14</sup> and self-harm<sup>15</sup> among those who report adverse childhood experiences. The increased likelihood of risk behaviors associated with adverse childhood experiences may be one reason there is an increase in the likelihood of negative mental and health outcomes in this population.

As expected, ACEs were associated with chronic and mental health conditions such as diabetes, asthma, heart disease, hypertension, mental health conditions, and poor self-rated health. In addition to the propensity toward negative behaviors that increase the risk of chronic disease, there is mounting evidence indicating that early adverse experiences can induce biological and physiological changes that place an individual at increased risk for premature mortality and morbidity early in life.<sup>16</sup> Focusing prevention efforts early in life can impact one's life-course trajectory given the long-term behavioral, social and chronic health costs that arise from adverse childhood experiences. Given rising health care costs and the possibility of rising rates of adverse childhood experiences that come in times of economic and political instability it is imperative that we implement targeted, community wide prevention and intervention programs to reduce the negative consequences of early life adversity.

Two additional adverse childhood experiences were examined in this population including discrimination and bullying. Both of these factors increased the likelihood of negative physical and mental health outcomes over and above the impact of the most common ten adverse childhood experiences examined. Bullying was associated with an increased likelihood of asthma, heart disease, and poor mental health whereas discrimination was associated with an increased likelihood of these conditions as well as diabetes and hypertension. Understanding the impact of additional adverse childhood experiences such as bullying and discrimination is critical to be able to implement a comprehensive prevention program that targets key components of childhood adversity.

One recent advancement within pediatric health care delivery has been the adoption of the medical home. The medical home provides a continuous and comprehensive approach to care from infancy to young adulthood and maybe be an important tool to advance the health of the populations, especially among those who experience adversity in childhood.<sup>17</sup> Within a large sample of children aged 6 to 17 years, access to a medical home was associated with higher

levels of overall well-being and protected children from the negative impact of adverse childhood experiences faced within their life.<sup>18</sup> The impact of access to a medical home in moderating the negative impact of childhood adversity on later life health outcomes is an exciting avenue for further exploration.

Within this population of Delawareans, the public health impact of ACEs is evident in its strong association with substance abuse, self-harm, and physical and mental health conditions.

The high prevalence of ACEs calls for an increased investment in programs and policies targeting prevention and intervention strategies to ameliorate the negative consequences on physical and mental health in adulthood. Such efforts can lead to improvements in overall well-being as well as result in the achievement of health equity within populations. Prevention and intervention programs will need to be tailored to fit the needs of the population given the high prevalence found in both rural and urban areas in order to have the greatest impact of overall health and well-being.

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