The Impact of Adverse Childhood Experiences on Adolescent Health Risk Indicators in a Community Sample

Elizabeth C. Meeker1, 2, Briannon C. O’Connor1, 2, Lourah M. Kelly1, 2, 3, Debra D. Hodgeman4, Amy H. Scheel-Jones1, and Cassandra Berbary2

1 Coordinated Care Services Incorporated, Rochester, New York, United States
2 College of Health Sciences, Rochester Institute of Technology, Rochester, New York, United States
3 School of Medicine, University of Connecticut, Farmington, Connecticut, United States
4 Monroe County Office of Mental Health, Rochester, New York, United States

Objective: Despite growing awareness of the high prevalence of adverse childhood experiences (ACEs) in community samples of adolescents, little work has examined the impact of ACEs on adolescence and well-being during this critical period of development. Much research has focused on retrospective reports of ACEs by adults and adult physical and mental health, finding that ACEs contribute to a range of diseases and mental health disorders in adulthood. This study examined differences in self-reported mental health, nonsuicidal self-injury, suicidality, violence, and substance use between adolescents without self-reported history of ACEs, youth with one self-reported ACE, and youth with self-reported multiple (2 or more) ACEs.

Method: The sample included 1,532 adolescents who completed the Youth Risk Behavior Surveillance Survey in their local high schools. By local consensus, this national survey was augmented with questions exploring prevalence of 11 commonly identified ACEs.

Results: After controlling for age, gender, and race, youth with multiple ACEs reported 3 to 15 times the odds of a range of negative health experiences.

Conclusions: Findings indicate a serious burden of ACEs on adolescent social emotional well-being. This study did not include youth in out of school placements or who were not present the day the survey was given, and thus represent youth who may benefit from universal prevention and intervention programs. Universal screening of ACEs and health-related outcomes suggests that reporting multiple ACEs is strongly related to a wide range of mental health, violence, and substance use histories.

Clinical Impact Statement
Youth with multiple ACEs report significantly greater likelihood of mental health problems, suicidality, substance use, and aggression than youth without ACEs. The largest differences between youth with multiple ACEs and youth without ACEs were found in suicidality (i.e., suicide attempts, suicidal ideation) and violence (e.g., weapon and gun possession). Suicide and violence prevention should therefore be a key part of trauma interventions. Youth with self-reported exposure to traumatic events should be screened for mental health, suicidality, substance use, and violence risk; similarly, youth demonstrating high risk behaviors should be screened for trauma. Integrated treatments for mental health, substance use, and aggression for youth survivors of trauma are indicated. Because a third of youth reported multiple ACEs and having multiple ACEs were associated with a broad range of high risk mental health, substance use, and violence indicators, a comprehensive system of care that is trauma and culturally responsive to the needs of youth and their families is indicated.

Keywords: trauma, adverse child events, mental health, aggression, substance use
Adverse childhood experiences (ACEs) are potentially traumatic events that occur prior to age 18 that can have lasting negative impact on an individual’s overall health and well-being (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014) and are now recognized as a growing public health concern. ACEs are historically categorized into three major groups: abuse, neglect, and family/household challenges (Felitti et al., 1998). Data from the 2016 National Survey of Children’s Health indicate that almost half (46.3%) of all children and 55.7% of adolescents aged 12–17 in the United States have experienced at least one abuse or neglect-related ACE (Bethell et al., 2017). This rate is higher among Black (63.7%) and Hispanic/Latinx (51.4%), compared to White (40.9%) and Asian children (23%; Bethell et al., 2017). Nationally, 10% of children have experienced three or more ACEs (Sacks & Murphy, 2018). Similarly, over half of state-population based samples of adults (57%) report at least one ACE and 8.3% report five or more ACEs (Schüssler-Fiorenza et al., 2014). If broader family/household challenges are included in ACE assessments, adult lifetime rates of at least one ACE are up to 80% (Merrick et al., 2017). Given the high prevalence of ACEs and their impact on neurological, social-emotional, and behavioral health in youth (Shonkoff et al., 2012), it is critical to better understand the effects ACEs have on a range of youth health indicators.

The relationship between ACEs and later adult health outcomes and risk behaviors has been well-established (Larkin et al., 2012). Early research by Felitti and colleagues (1998) investigated the following types of ACEs: physical abuse and neglect; emotional abuse and neglect; sexual abuse; witnessing domestic violence; and living with a family member who experienced chemical dependence, mental illness, or incarceration. There was a strong relationship between retrospective reports of ACEs and poor adult mental and physical health outcomes. Adults with four or more ACEs were more likely to experience mental health problems (i.e., substance use, depressed mood, suicide attempt), physical health problems (i.e., sexually transmitted infections, obesity, ischemic heart disease, diabetes, stroke, cancer, lung disease, liver disease), and physical health risk behaviors (e.g., smoking, ≥ 50 sexual partners, physical inactivity). There was also a dose-response relationship for many physical health problems, such that adults with more ACEs were more likely to have a history physical health problems (Felitti et al., 1998).

Similarly, more recent research has elucidated this relationship, consistently finding links between ACEs, risk behaviors, and poor physical and mental health outcomes in adult samples. Health outcomes linked to ACEs include chronic disease, diabetes, stroke (Gilbert et al., 2015), cancer (Brown et al., 2010), and heart disease (Dong et al., 2004). Furthermore, mental health outcomes related to ACEs include depression (Anda et al., 2002; Chapman et al., 2004; Edwards et al., 2003), anxiety disorders and posttraumatic stress disorder (Cougle et al., 2010), and suicidality (Dube et al., 2001; Merrick et al., 2017), as well as substance use including tobacco (Edwards et al., 2007; Ford et al., 2011), alcohol (Anda et al., 2002; Dube et al., 2002; Dube et al., 2006; Strine et al., 2012; Merrick et al., 2017) and other drug use (Dube et al., 2003; Merrick et al., 2017). Retrospective research has also documented a dose response relationship between ACEs and adult substance use (Anda et al., 2007; Dube et al., 2002; Dube et al., 2003; Dube et al., 2006; Flouri & Kallis, 2011) and depressed mood and suicidal ideation (Merrick et al., 2017).

Although a majority of ACEs studies have focused on the original categories of ACEs (emotional neglect and abuse, sexual abuse, physical neglect and abuse, domestic violence, parental separation/divorce, household mental illness, household substance abuse, incarcerated household member; Brown et al., 2010), more recent research has expanded the definition of ACEs to include experiences such as peer victimization/bullying, discrimination, racial inequity, economic hardship, community violence, and parental death. Indeed, recent work suggests the original ACEs of maltreatment and household challenges should include community violence and peer violence/victimization when assessed in young people (Karatekin & Hill, 2018). When the expanded ACEs of exposure to bullying, community violence, neighborhood safety, racism, and living in foster care was included in a community ACE studies in Philadelphia, Pennsylvania (Public Health Management Corporation, 2013), the percentage of adults reporting at least one ACE increased to 83.2%. This shift toward a more comprehensive understanding of ACEs is reflected in the World Health Organization’s (2009) and other ACE researchers’ (see Lee et al., 2017) recommendation that exposure to community violence be considered as an ACE category. Research using assessments beyond the original 10-item measure has shown similar results to early work; higher ACEs are associated with greater likelihood of poorer health outcomes (Finkellhor et al., 2013; Hussaini et al., 2016).

A key limitation of the existing literature examining proximal outcomes associated with ACEs is reliance on adult retrospective reporting (see Hardt & Rutter, 2004). Though some research showed stability in retrospective reports of ACEs over time (Dube et al., 2004), retrospective reporting is subject to recall and response biases and has been shown to artificially inflate the relationship between ACEs reported via self-report surveys and subjective reports of mental and physical health outcomes (Reuben et al., 2016). Some research suggests that adults with negative social and health-related outcomes (e.g., mental health and substance use problems) may be more likely to recall ACEs (Green et al., 2010; Whitaker et al., 2014), whereas other research suggests that adults who experience stressful events may be less likely to recall ACEs due to memory difficulties (Brown et al., 2007). In addition, when comparing childhood to adult ACE reports, participants’ retrospective recall of ACEs in young adulthood, assessed via interview, differed substantially from what was reported prospectively (Nackler et al., 2017).

Building on the strength of concurrent and prospective research with youth, some studies have investigated proximal risk behaviors related to adolescent ACEs; though the majority of these studies have focused on the relationship between ACEs and a few behaviors (e.g., substance use and violence perpetration). For example, in a sample of students in Grades 7–12, Hamburger and colleagues (2008) found that witnessing domestic violence, experiencing physical abuse, and experiencing sexual abuse were associated with an increased likelihood of alcohol initiation during adolescence. Dube and colleagues (2006) found a dose-response relationship between the number of ACEs reported and alcohol initiation in adolescence, such that ACEs accounted for a 20% to 70% increased likelihood of alcohol initiation during adolescence. Similarly, an investigation of the cumulative impact of ACEs found that adolescent nonmedical prescription drug use increased by
roughly 62% for each additional ACE reported (Forster et al., 2017). In a sample of students in Grades 6 through 12, Duke and colleagues (2010) found that ACEs, specifically abuse and household dysfunction, were significantly associated with interpersonal violence perpetration (delinquency, bullying, physical fighting, dating violence, weapon-carrying on school property) and self-directed violence (self-injurious behavior, suicidal ideation, and suicide attempt). In one of the few studies using adolescent self-reports and multiple outcomes, cumulative exposure to trauma predicted a variety of risk behaviors (e.g., running away from home, criminal activity, suicidality, self-injurious behaviors, substance use, truancy) after controlling for demographic variables (Layne et al., 2014).

Additional representative research with adolescent self-report is needed to increase understanding of the proximal impact of ACEs during adolescence on the initiation of a variety of risky behaviors and mental health problems. Bethell and colleagues (2017) found that children with two or more ACEs were more likely to qualify for special health care needs and repeat a grade at school, indicating that the impact of trauma on development occurs at much lower thresholds (e.g., at two rather than four to five or more ACEs) than previously suspected. Further, understanding the relationship between trauma and high-risk behaviors that typically begin to emerge in adolescence will support early intervention strategies by informing more comprehensive screening and assessment and well as more focused intervention for adolescents with two or more ACEs, preventing negative health outcomes long-term. In addition, the cumulative impact of ACEs is important as many studies examine specific risk factors impact on single outcomes, rather than the breadth of ACEs and the range of negative behavioral and mental health outcomes adolescents may experience (see Moore & Ramirez, 2016).

Current Study

The current study had two primary aims: (a) to understand the prevalence of ACEs in an adolescent community sample, and (b) to explore the impact of having experienced multiple ACEs on a range of health risk behaviors. We hypothesized that youth with one and two or more ACEs would have significantly greater likelihood of endorsing a range of negative health indicators related to mental health, nonsuicidal self-injury, suicidality, violence, and substance use compared to youth who report no ACEs. We expected differences between youth with one ACE and no ACEs to be smaller in size than differences between youth with multiple ACEs and those with no ACEs, due to prior research demonstrating that endorsing one ACE is fairly normative and experiencing multiple ACEs infers greater risk (Duke et al., 2010; Mersky et al., 2013). In addition, we expected a dose-response relationship in which an increasing number of ACEs would be associated with increased likelihood of endorsing high risk health indicators.

Method

Participants

Data were collected anonymously from high school students across a single county in western New York through the Youth Risk Behavior Survey (YRBS), which is administered on a biennial basis. The YRBS is a self-report survey with items assessing sequelae related to leading causes of mortality and morbidity: violence, sexual behaviors, substance use, poor nutrition, and limited physical activity (see Centers for Disease Control, 2020 for more information). The survey is administered through the county Department of Public Health in partnership with the local public-school districts. In the 2016–2017 school year, districts were given two options for administering the survey: (a) “county level,” which included a random selection of classes from each school that contributed to the total county sample only or (b) “district level,” which included all students who provided assent to participate in order to describe the level of risk behaviors within their school district. Two districts participated at the county level only. For these districts, the Department of Public Health randomly selected classes for each school from a list of classes that all students were required to take. Once classes were selected, no substitutions were made. Thirteen districts administered the survey at the district level. Within these districts, surveys were given during classes that all students were required to attend. All surveys were administered using a confidential computer-based survey platform. Three suburban districts opted not to participate in the survey and so the remaining suburban districts were oversampled. Based on enrollment within each school, the Department of Public Health developed a random sample of students with a projected 5% margin of error and an 80% response rate. The final sample closely reflects the gender and grade distribution of enrollment in public high schools in the county, so weighting of the sample was not conducted.

A total of 1,826 adolescents took the YRBS survey during Spring 2017. For this study, records were excluded in cases with evidence of unreliable responding (e.g., selected all possible gender/race options; n = 9) or where students chose not to answer demographic (n = 8) or ACEs items (n = 124). In addition, youth who indicated age under 14 (n = 14) or gender as “other” (n = 35) were excluded from analyses due to the small number of youth endorsing either item and therefore limited power to detect differences in these groups. An additional (n = 104) students were missing data on health outcome variables and were removed from subsequent analyses, which resulted in a final sample of 1,532 adolescents. Of the total sample, 37.3% (n = 570) reported zero, 26.2% (n = 400) reported one, and 36.5% (n = 558) reported experiencing two or more ACEs. This study was approved as exempt given the anonymity of the dataset by the Rochester Institute of Technology Institutional Review Board.

Measures

Demographics

Youth self-reported their age, gender, and race/ethnicity. For race/ethnicity, youth who indicated one race/ethnicity were coded as that category, and any youth that indicated more than one race/ethnicity were coded as multiracial/other. The exception to this pattern was for youth who indicated Hispanic/Latinx, as these youth were coded as Latinx regardless of whether other race/ethnicity categories were also indicated. This was intended to maintain consistency with how the local Department of Public Health codes race/ethnicity so results would be comparable with other county-wide data, and also with the understanding that
Latinx ethnicity is likely the predominant cultural affiliation of these youth, as less than 1% of Hispanic/Latinx adults report any other race besides Hispanic/Latinx in simulated census data collection (Mathews et al., 2017).

**ACES**

Eleven items (coded “yes”/”no”) assessed youths’ experiences of stressful or traumatic situations. First, we replicated Felitti and colleagues’ (1998) and Dube and colleagues’ (2004) in assessing the following 10 ACEs: not living with both parents, living with someone with mental health problems, living with someone with substance use or gambling problems, household member history of jail or prison, experienced verbal abuse, experienced sexual abuse, experienced physical abuse, family does not give help or support, they need, history of not enough money for family basic needs, and history of adults in home involved in physical altercations. In addition, a question was added to the survey regarding witnessing community violence in line with work showing the prevalence and relationship between community violence and negative health outcomes and improvement of the predictive power of ACEs when including community violence (Finkelhor et al., 2013). The Kuder–Richardson formula (Kuder & Richardson, 1937) was used to measure internal consistency due to the dichotomized nature of the 11 ACEs items; internal consistency in the present sample was adequate at .70.

**Health Risk Indicators**

Several items that assessed four key domains of self-reported health from the YRBS were examined in this study, specifically mental health, nonsuicidal self-injury and suicidality, substance use, and violence.

**Mental Health.** Two items were used as indicators of mental health symptoms: cognitive difficulties (“Because of a physical, mental, or emotional problem, do you have serious difficulty concentrating, remembering, or making decisions?”) and depressed mood (“During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?”). Both items were rated as “yes” or “no.”

**Self-Injury and Suicidality.** Three items were used as indicators of self-harm and suicidality: self-injury (“Have you ever hurt yourself on purpose (by cutting, burning or bruising etc.) without the intention of committing suicide?”), suicidal ideation (“During the past 12 months, did you ever seriously consider attempting suicide”), and suicide attempt (“During the past 12 months, how many times did you actually attempt suicide?”). Items were rated as “yes” or “no.”

**Substance Use.** Four items were used as indicators of substance use: First, recent alcohol use (“During the past 30 days, on how many days did you actually attempt suicide?”), recent marijuana use (During the past 30 days, on how many days did you use marijuana?), recent intoxication at school (“During the past 30 days, did you go to school or school events under the influence of any of the following [listed substances]?”) were rated in terms of frequency in the past month with the following scale (0, 1–2 times, 3–9 times, 10–19 times, 29–39 times, 40+ times). Because more than half of the sample did not use alcohol, marijuana, or attend school while under the influence of substances, these variables were dichotomized. Lastly, lifetime substance use other than alcohol or marijuana was a dummy-coded variable that included use of cocaine, heroin, methamphetamine, ecstasy, hallucinogens, and prescription drugs [for the purpose of getting high]. Substance use was rated on a frequency scale (0, 1–2 times, 3–9 times, 10–19 times, 29–39 times, 40+ times) and then dichotomized into 0 or 1 or more times.

**Violence.** One item was used to identify whether youth were a recent victim of school violence (“During the past 30 days, on how many days were you called names, teased, harassed, or attacked at school or on the way to school?”). Three additional items assessed whether youths engaged in behaviors related to violence: engaged in fight (“During the past 12 months, how many times were you in a physical fight?”), carried a weapon (“During the past 30 days, on how many days did you carry a weapon such as a gun, knife, or razor?”), and carried a gun (“During the past 12 months, on how many days did you carry a gun? (Do not count the days when you carried a gun only for hunting or for a sport, such as target shooting.)”). Being a victim of school violence, carrying a weapon, and carrying a gun were rated on a 5-point scale ranging from 1 (0 days) to 5 (6 or more days). Past year physical fights were rated on an 8-point scale ranging from 1 (1 time) to 8 (12 or more times). Violence item responses were dichotomized into 0 or 1 or more times, since roughly half or more of the sample did not endorse violence indicators.

**Statistical Analyses**

Standard descriptive statistics (e.g., frequency distributions, χ² tests) were used to summarize demographic characteristics and distributions of outcomes of interest. Logistic regression models compared the differential odds of engaging in or experiencing any of the health risk indicators between ACEs groups (youth reporting 0 ACEs compared to youth reporting one ACE and youth reporting two or more ACEs). Gender, race/ethnicity, and age were included as covariates in all regressions; females, White, and 14-year-olds served as reference groups. Odds ratios (OR) were converted to percent likelihood odds with the following formulas: (for ORs <1) \( \% = OR/(1 + OR) \) or (for ORs ≥1) \( \% = [(1 - OR) \times 100] \) and interpreted according to recommendations by Tabachnick and Fidell (2019). Logistic regressions also then tested ACEs dose-response hypotheses, specifically if increasing numbers of total ACEs reported by students were associated with differential odds of engaging in or experiencing each health risk indicator.

**Results**

**Descriptives**

The total sample identified as about half (52.0%) female and majority White (60.8%), with 15.1% Black/African American, 13.2% Hispanic/Latinx, 4.6% Asian, and 6.3% other races. There was a fairly even distribution in age from 14 to 18 and older (see Table 1). Approximately a third of the total sample reported zero ACEs (37.3%; \( n = 570 \)), whereas most of the sample (62.5%, \( n = 958 \)) reported experiencing at least one ACE. Specifically, slightly more than a third reported multiple ACEs (36.5%, \( n = 558 \)), whereas about a quarter of the sample reported experiencing only one ACE (26.2%, \( n = 400 \)). ACEs groups significantly differed by
gender and race/ethnicity: gender, $\chi^2(1) = 16.16, p < .001$, and race $\chi^2(4) = 152.52, p < .001$. As shown in Table 1, youth reporting zero ACEs were significantly more likely to be male (52.3% vs. 47.7% female), and youth reporting two or more ACEs were significantly more likely to be female (58.8% vs. 41.2% male). The gender distribution for youth with a single ACE were similar to the overall sample. Youth who indicated their race as White were substantially more likely to report zero ACEs (76.3% vs. 57.3% one ACE vs. 47.5% two or more ACEs) while roughly 20% of youth identifying as Black or Latinx reported experiencing two or more ACEs compared 10% or less reporting zero ACEs. Though there were no differences in age between groups, $F(3,1508) = 7.17, p = .52$, age was included as a covariate in logistic regressions due to its conceptual impact on both predictor and outcome variables.

Table 1
Demographic Characteristics of Youth With No ACEs, One Ace, and Multiple ACEs ($n = 1,528$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>0 ACEs</th>
<th>1 ACE</th>
<th>2+ ACEs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>%</td>
<td>$n$</td>
<td>%</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>733</td>
<td>48.0</td>
<td>272</td>
<td>47.7</td>
</tr>
<tr>
<td>Female</td>
<td>795</td>
<td>52.0</td>
<td>298</td>
<td>52.3</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>929</td>
<td>60.8</td>
<td>435</td>
<td>76.3</td>
</tr>
<tr>
<td>Black</td>
<td>231</td>
<td>15.1</td>
<td>46</td>
<td>8.1</td>
</tr>
<tr>
<td>Latinx</td>
<td>201</td>
<td>13.2</td>
<td>26</td>
<td>4.6</td>
</tr>
<tr>
<td>Asian</td>
<td>71</td>
<td>4.6</td>
<td>39</td>
<td>6.8</td>
</tr>
<tr>
<td>Other</td>
<td>96</td>
<td>6.3</td>
<td>24</td>
<td>4.2</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>211</td>
<td>13.8</td>
<td>80</td>
<td>14.0</td>
</tr>
<tr>
<td>15</td>
<td>353</td>
<td>23.1</td>
<td>142</td>
<td>24.9</td>
</tr>
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<td>16</td>
<td>382</td>
<td>25.0</td>
<td>148</td>
<td>26.0</td>
</tr>
<tr>
<td>17</td>
<td>396</td>
<td>25.9</td>
<td>138</td>
<td>24.2</td>
</tr>
<tr>
<td>18+</td>
<td>186</td>
<td>12.2</td>
<td>62</td>
<td>10.9</td>
</tr>
<tr>
<td>Total</td>
<td>1528</td>
<td>100</td>
<td>570</td>
<td>37.3</td>
</tr>
</tbody>
</table>

Note. ACE = adverse childhood experiences.

Table 2
Types of ACES Reported by Adolescents With One and Two or More ACEs ($n = 958$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>One ACEs ($n = 400$)</th>
<th>2+ ACEs ($n = 558$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>%</td>
</tr>
<tr>
<td>Not living with both parents</td>
<td>207</td>
<td>51.7</td>
</tr>
<tr>
<td>Household member with mental health problem</td>
<td>69</td>
<td>17.3</td>
</tr>
<tr>
<td>Household member with substance or gambling problem</td>
<td>37</td>
<td>9.3</td>
</tr>
<tr>
<td>Household member went to jail or prison</td>
<td>16</td>
<td>4.0</td>
</tr>
<tr>
<td>Seen violence in neighborhood</td>
<td>23</td>
<td>5.8</td>
</tr>
<tr>
<td>Verbal abuse</td>
<td>18</td>
<td>4.5</td>
</tr>
<tr>
<td>Sexual abuse</td>
<td>16</td>
<td>4.0</td>
</tr>
<tr>
<td>Absence of family support</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Money problems</td>
<td>5</td>
<td>1.3</td>
</tr>
<tr>
<td>Physical abuse</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Physical altercation in home</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Total average ACES</td>
<td>1.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note. ACE = adverse childhood experience.
Logistic Regressions of Health Risk Indicators

Mental Health

Table 3 shows the results of logistic regressions examining differences between youth with one ACE and two or more ACEs compared to youth with no ACEs on all health indicators tested. Youth with two or more ACEs were significantly more likely than youth without ACEs to report cognitive difficulties (OR = 7.29, p < .001) and depressed mood (OR = 7.99, p < .001). Youth with one ACE were significantly more likely than youth without ACEs to report cognitive difficulties (OR = 2.29, p < .001) and depressed mood (OR = 2.27, p < .001); effects were smaller between youth with one and zero ACEs than comparisons between youth with multiple and zero ACEs. Compared to males, females were significantly more likely to report experiencing both cognitive difficulties and depressed mood (ORs = 2.42–2.50, p < .001). Youth identifying as Black were significantly less likely than youth identifying as White to report experiencing both cognitive difficulties and depressed mood (ORs = 0.44–0.57, p < .01). Age differences in cognitive difficulties and depressed mood were not significant.

Self-Injury and Suicidality

Youth with two or more ACEs were significantly more likely than youth without ACEs to report nonsuicidal self-injury (OR = 6.12, p < .001), suicidal ideation (OR = 9.41, p < .001), and suicide attempt (OR = 15.60, p < .001). Similarly, youth with one ACE were significantly more likely than youth without ACEs to report self-injury (OR = 1.88, p < .01) and suicidal ideation (OR = 3.08, p < .001); differences between youth with one and zero ACEs in suicide attempt analyses approached significance (OR = 2.91, p = .05). Females were significantly more likely to report nonsuicidal self-injury, suicidal ideation, and suicide attempt (ORs = 1.65–2.99, p < .05) than males. Black youth were significantly less likely that White youth to report self-injury and suicidal ideation (OR = .36–.40, ps < .001); racial/ethnic differences in suicide attempt history were not significant. Age differences in self-injury and suicidality were not significant.

Substance Use

Youth with two or more ACEs were significantly more likely than youth without ACEs to report alcohol use (OR = 2.87, p < .001), marijuana use (OR = 3.98, p < .001), other substance use (OR = 7.07, p < .001), and intoxication at school (OR = 5.99, p < .001). There were no significant differences between males and females in substance use indicators. Asian, Black, Latinx, and other youth of color were significantly less likely to report alcohol use than White youth (OR = 0.06, 0.28, 0.52, and 0.55, respectively; p < .05). Asian youth were less likely than White youth to report marijuana use (OR = 0.16, p < .01). Black and Latinx youth were less likely than White youth to report substance use other than alcohol and marijuana (OR = 0.53 and 0.58, respectively, p < .05). Older youth were significantly more likely than younger youth to report both alcohol (15–18 year olds’ ORs = 1.65–4.63, p < .05) and marijuana use (15–18 year olds’ ORs = 1.76–4.07, p < .05). Seventeen-year-olds were significantly more likely than 14-year-olds to report having been intoxicated at school (OR = 1.87, p < .05).

Violence

Youth with two or more ACEs were significantly more likely than youth without ACEs to report that they were a victim of school violence (OR = 3.52, p < .001), had engaged in a fight (OR = 5.10, p < .001), carried a weapon (OR = 7.02, p < .001), and carried a gun (OR = 8.78, p < .001). Comparisons for youth with one ACE and youth without ACEs were statistically significant but smaller than those comparing youth with multiple ACEs, specifically for being a victim of school violence (OR = 1.75, p < .01), engaging in a fight (OR = 1.90, p < .01), and carrying a weapon (OR = 2.10, p < .01). Differences between youth with
one and zero ACEs for carrying a gun were not significant. Females were significantly less likely than males to report that they had engaged in a fight (OR = 0.44, p < .001), carried a weapon (OR = 0.18, p < .001), and carried a gun (OR = 0.06, p < .001). Compared to youth identifying as White, youth identifying as Black (OR = 2.19, p < .001) or Latinx (OR = 1.66, p < .05) were significantly more likely to report that they had engaged in a fight, whereas youth identifying as Black were also significantly less likely to report carrying a weapon (OR = 0.56, p < .05). Older youth were significantly less likely to report that they had engaged in a fight (17- and 18-year-olds ORs = 0.40 and 0.53, respectively, ps < .05). Sixteen-year-olds were less likely than 14-year-olds to report they had carried a weapon (OR = .57, p < .05).

### Dose-Response Analyses

Similar sets of logistic regressions were run with the total number of ACEs as the predictor variable and each health indicator as the dependent variable, controlling for age, gender, and racial/ethnic. The pattern and significance of results for mental health, self-injury/suicidality, substance use, and violence were the same for analyses comparing adolescents with zero versus one versus two or more ACEs; however, all odds ratios were small in size with total number of ACEs as the outcome. Differences between youth with 0 compared to multiple ACEs is greater than the effect of each increase in total number of ACEs. Effects of total number of ACEs on health indicators were lowest for being the victim of school violence (OR = 1.33, p < .001) and highest for depressed mood (OR = 1.74, p < .001) and suicide attempts (OR = 1.76, p < .001), though all were statistically significant. Reporting higher number of ACEs was associated with higher odds of cognitive difficulties (OR = 1.63, p < .001), self-injury (OR = 1.62, p < .001), and suicidal ideation (OR = 1.68, p < .001). Substance use also increased with higher number of ACEs reported, specifically with alcohol (OR = 1.39, p < .001), marijuana (OR = 1.47, p < .001), and other substance use (OR = 1.63, p < .001), as well as intoxication at school (OR = 1.59, p < .001). Lastly, likelihood of carrying a weapon (OR = 1.66, p < .001), engaging in a fight (OR = 1.52, p < .001), and carrying a gun (OR = 1.74, p < .001) all increased with increases in number of ACEs reported by adolescents. Overall, higher number of ACEs were associated with a 57% (school violence victimization) to 76% (suicide attempt) increase in health risk indicators.

### Discussion

The prevalence of ACEs and relationships between experiencing multiple ACEs and a range of mental and behavioral health indicators found in this adolescent community sample are consistent with early ACEs research (Felitti et al., 1998) and other community-based studies (e.g., Layne et al., 2014). The rate of at least one ACE in this sample (62.5%) is higher than other self-reported rates of ACEs in adults (57%; Schüssler-Fiorenza et al., 2014) but similar to adult samples with broader definitions of ACEs (e.g., Merrick et al., 2017). Current findings are higher than other self-reported ACE rates in adolescents (e.g., 56%; Beihell et al., 2017) and may be due to potentially rising rates of ACEs or inclusion of community violence as an ACE. Finally, the county in which the data was collected has high rates of poverty and the higher rates of ACEs could be reflective of the link between poverty and trauma. The primary finding in this study was that adolescents with multiple ACEs showed significantly higher likelihood of reporting a variety of mental health symptoms, suicidality, violence, and substance use. ACEs were related a spectrum of health-related problems from cognitive difficulties, getting into fights and alcohol use to suicide attempts, carrying a weapon and intoxication at school. These findings reinforce the importance of a prevention and early intervention approach in order to prevent early signs or symptoms of the impact of trauma from escalating.

Youth with multiple ACEs had the greatest likelihood of reporting two of the higher risk mental health and violence indicators assessed: suicide attempt and carrying a gun. Even after controlling for age, and racial/ethnic differences, youth with multiple ACEs were at 15.6 times higher odds of reporting suicide attempt and 8.78 times the odds of carrying a gun in the past year. Suicide attempts also differed by gender, with females showing significantly greater likelihood of suicide attempts, similar to prior research showing stronger relationships between ACEs and suicide attempts for females (Isohokana et al., 2013). Though White students (compared to Black/African American students) were more likely to report depressed mood, nonsuicidal self-injury, and suicide planning, these differences in risk for suicide attempts did not translate to demographic differences in reports of suicide attempts. Findings that female adolescents report significantly higher depressed mood, nonsuicidal self-injury, suicidal ideation, and suicide attempts fits in with other findings related to a “gender paradox” in suicidality (Canetto & Sakinofsky, 1998; Nock et al., 2008) whereby females show higher rates of suicidal ideation and attempts, whereas males are more likely to die by suicide. Though ideation-to-action models of suicidality (Klonsky & May, 2015) suggest individuals progress from suicidal ideation to planning to attempts, current study findings suggest that for some adolescents (i.e., namely White students) higher levels of depressed mood and suicidal ideation does not necessarily co-occur with higher incidence of suicide attempts. Current findings of higher rates of depressed mood, self-injury, and suicidal ideation among females and White students compared to males and Black students is similar to national YRBS data (Ivey-Stephenson et al., 2020); however, our findings differ from national data showing significantly higher rates of suicide attempts among Black/African American students relative to White students (Ivey-Stephenson et al., 2020). Because ACEs have shown increased risk of suicide as well as violent behavior, even after controlling for demographic and aggression risk factors (Fox et al., 2015), suicide and violence prevention may be two key areas for intervention for youth who experience multiple ACEs.

There was a significant relationship in the dose-response rate of ACEs and behavioral health indicators. For every 1.8 additional ACEs that youth reported on average, they were 57–76% more likely to report any behavioral health risk indicator. Experiencing multiple ACEs or potentially a particularly detrimental combination of ACEs may infer more risk than the impact of two versus three ACEs, three versus four ACEs, and so on. Further understanding of the interaction of combinations of ACEs on risk for particular outcomes, especially with youth who have more biological or environmental vulnerability to these outcomes, such as those with family history of suicide death for example or the additional burden of toxic stress associated with poverty and racism, is needed. However, it is still important to note that
increases in ACEs were associated with all mental health, self-injury and suicidality, substance use, and violence indicators tested in this study. Thus, ACEs appear to have a broad impact on adolescent development, not only on isolated indicators.

Notably, the most common ACE reported by both youth with only one ACE and youth with multiple ACEs was being separated and/or divorced parents/caregivers and was endorsed by almost 40% of the overall sample. Though parental separation is fairly normative in this community sample, findings should be taken into consideration of the broader context of ACEs and family functioning. Although this study is cross-sectional and therefore causality cannot be determined, given the number of students who report having separated and/or divorced parents/caregivers as at least one ACE, a universal, trauma-informed approach is indicated. Key adults who support youth (i.e., educators, pediatricians, coaches, etc.) should be aware that childhood household factors, including parent/caregiver relationships, may be associated with later adolescent functioning. A universal trauma-informed approach as described by the SAMHSA (2014) provides a framework which increase adult knowledge and understanding of trauma and its impact while implementing policies, procedures, and practices to support the child’s recovery and resilience.

Despite the higher rate of ACEs reported within this study, this rate is still possibly an underrepresentation of the prevalence of ACEs among adolescents. First, students in this study needed to be in school the day the YRBS was administered, which precluded students with chronic absenteeism, who were suspended, or who attend out of placement programs. Youth who are in foster care and other out of home placement (Rebbe et al., 2017), juvenile justice settings (Fox et al., 2015), psychiatric hospitals (Isomokana et al., 2013), and residential placements (Zelechowski et al., 2013) report higher rates of ACEs and thus would likely increase the rates of ACEs found in this study. Second, surveys were over 100 items, which may have precluded students who did not have the stamina to complete a lengthy questionnaire due to cognitive, emotional, or behavioral challenges. Because these findings were demonstrated in a community-based sample, the wide prevalence and impact of ACEs on youth development is underscored; these are not only youth with severe emotional and behavioral concerns, but rather a third of the youth in regular education in public high schools across the county reported multiple ACEs.

There were several notable gender and racial ethnic differences in the impact of having multiple ACEs on mental and behavioral health indicators. Though females, Black, and Latinx youth reported disparately higher levels of ACEs compared to male and White youth, respectively; Black youth were less likely to report cognitive difficulties, depressed mood, self-injury, and suicidal ideation than White youth. It is possible that the items that assessed mental health difficulties (e.g., feeling sad, depressed), may not accurately capture internalizing problems experienced by Black and Latinx students. Rather than suggesting that Black and Latinx students have lower rates of internalizing problems, it may be that these face valid items are not culturally appropriate measures of mental health difficulties faced by youth of color. These youth may also have greater perceptions of stigma and lower perceived need for mental health treatment compared to White youth (Breslau et al., 2017), and so may underreport symptoms in this context. It is important to note that there were no differences between White and Black youth in report of suicide attempts. Given that suicide rates have increased by 73% for Black adolescents in recent years (Lindsey et al., 2019), development of culturally responsive, brief measures of adolescent mental health for use in both school-based and health screenings as well as for use in county, state, and national surveys are needed.

The current study should be interpreted within the context of the study design and sample. First, this study used single items to assess health indicators, given the length of the survey and wide array of experiences and behaviors assessed. Well-validated self-report or clinical interviews of mental and behavioral health indicators may provide more specific understanding of relationships between ACEs and clinical diagnoses of depression (e.g., Child Depression Inventory-II; Kovacs, 2011 or Child Depression Rating Scale; Poznanski & Mokros, 1996, for self and clinician-rated depressive symptoms). Although the survey was anonymous, some students may be unwilling to disclose ACEs or other experiences due to stigma, avoidance, and fear of investigation by child services. This survey was deployed in western New York and may not generalize to other regions. Students who endorsed their gender as “other” were not included due to the small number of students who endorsed this response, which may underestimate ACEs and relationships to mental health difficulties found in transgender youth (Schnarrs et al., 2019) and thus future research would need to capture and test these relationships among nonbinary students.

This study was also conducted in English and likely is not representative of students without English reading proficiency. The cross-sectional design prevents determination of directions of relationships between ACEs and health outcomes. The persistence of ACEs was also not assessed; a student who lived with a family friend with a mental health or substance use problem for a short time and a student one who lived with an impaired primary biological caregiver for the duration of their life may have both endorsed the ACE item related to living with an adult with mental health problems. Similarly, we did not examine type of ACEs (e.g., household dysfunction vs. abuse and neglect) that may infer the greatest level of risk. Future work employing person-centered analyses, such as cluster analysis and latent class analysis, should identify ACEs that may co-occur and infer the greatest level of risk to inform intervention and prevention efforts. Lastly, this study did not test the impact of protective factors on relationships between ACEs and health indicators; resilience factors that mitigate the impact of ACEs across the life span are a key avenue for future research.

Overall, this study has important implications for a universal, prevention approach that is grounded in trauma-responsive practices and intervention for adolescents. Given that almost two thirds of youth reported at least one ACE and one third reported multiple ACEs in the current study, implementation of universal strategies through a public health approach are indicated. Effectiveness of trauma-responsive implementation strategies and programs within school settings have primarily focused on mental health indicators such as depression and traumatic stress symptoms (Thomas et al., 2019); however, results of this study suggest that substance use, suicidality, and violence indicators should also be key intervention targets. A roadmap for trauma-informed community includes community-wide education about the impact of trauma and ways to promote resilience, universal screening for trauma, linkage to appropriate services and supports, and implementation of trauma
responsive practices across settings serving youth and their families (see SAMHSA, 2014).

In addition, based on the findings that suggest that youth with multiple ACEs are at serious risk for attempted suicide and carrying a gun, a tiered approach with more focused intervention for youth at higher risk is needed. Youth with reported exposure to traumatic events and associated symptoms should be screened for suicidality and violence risk as part of a comprehensive assessment to determine an appropriate intervention and treatment. In addition, it is important that youth demonstrating high risk behaviors are screened and assessed for trauma as trauma exposure may be a contributing factor to the current symptom presentation. For youth at highest risk, integrated, trauma specific treatment models that address mental health, substance use, and violence are indicated. As it is well documented that those youth who are most in need of treatment (e.g., those with mental and behavioral health diagnoses) have low rates of specialized service use (US Department of Health & Human Services, 2000; SAMHSA, 2019), it is critical that a comprehensive system of care that is trauma and culturally responsive to the needs of youth and their families are developed.

Systems-level efforts to prevent and mitigate ACEs through the implementation of trauma responsive practices, starting in early childhood through adolescence, may be a key factor to reduce a range of mental and behavioral health outcomes and could have a significant public health impact. By taking a universal, prevention approach, the cumulative impact of ACEs on mental and physical health may be mitigated by early intervention and perhaps even preventing additional ACEs from occurring. Given the increased risk associated with the increased number of ACEs, the presentation of high-risk behaviors in adolescents can serve as an indicator for underlying exposure to trauma.

References


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Received July 2, 2020
Revision received November 4, 2020
Accepted November 16, 2020