

**PATTERNS OF MENTAL HEALTH SYMPTOMS, VIOLENCE EXPOSURE, AND
HEALTH SERVICE UTILIZATION AMONG ADOLESCENTS: RESULTS FROM THE
HEALTHY ALLEGHENY TEENS SURVEY**

by

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ABSTRACT

Introduction: Mental illness is widely known to be a serious public health concern. This study attempts to examine area-level differences in mental health symptoms, violence, and health utilization services. It also explores any demographic differences in the above measures across age, sex, and race.

Method: The sample comprised 1813 teenagers aged 14-19 residing in Allegheny County completed the Healthy Allegheny Teens Survey via telephone interviews. Differences among variables of interest were examined using categorical data analyses. Binary and multivariate logistic regression models were used to test associations between variables of interest.

Results: Significant differences across age, race, and sex were found for the above variables. For area-level differences, Medically Underserved Areas and municipalities with high homicide rates reported greater disparities in mental health symptoms, experiences with violence, and health service use. Measures of violence remained significant even after adjusting for age, race, and sex.

Public Health Significance: This study is the first of its kind to examine adolescent mental health across Allegheny County using an area-level perspective. Future interventions can be designed to target specific areas of the County which report the greatest need. These findings can

also guide the local health policy decision-making process and result in efficient distribution of public health resources.

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1.0 INTRODUCTION

Mental illness is a serious public health issue with about 129,000 children in Pennsylvania currently living with mental health conditions (NAMI, 2010). Untreated mental illness has been shown to yield costly consequences with suicide being the third leading cause of death among youth and young adults (Brenner, Krug, & Simon, 2000; Cicchetti & Rogosch, 1999). The National Alliance for Mental Illness reports that suicide is one of the leading causes of death among youth aged 15-24 (NAMI, 2010) . In 2006-2007, over a quarter of school-going children were affected as roughly 27 percent of students aged 14 and older with debilitating mental health conditions and receiving special education services dropped out of high school (NAMI, 2010) . There is also substantial research linking mental health with substance use, and delinquent behaviors. According to the High School Youth Risk Behavior Survey in Pennsylvania, almost 22% of high school students reported drinking more than 5 drinks a day and approximately 16% engaged in drug solicitation on school campuses (CDC, 2009).

It is known that adolescence is the most vulnerable developmental phase in terms of onset of a diagnosable depressive disorder (Cairns, Yap, Pilkington, & Jorm, 2014). Since this period of life is significant in terms of physical and emotional development, untreated mental illness can have serious implications later on in adulthood. According to the Substance Abuse and Mental Health Services Administration, almost 60% of youth aged 12-17 with a recent (past year)

depressive episode did not receive any treatment for their illness (SAMHSA, 2013). The same report found that approximately 62% of youths who received treatment through the public mental health system reported improved functioning after treatment (SAMHSA, 2013). This clearly indicates a need for better mental health services to reduce long-term risks and consequences of mental illness.

It is known that early identification and treatment of mental health conditions and associated risk factors can reduce adverse effects in the future (Davis, Martin, Kosky, & O'Hanlon, 2000; Durlak & Wells, 1998). However, limited funding to improve mental health has impeded efforts to further understand risk factors and develop intervention strategies. In 2006, just 4.8 percent of PA's total spending was devoted to mental health agency services (NAMI, 2010). Therefore, demonstrating increased need in certain areas of the state and county with the proposed study can lead to better distribution of limited resources. The Healthy Allegheny Teens Survey provides location data at the municipality allowing for greater accuracy in identifying vulnerable areas. Assessing area-level factors would be extremely beneficial in terms of assessing which parts of the county are most prone to experiencing such outcomes and possibly are in greater need of health-related interventions. Various adverse health outcomes that are linked to demographic and socioeconomic factors are also associated with differences in residential patterns. Therefore, area of residence may serve as an important population health status indicator (Eberhardt & Pamuk, 2004).

1.1 MENTAL HEALTH AND VIOLENCE

Previous research has provided sound evidence establishing the association between mental health and exposure to violence among adolescents. Exposure to violence results in debilitating effects on mental health in youth. Experiencing violence in some form can result in a wide range of mental health problems which tend to persist over the developmental trajectory and can lead to chronic interpersonal difficulties and other accompanying health problems later in life (McCloskey, Figueredo, & Koss, 1995).

In a meta-analysis of community violence, Fowler and colleagues found that witnessing and hearing about violence were associated with internalizing problems and PTSD symptoms (Fowler, Tompsett, Braciszewski, Jacques-Tiura, & Baltes, 2009). Intimate partner violence can indirectly impact children leading to developmental delays, conduct problems, social withdrawal or aggression among many other outcomes (Campbell & Lewandowski, 1997; Osofsky, 2003).

Similarly, adversities in childhood such as neglect have been shown to result in personality disorders and substance abuse later in life for both men and women (Horwitz, Widom, McLaughlin, & White, 2001) . A study on adverse childhood experiences found a significant association between childhood maltreatment and mental health scores (Edwards, Holden, Felitti, & Anda, 2003). Sexual abuse in childhood and adulthood were associated with greater PTSD symptoms and maladaptive coping strategies (Filipas & Ullman, 2006).

Associations with Age:

Results from the National Survey of Adolescents (NSA) found that among youth aged 12-17, being female, or of older age, reporting a family history of alcohol use problems, or experiencing physical assault were risk factors for developing Major Depressive Disorder. They also found that substance abuse and dependence were associated with risk factors such as family history of alcohol abuse, older age, witnessed violence, and physical assault. Among other findings, experiences of child abuse and neglect have been shown to be serious factors for developing mental health problems as shown in a community-level study by Cohen and colleagues (Cohen, Brown, & Smailes, 2001). In this study, those who had been identified as victims of physical abuse and neglect were at a higher risk for depression, behavioral problems, and Cluster B personality disorders which include narcissistic, borderline, and histrionic personality disorders. They also found that the severity of these symptoms tend to decline with age (Cohen et al., 2001).

Associations with Sex:

A study using the National Survey of Adolescents (NSA) found that boys who were victimized at an earlier age were more likely to engage in high risk behaviors such as alcohol use, drug use, or delinquent behavior. However, different patterns were found for girls based on the form of victimization to which they were exposed. Results indicated that girls exposed to sexual abuse were six times more likely than boys to refrain from delinquent behaviors than engage in them (Begle et al., 2011).

Associations with Race:

Among studies of violence in specific ethnic groups, Wadsworth and Records found that in a sample of African-American women aged 13 and older, sexual assault was associated with an increased risk of poor mental and physical health outcomes along with a greater likelihood of engaging in risky behaviors (Wadsworth & Records, 2013) . Protective demographic factors against substance abuse and dependence were being female, or of African-American descent (Kilpatrick et al., 2003).

Research on dating violence among teenagers and young adults has shown that the odds of victimization are higher for African-American and Asian/Pacific Islander males compared to White males. Other associated risk factors include non-traditional family structure, school size, and the absence of a father figure. Among females, psychological victimization was associated with parental education, academic achievement, and the number of relationships reported (Halpern & Dodson, 2006) .

These studies clearly suggest that mental health, violence, and other health-risk behaviors are strongly interrelated. Additional exploratory population-based studies can further our understanding of the higher-level indicators of health and health outcomes among youth.

1.2 HEALTH SERVICE UTILIZATION

Research has established differential patterns of how health services are used across race, sex, and age groups. The term “health services” has been broadly defined by the World Health

Organization as: "... [A]ll services dealing with the diagnosis and treatment of disease, or the promotion, maintenance and restoration of health. They include personal and non-personal health services. Health services are the most visible functions of any health system, both to users and the general public..."(WHO).

Cummings and colleagues found that African-Americans, Asians, and Hispanic children were less likely to receive treatment or prescription medication for depression than non-Hispanic Whites after adjusting for family income and insurance status (Cummings & Druss, 2011). They also found that there were differences in service utilization based on the setting. In clinical settings, African-Americans, Asians, Pacific-Islanders, and Hispanics who were at high risk for depression, suicide, and delinquent behavior were less likely to be referred for counseling than their White counterparts. Interestingly, no differences by race were found in school-based settings (Cummings, Ponce, & Mays, 2010).

In a study of youth at high risk for suicide, females with reported suicidal ideation were less likely to receive regular visits to a mental health professional than males. However, males with serious suicidal intent were more likely to receive treatment than their female counterparts (Ahmedani et al., 2015). Analyses from the NHANES survey showed that only one-half of those aged 8-15 with a psychiatric disorder sought any treatment. They also found that 36.2% of teenagers aged 13-18 with a psychiatric disorder received any services. Only one-half of those with a severely debilitating mental health condition received some form of treatment. They also reported the highest rate of services for ADHD (attention-deficit hyperactive disorder) and

behavioral health disorders. However, only 1 in 5 received services for anxiety, eating, or substance use disorders (Merikangas et al., 2010).

Factors indirectly associated with race and areas of residence have also been found to influence health service use. P'Olak found that socio-economic position (SEP) and maternal education predicted the use of health services after accounting for mental health severity (Amone-P'Olak et al., 2010). In a sample of individuals at high risk for suicide, Ahmedani and colleagues studied ethnic differences in patterns of medical visits. They found that with regard to timing of medical visits, whites made visits closer to the time of suicide attempt. The authors suggest that this allows for a suitable intervention time point to reduce the risk of suicide attempts in this population – especially since whites are known to have high suicide rates. Their study also found that most visits were on an outpatient basis and did not screen for suicide. It is known that the US Preventive Services Task Force guidelines do not include recommendations for suicide screening. However, these findings suggest the need for suicide screening in outpatient settings since this is the most common point of contact for patients.

Among racial differences, Asians were least likely to make medical visits before suicide attempts. Possible reasons could include language barriers, provider stereotyping, and perceived discrimination. Whites and Native Americans were most likely to get mental health/substance use diagnoses than other ethnic groups. This is consistent with their high rates of suicide and other mental health conditions. Overall, mental health and substance use diagnoses were less common than other diagnoses. These findings suggest that minorities may be differentially

diagnosed and that suicide prevention strategies must be designed to increase cultural competency (Ahmedani et al., 2015).

Another study by Keller et al. examined the prevalence and timing of mental health and substance use disorders among older adolescents in the child welfare system. They found that African-Americans and those in kinship family foster care are less likely to receive diagnoses whereas Caucasian adolescents are more likely to have diagnoses prior to entering the welfare system. However, they also found that race differentials were less pronounced for diagnoses after placement in foster care (Keller, Salazar, & Courtney, 2010).

Kleinfeld and colleagues studied unmet needs in a survey of mental health in Israel among adolescents aged 14-17 and their mothers. They found that 66% of adolescents and 60% of mothers reported unmet health care needs. This study used mothers' reports as children's access to health services largely depends on parental ability to afford services, along with transportation and time (Mansbach-Kleinfeld et al., 2010).

The studies discussed above emphasize the heterogeneity that exists in health service use among children and adolescents. The literature available so far suggests that there may be differences in how health services are utilized and the prevalence of mental health problems and violence. Building on previous research, this study will attempt to characterize patterns of health service utilization and identify any disparities that may exist across gender, race, age, and area of residence.

1.3 AREA LEVEL INFLUENCES

Recently, there has been growing interest in exploring area level factors and their influence on adverse health outcomes. However, the limitations of some of these studies has left a lot to be explored. A neighborhood level study examined the risk for intimate partner violence (IPV) in Valencia, Spain and found a greater likelihood of IPV cases in areas with a high immigrant population, crime, public and physical disorder. However, IPV cases were measured using police protection orders, no definition of “immigrant population” was offered, and there was no explanation of variation in policing activity and decisions in these areas. (Gracia, López-Quílez, Marco, Lladosa, & Lila, 2014).

Another similar study in Sacramento, California found that the presence of off-premise alcohol outlets was associated with a greater likelihood of IPV related calls and crime reports. However, it is unclear if the presence of such outlets is indeed related to an increase in IPV calls and reports or whether SES/geographical factors may play a role as well. Also, there are no data available on the characteristics of victims/perpetrators to determine which target population is at a higher risk for IPV in these areas (Cunradi, Mair, Ponicki, & Remer, 2011). According to a review of neighborhood level characteristics on child outcomes, higher socio-economic status and neighborhood affluence are associated with better academic ability and achievement (Leventhal & Brooks-Gunn, 2000).

Neighborhood effects were also found for behavioral and emotional problems among youth. Low SES neighborhoods were associated with externalizing behavioral problems and greater peer rejection. The Pittsburgh Youth Study found that for males aged 13-16, living in neighborhoods

with greater unemployment, welfare receipt, African-American presence, and male joblessness were associated with increased criminal and delinquent behavior. Other outcomes associated with low-income and low-SES neighborhoods were violent crimes, drug offenses, and truancy (Loeber & Wikstrom, 1993; Peeples & Loeber, 1994). A community based study in Los Angeles found differential effects by race of neighborhood SES level on behavioral problems. African-American and Hispanic youth were at higher risk for oppositional defiant disorder and conduct disorder. Latino youth were at higher risk for depressive symptoms than their counterparts in low SES neighborhoods (Leventhal & Brooks-Gunn, 2000).

Another study on family and neighborhood effects on psychiatric disorders in children and adolescents found that those living in deprived neighborhoods were more likely to be diagnosed with internalizing and externalizing disorders with a significant association between attention deficit hyperactive disorder and moderately deprived neighborhoods (Sundquist et al., 2015). The study by Keller et al. discussed above found that statewide differences existed in the age of onset of mental health disorders prior to entering the welfare system. The authors suggest that this could be attributed to differences in state policies with respect to entry into the welfare system and foster home placement (Keller et al., 2010). A study on neighborhood characteristics affecting out-of-hours (OOH) care showed that areas with more women, low-income households, non-Western immigrants, low SES neighborhoods, and high urbanization had higher demands for OOH services. The authors offer some insight about high OOH care use suggesting that low health literacy, and lack of knowledge of inappropriate use of OOH care could contribute to these differences (Jansen, Zwaanswijk, Hek, & de Bakker, 2015).

Area-level differences also exist according to the form of health service used. In a study focusing on emergency services for mental health care found that those belonging to minority groups were more likely than Whites to use emergency services in high poverty areas than low poverty areas. Even those minorities who were enrolled in Medicaid were more likely to use the emergency room than Whites. Interestingly, there were age differences in utilization patterns as younger adults belonging to minority groups were more likely to use mental health services than their older counterparts (Chow, Jaffee, & Snowden, 2003).

The study by Kleinfeld et al. discussed previously found that the proportion of reported unmet needs differed by locality in Israel – 91% of participants living in Arab localities reported unmet needs compared to 54% of those in Jewish/mixed localities. This difference was attributed to fewer municipal resources and higher poverty rates in Arab-majority regions. Cultural factors such as referral bias and the lack of Arabic-speaking professionals were also suggested. Interestingly, children of Arab parents reported higher use of school-based health services which they could access themselves rather than through their parents (Mansbach-Kleinfeld et al., 2010).

1.3.1 Rationale for examining area-level differences

In Allegheny County, there are limited data available to accurately assess the magnitude of negative health outcomes among teenagers in terms of frequency, distribution, economic and public health impact. Currently, there are publicly available data on Medically Underserved Areas (MUAs) within the County. The HRSA has designated Medically Underserved Areas (MUAs) within each county, which are areas with significantly fewer primary care providers and

higher negative health outcomes such as infant mortality ("Shortage Designation: Health Professional Shortage Areas & Medically Underserved Areas/Populations,").

This project will help in characterizing disparities that may exist in health service utilization, mental health outcomes, and violence exposure that may exist within Allegheny County.

Continued exploratory research about area-level differences will better inform allocative health policies and more efficient distribution of limited public health resources. The proposed study will add to our understanding of the dynamic relationship between mental health, violence, residence, and health service use among teenagers. These findings can inform public health researchers and practitioners about which factors are most strongly associated with each other and which areas need more targeted interventions. Medical professionals will benefit from the population-level perspective on health beyond the clinical realm. Policy-makers can also use these findings during their decision-making process to allocate funds.

Extensive literature exists on area-level physical health disparities, mortality, and chronic health conditions. Behavioral risk factors such as smoking and sedentary lifestyles have also been linked to these disparities with an area-level perspective. However, there is limited (but growing) research on area-level mental health disparities and associated risk factors. It is understandably challenging to conduct area-level research as existing geographic classifications do not permit a more detailed classification of the population. As mentioned above, there are no data on area-level factors affecting health outcomes in teenagers living in Allegheny County. This study has the potential to be replicated in other counties and be scaled up to the state-level. It will attempt to address limitations observed in the literature by operationalizing variables such that they

accurately capture information needed to address the research objectives (specified below). This study can also introduce novel approaches to population-based research by introducing an area-level perspective.

1.4 THEORETICAL FRAMEWORK

There are several well-established psychological theories that have described the etiology of depression. One of the most prominent theories is the Diathesis Stress Model (Monroe & Simons, 1991). The main premise of this theory is that the occurrence of stressful events activates the diathesis - increasing the predisposition for the onset of a wide range of psychopathology. Here, “stressful events” could take on any temporal (acute/chronic) or dimensional (major/minor) form. The term “diathesis” refers to the existing, inherent tendency or “susceptibility” for mental illness. The presence of specific forms of stressors may play different roles in relation to the diathesis (Belsky & Pluess, 2009; Lewinsohn, Joiner Jr, & Rohde, 2001). Some research suggests that minor, low stress, but high frequency, recurrent events may be better indicators of vulnerability than isolated major events (Monroe & Simons, 1991).

The theoretical basis for the research questions being examined in this study are best illustrated by this model (Figure 1). Within the framework of the Diathesis Stress Model, it is proposed that the onset of depression and suicidality can be explained by the interaction between certain domains of stressful events and components of the diathesis. Specifically, stressors included in this model are adverse childhood events, lack of adequate health services within one’s neighborhood, and residential characteristics such as neighborhood violence and unsafety. These

could trigger the diathesis comprising inherent biological traits and sociodemographic characteristics. Together, their interactive effect may be associated with the presence of disorders specifically depression and subsequently, suicidality.

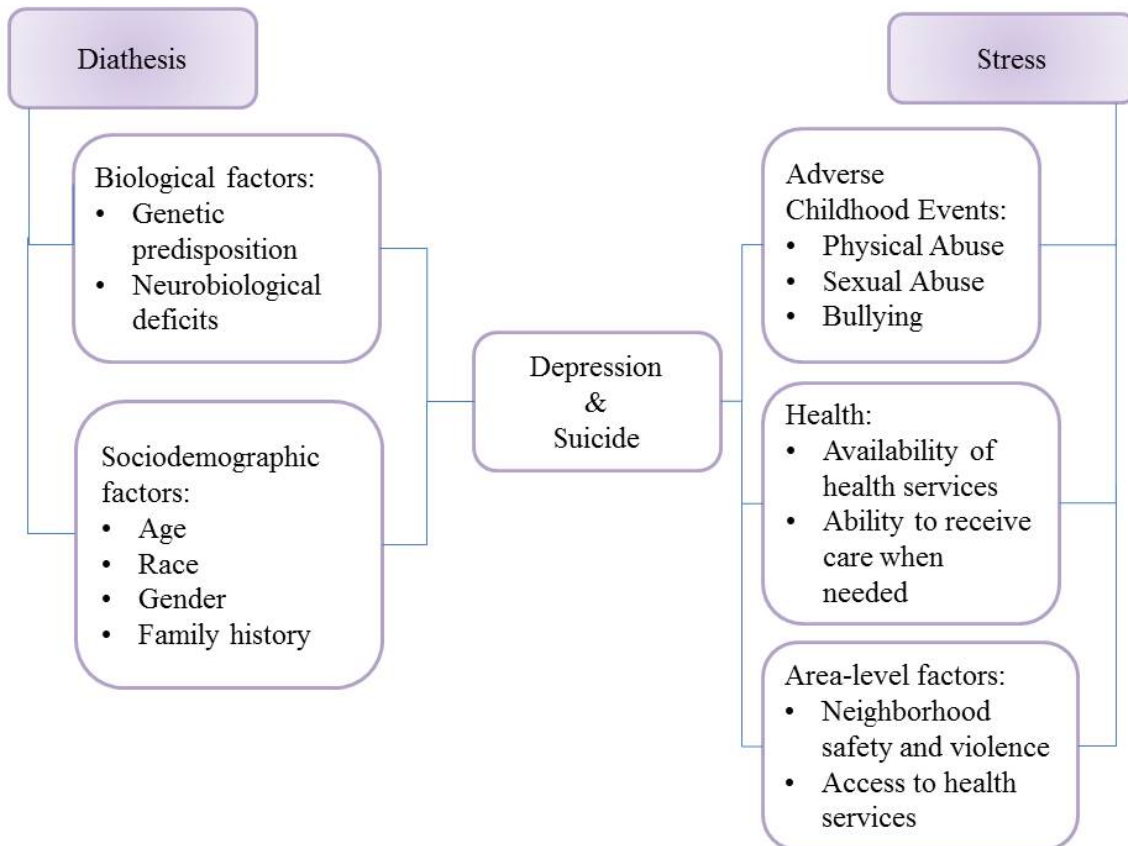


Figure 1. Schematic Representation of the Diathesis-Stress Model

1.5 SPECIFIC OBJECTIVES

The study is an exploratory examination of health and health behaviors reported by a sample of teenagers in Allegheny County. The specific objectives of the study are:

- To describe patterns of reported mental health symptoms, violence exposure, and health utilization services among teenagers.
- To identify any differences by area of residence, age, sex, and race.
- To explore any associations between reported mental health symptoms, violence exposure, and health utilization services.

1.6 HYPOTHESES

The hypotheses for this study are as follows:

- Teenagers living in areas with fewer resources will report
 - Higher violence exposure
 - Greater mental health symptoms
 - Less health service underutilization.
- Teenagers belonging to racial/ethnic minorities will report:
 - Greater mental health symptoms and violence exposure than their White counterparts.
 - Less use of healthcare services than their White counterparts.
- Female and males will differ in reports of mental health symptoms, violence exposure, and health service use

2.0 RESEARCH METHODS

The primary source of data for this study was the Healthy Allegheny Teens Survey conducted as a collaborative project by the Allegheny County Health Department, University of Pittsburgh School of Medicine, and Graduate School of Public Health. The purpose of this survey was to examine the health status, behaviors, and associated outcomes among teenagers in the County. The target population, sample, data collection methods, and variables measured are described in the following sections.

2.1 TARGET POPULATION AND SAMPLE

2.1.1 Target Population

According to the 2010 Census, there were approximately 1,223,348 people living in Allegheny County of which approximately 110,000 were children aged 13-19. Approximately 76% of these children were non-Hispanic White, 20% African-American, 2% Asian, and 2% Hispanic (CRHC) . The target age range for this study was 14-19 years. In Allegheny County, there are approximately 94,960 teenagers in this age group.

2.1.2 Sample

The sample comprised 1813 adolescents aged 14-19 residing in Allegheny County completed a telephone survey for this study. The median age of the sample was 16 years.

2.1.3 Sampling Design

Participants were selected using random digit dialing from a list of phone numbers in Allegheny County obtained from Marketing Systems Group. The research design was cross-sectional – participants were surveyed at only one point in time. A disproportionate sampling design was used in order to increase the efficiency of the sample, and draw more numbers from the landline frame to better target households with children in the target age range.

2.1.4 Weighting methods:

Weighting was used to account for differential nonresponse and under-coverage. Design weights were computed to reflect selection probabilities of households. These were calibrated so that the resulting final weights would aggregate to reported totals for the target population with respect to specific geodemographic characteristics.

2.2 SURVEY MEASURES

The survey comprised of 147 questions on health and health-related behaviors. Some of the main domains and variables are listed in Table 1.

Table 1. Survey Measures

<i>Domain</i>	<i>Variables Measured</i>
Basic Demographics	<ul style="list-style-type: none"> ○ Age ○ Education ○ Sex ○ Race ○ Area of Residence
School	<ul style="list-style-type: none"> ○ Education level ○ School Environment ○ Safety ○ Social Network ○ Disruptive behavior
Physical Health	<ul style="list-style-type: none"> ○ Diet ○ Physical Activity ○ Disability ○ Knowledge of safer sex and STDs ○ Body weight
Stressful life events	<ul style="list-style-type: none"> ○ Hunger ○ Homelessness ○ Bullying ○ Neighborhood social cohesion
Social Support	<ul style="list-style-type: none"> ○ Frequency of social support available when needed
Health Behaviors	<ul style="list-style-type: none"> ○ Screen for eating disorder symptoms ○ Smoking ○ Vehicular safety ○ Drug and alcohol use ○ Safe sex practices
Violence Exposure	<ul style="list-style-type: none"> ○ Form of violence exposure ○ Weapon use ○ Physical aggression ○ Dating violence
ACES	<ul style="list-style-type: none"> ○ Physical Abuse ○ Sexual Abuse ○ Verbal Abuse ○ Witnessed domestic violence

Table 1. Continued

Mental Health	<ul style="list-style-type: none">○ Depression○ Suicidal ideation○ Suicide attempts○ Self-injurious behavior
Health Service utilization	<ul style="list-style-type: none">○ Type of service used○ Reasons for being unable to use service when needed

2.3 DATA ANALYSES

Categorical data analyses were conducted using Rao-Scott Chi-Square tests for differences between proportions. This method was most appropriate as it takes the design effect into account. Distributions of continuous variables were checked for normality using the Kruskal-Wallis test. Non-normally distributed variables were tested using non-parametric methods such as the Wilcoxon Sum Rank Test. Pearson's correlations were computed to examine the degree of dependence between variables. Associations between variables of interest were examined using binary logistic regression using the PROC SURVEY LOGISTIC command. All analyses were conducted using SAS Version 9.4. The data analysis plan for this study is presented in Table 2 below.

Table 2. Data Analysis Plan

<i>Study Objective</i>	<i>Independent Variable</i>	<i>Dependent Variable</i>	<i>Analyses</i>
Basic descriptive statistics and distributions	Age Race Gender Education Depression Suicide ACEs Violence Bullying	--	Frequencies Percentages
Association between Mental Health, Violence, Bullying, and ACEs	Violence Bullying, ACEs Age Gender Race	Mental Health	Pearson's Correlations Chi Square Tests Binary Logistic Regression
Association between Health service use and demographic variables Area level differences in mental health, violence, and health service use	Age Gender Race MUA (Medically Underserved Areas) HM (Municipalities with high homicide rates)	Health service use Mental health Violence ACES Health Service Use Bullying	Chi Square Tests Chi Square Tests Binary Logistic Regression

3.0 RESULTS

Basic descriptive statistics and demographic characterization:

The overall sample characterization in terms of age, race and education were calculated for the entire sample. The sample was approximately equally divided by sex categories (49.6% male and 50.4% female). Results are presented in the figures below.

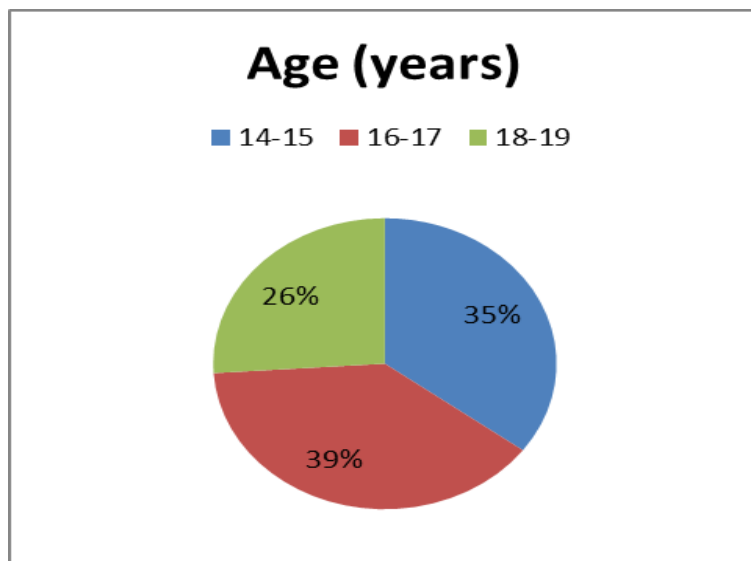


Figure 2. Age

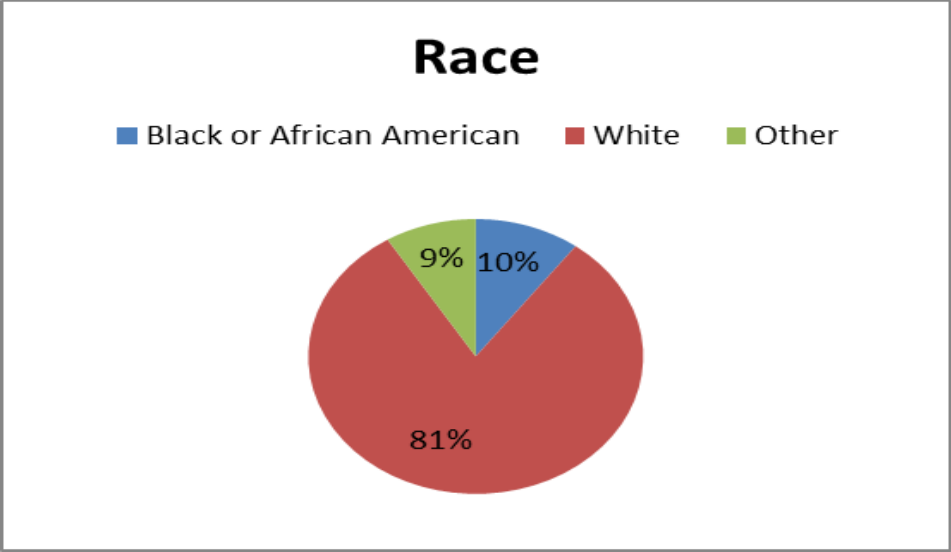


Figure 3. Race

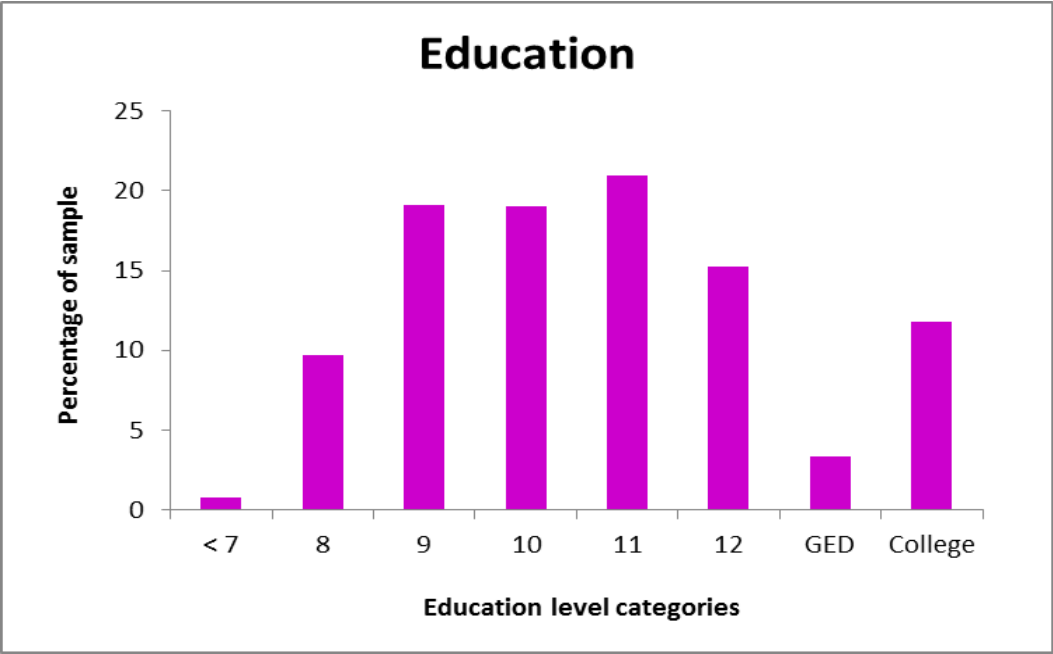


Figure 4. Education

Mental health was assessed with questions assessing for symptoms of depression and suicidality during the past 12 months. Participants were asked to respond about whether they experienced sadness or hopelessness, and if they seriously considered attempting suicide. Since responses

were voluntary, there were 218 missing responses for the depression item and 225 missing responses for the suicide item. The number of responses and corresponding percentages are reported below.

Table 3. Summary Table for Variables

<i>During the past 12 months, did you ever feel so sad or hopeless</i>	<i>Frequency</i>	<i>Percent</i>
YES	270	16.93
<i>During the past 12 months, did you ever seriously consider attempting suicide?</i>		
YES	181	11.4
<i>During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club?</i>		
ENDORSES	74	4.59
<i>Have you ever been physically forced to have sexual intercourse when you did not want to?</i>		
YES	63	3.92
<i>At any time in your life, were you neglected?</i>		
YES	89	5.55
<i>At any time in your life, did you get scared or feel really bad because grown-ups in your life called you names, said mean things to you, or said they didn't want you?</i>		
YES	333	21.08
<i>At any time in your life, was anyone close to you murdered, like a friend, neighbor, or someone in your family?</i>		
YES	148	9.28
<i>During the past 12 months, have you ever been electronically bullied?</i>		
YES	185	11.5
<i>During the past 12 months, have you ever been bullied?</i>		
YES	387	24.56
<i>Not including spanking on your bottom, at any time in your life did a grown-up in your life hit, beat, kick or physically hurt you in any way?</i>		
YES	188	11.89

Table 3. Continued

<i>At any time in your life did you see a parent get pushed, slapped, hit, punched or beat up by another parent?</i>		
YES	164	10.32
<i>At any time in your life, did one of your parents threaten to hurt another of your parents and it seemed he or she might really get hurt?</i>		
YES	82	5.14
<i>At any time in your life, did one of your parents, because of an argument, break or ruin anything belonging to another parent, punch the wall, or throw something?</i>		
YES	320	20.28

Overall association between mental health and violence in the sample:

Correlations were computed between mental health and violence variables. Statistically significant correlations are presented below (all p values <0.01 unless stated otherwise). Weak to moderate correlative associations were found between variables assessing for mental health, violence, and ACEs.

Table 4. Correlations

	Sadness	Suicidality	Threat w/ weapon	Bullying	Electronic Bullying	Sexual Coercion	Childhood Physical Abuse	Childhood Verbal Abuse	Neglect	Witness domestic violence	Murder of close ones	Witness parental threat	Witness damage d/t parent aggression
Sadness	1	0.56	-0.16	0.21	0.29	0.18	0.22	0.34	0.11	0.24	0.13	0.15	0.22
Suicidality	0.56	1	-0.13	0.16	0.27	0.24	0.21	0.31	0.08	0.16	0.11	0.11	0.16
Threat/Injury w/ weapon	-0.16	-0.13	1	-0.12	-0.15	-0.1	-0.1	-0.14	-0.18	-0.17	-0.15	-0.11	-0.09
Bullying	0.21	0.16	-0.12	1	0.46	0.1	0.11	0.23	0.3	0.12	0.04	0.05	0.07
Electronic Bullying	0.29	0.27	-0.15	0.46	1	0.21	0.16	0.27	0.15	0.18	0.12	0.09	0.13
Sexual Coercion	0.18	0.24	-0.1	0.1	0.21	1	0.17	0.18	0.19	0.18	0.1	0.09	0.16
Childhood Physical Abuse	0.22	0.21	-0.1	0.11	0.16	0.17	1	0.4	0.22	0.24	0.16	0.24	0.24
Childhood Verbal Abuse	0.34	0.31	-0.14	0.23	0.27	0.18	0.4	1	0.17	0.26	0.13	0.22	0.3
Neglect	0.11	0.08	-0.18	0.3	0.15	0.19	0.22	0.17	1	0.21	0.15	0.21	0.11
Witness domestic violence	0.24	0.16	-0.17	0.12	0.18	0.18	0.24	0.26	0.21	1	0.23	0.5	0.38
Murder of close ones	0.13	0.11	-0.15	0.04	0.12	0.1	0.16	0.13	0.15	0.23	1	0.17	0.14
Witness parental threat	0.15	0.11	-0.11	0.05	0.09	0.09	0.24	0.22	0.21	0.5	0.17	1	0.35
Witness damage d/t parent aggression	0.22	0.16	-0.09	0.07	0.13	0.16	0.24	0.3	0.11	0.38	0.14	0.35	1

Chi-square tests for differences in proportion were used to examine associations between variables of interest. Several differences across age groups, race, and gender were also found for these variables. The significant Chi-square test statistics (both design-adjusted and unadjusted) and corresponding p values are reported below for those who endorsed experiencing a particular behavior or experience (i.e., responded “Yes” to these respective items).

Table 5. Design-Adjusted Differences by Age

<i>Variable</i>	<i>14-15</i>	<i>16-17</i>	<i>18-19</i>	<i>Rao-Scott Chi Square (df=2)</i>	<i>P value</i>
Physical fight requiring medical care	1.6%	1.2%	8.2%	17.06	.0002
Feeling unsafe in school environment	1.1%	0.6%	0.2%	6.5	0.03

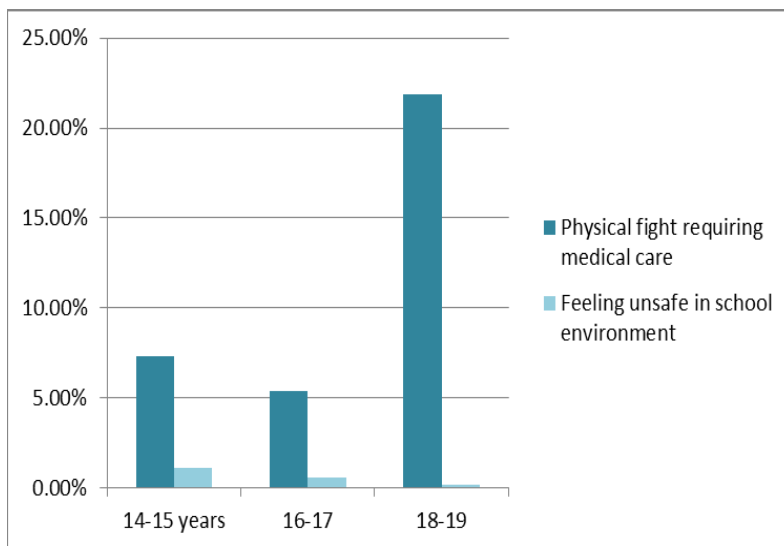


Figure 5. Adjusted Differences by Age

Table 6. Unadjusted differences by Age

<i>Variable</i>	<i>14-15 years</i>	<i>16-17</i>	<i>18-19</i>	<i>Chi Square (df=2)</i>	<i>P value</i>
Being bullied	27.8%	24.4%	20.1%	7.4945	0.0236
Childhood sexual abuse	2.4%	3.8%	6.3%	9.7133	0.0078
Childhood Physical abuse	8.6%	13.3%	13.6%	9.1384	0.0104
Witness domestic violence	3%	6.7%	5.8%	9.0038	0.0111
Homelessness > 2 nights	3.2%	3.7%	6.4%	7.8004	0.0202
Physical fight requiring medical care	7.3%	5.4%	21.9%	12.9152	0.0016

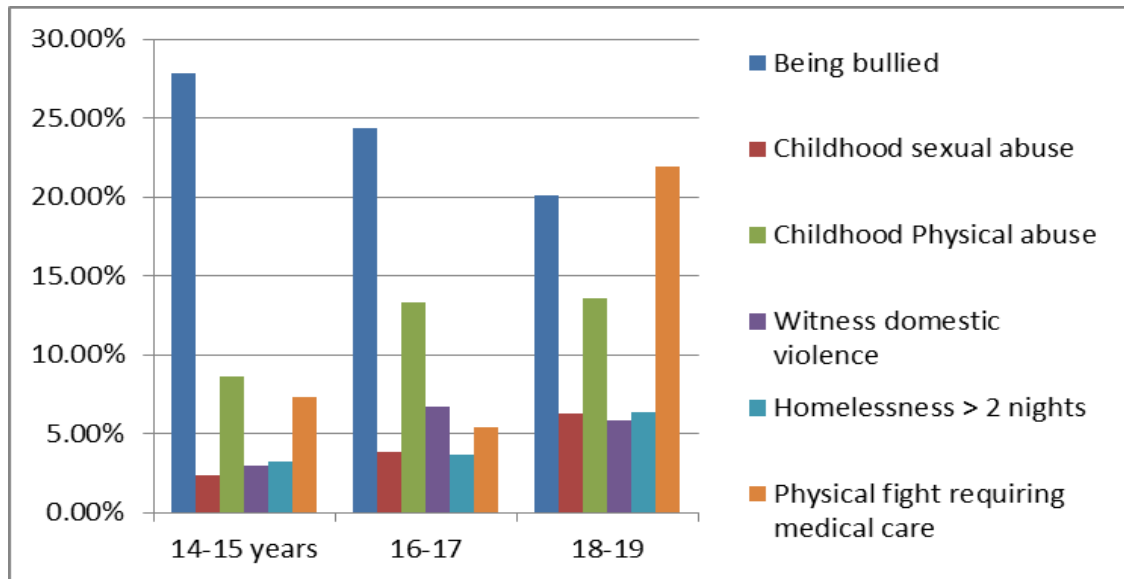


Figure 6. Differences by Age

Differences by Race for Endorsed Behaviors/Events are reported below (column-wise differences by race). The “Other” category comprises of Asian-Americans, Native American, Pacific Islander, and Multiracial groups.

Table 7. Unadjusted Differences by Race

<i>Variable</i>	<i>White</i>	<i>African-American</i>	<i>Other</i>	<i>Chi Square (df=2)</i>	<i>P value</i>
Depression	16%	19%	24.6%	6.9096	0.0316
Suicide	10.7%	9.1%	21.2%	14.1436	0.0008
Childhood Sexual Abuse	3.5%	5.3%	7.4%	6.2016	0.0450
Childhood Physical Abuse	10.7%	15.9%	19.4%	10.8316	0.0044
Childhood neglect	4.7%	7.8%	11.3%	11.4713	0.0032
Witness domestic violence	8.8%	18.3%	16.4%	19.0957	<.0001
Murder of family/friend/neighbor	4.9%	42.2%	16.4%	226.0251	<.0001
Witnessing domestic threat	4.5%	5.9%	11.4%	11.8731	0.0026

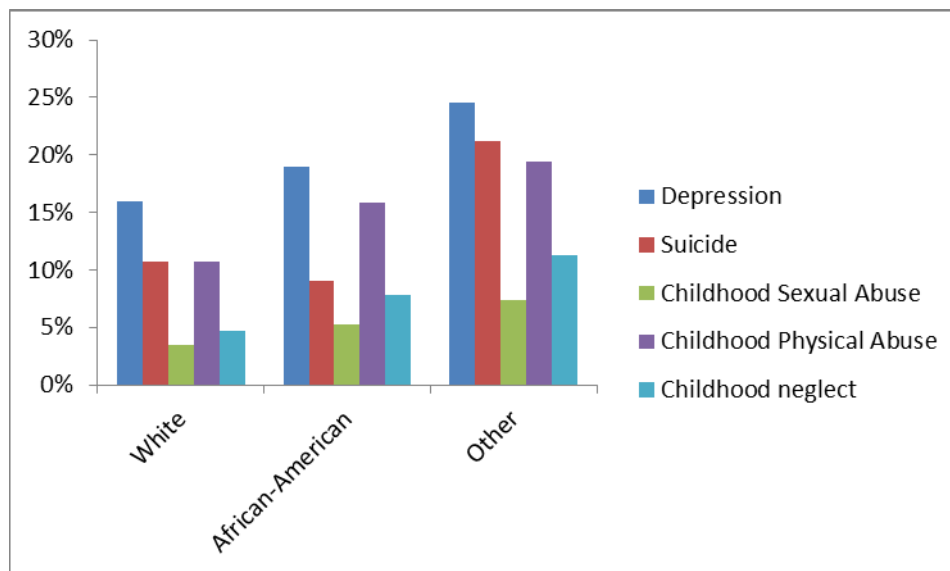


Figure 7. Unadjusted Differences by Race

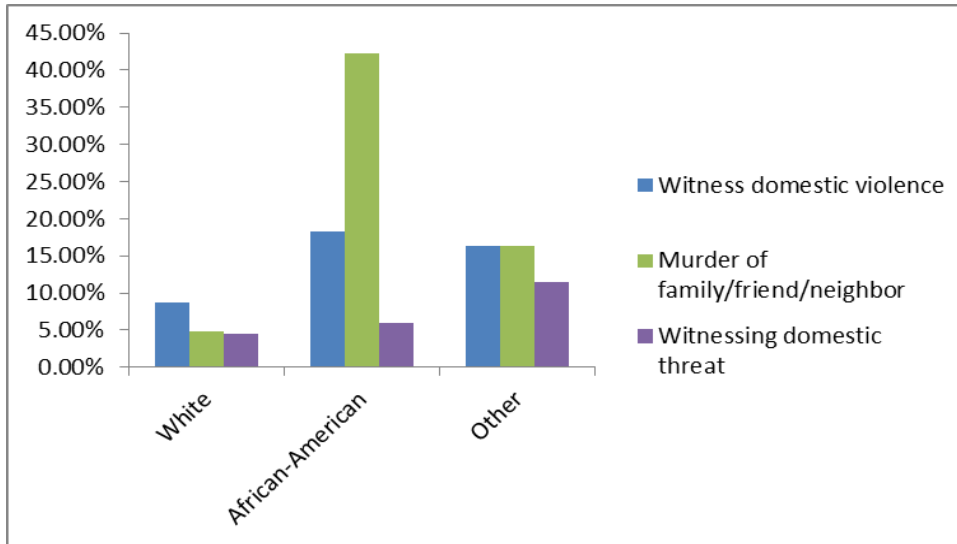


Figure 8. Unadjusted Differences by Race

Table 8. Adjusted Differences by Race

Variable	White	African-American	Other	Rao-Scott Chi Square (df=2)	P-value
Murder of family/friend/neighbor	4.3%	6.5%	2.6%	85.4	<.0001

Table 9. Adjusted Differences by Sex Category

Variable	Male	Female	Rao-Scott Chi Square (df = 1)	P value
Depression	6.8%	11.6%	7.3	0.007
Suicide*	3.9%	6.3%	3.7	0.055
Being bullied	10.2%	14.2%	4.3	0.038
Being electronically bullied	2.8%	6.6%	12.2	0.0005
Childhood verbal abuse	8.1%	13.3%	7.8	0.0052
Sexual coercion	0.8%	3.9%	10.2	0.0014
Witness parental aggression/threat	4.1%	1.9%	7.2	0.007
Witness damage due to parental aggression	8.9%	12.7%	3.9	0.04
Engaged in physical aggression	10.9%	6.6%	8.4	0.004
Feeling unsafe in school environment	1.1%	2.5%	3.9	0.04

*Approached significance

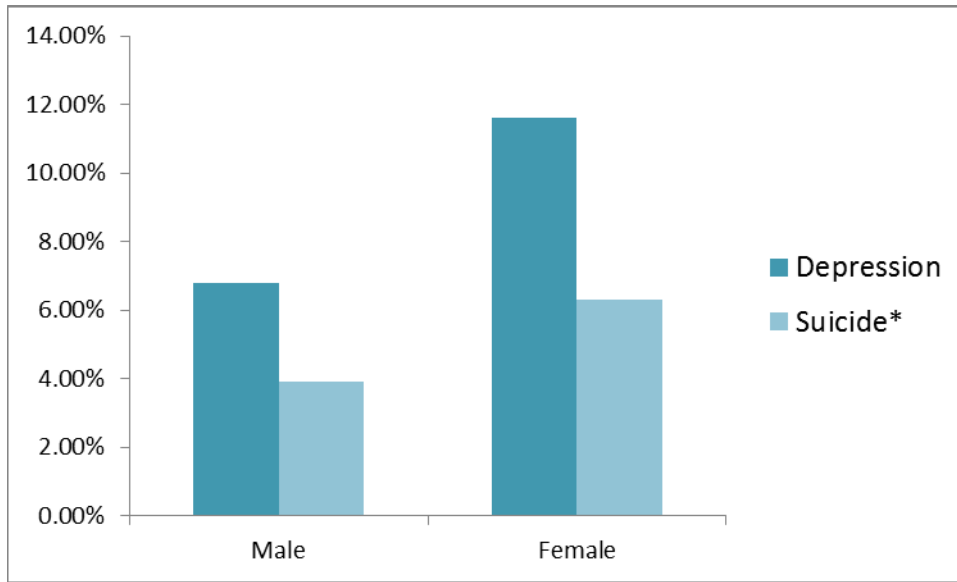


Figure 9. Sex Differences for Depression and Suicide

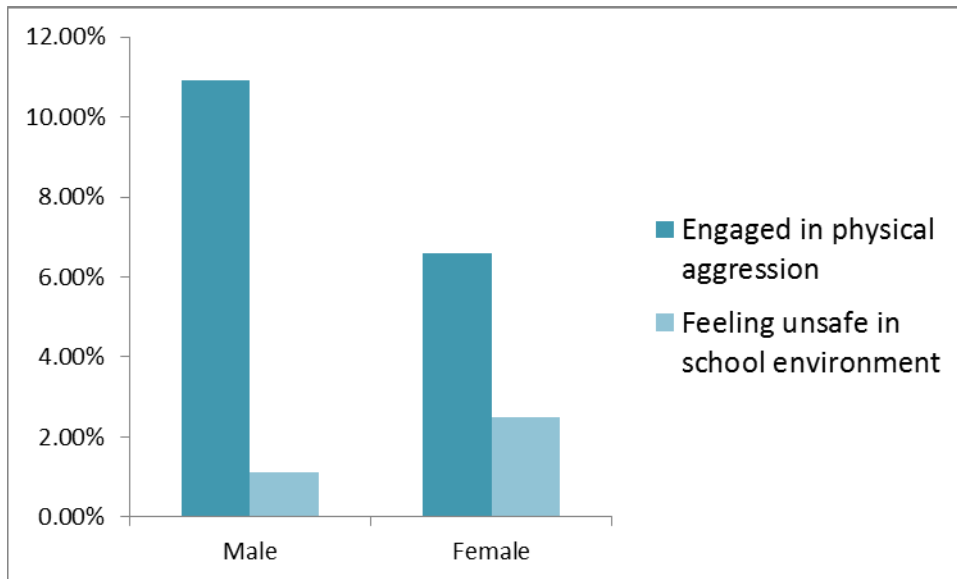


Figure 10. Sex Differences for Physical Aggression and Perceived Safety

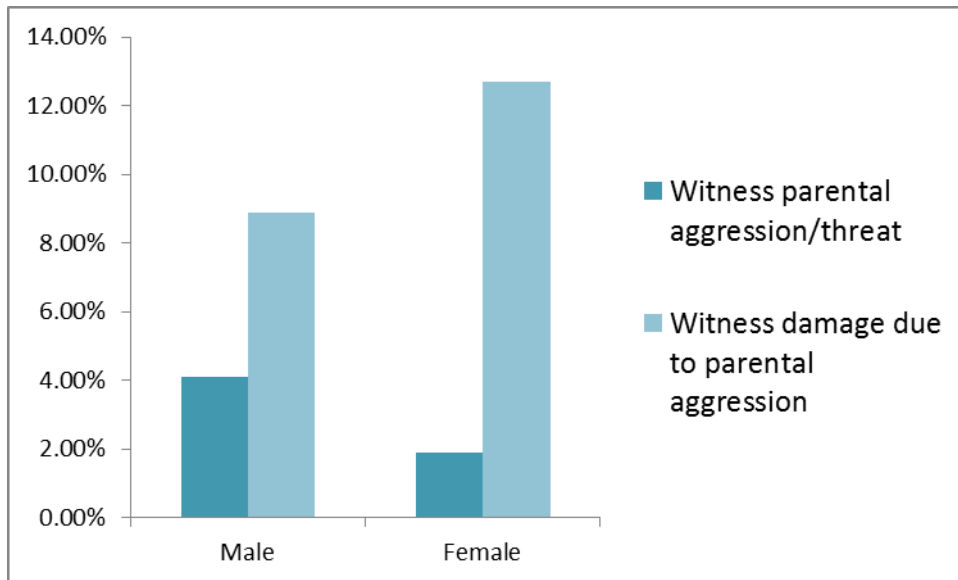


Figure 11. Sex Differences for Witnessed Violence

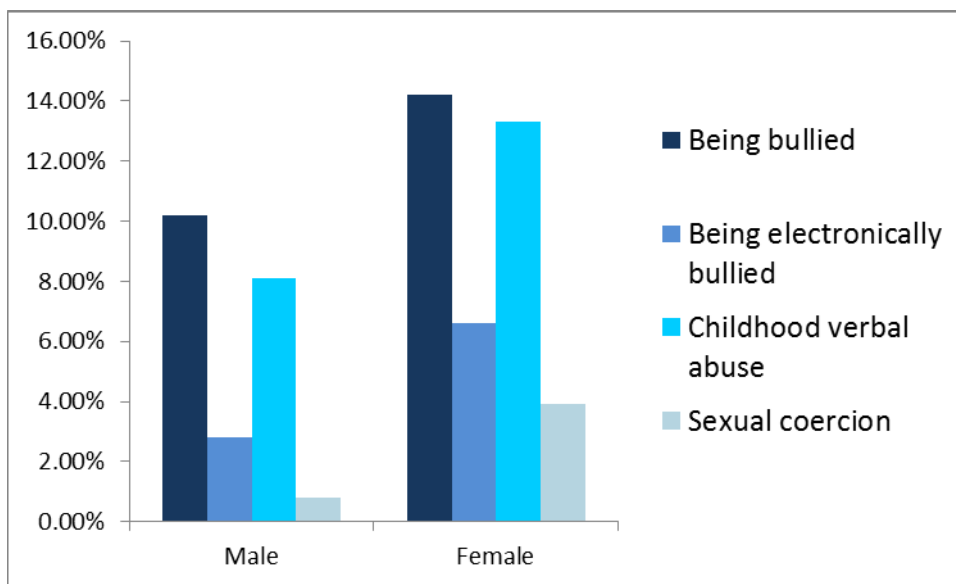


Figure 12. Sex Differences for ACEs and Bullying

For the next step of data analyses, binary logistic regression models were used to assess the presence of an association between the above variables (adjusting for race, sex, and age). The

significant beta coefficients and odds ratio estimates along with 95% confidence intervals are reported below:

Table 10. Binary Logistic Regression Model 1

<i>Dependent Variable: Depressive Symptoms</i>	<i>Parameter Estimate</i>	<i>Odds Ratio (Upper C.I, Lower C.I)</i>	<i>Wald Chi Statistic</i>	<i>P value</i>
Childhood Physical Abuse	1.02	2.774 (1.351, 5.694)	7.7	0.0054
Childhood Verbal Abuse	1.07	2.906 (1.565, 5.398)	11.4096	0.0007
<i>Dependent Variable: Suicide</i>	<i>Parameter Estimate</i>	<i>Odds Ratio (Upper C.I, Lower C.I)</i>	<i>Wald Chi Statistic</i>	<i>P value</i>
Childhood Sexual Abuse	0.9706	2.640 (1.024, 6.801)	4.0394	0.0444
Childhood Verbal Abuse	1.1790	3.251 (1.651, 6.401)	11.6375	0.0006
<i>Dependent Variable: Inability to receive health services</i>	<i>Parameter Estimate</i>	<i>Odds Ratio (Upper C.I, Lower C.I)</i>	<i>Wald Chi Statistic</i>	<i>P value</i>
Childhood Physical Abuse	1.2688	3.557 (1.613, 7.840)	9.8970	0.0017

Health service use:

Differences in use of health services were examined across age, race, and gender. For the purposes of this study, the following three questions with binary response structures (Yes/No) examined health service use in this sample:

- In the past 12 months, needed to go see a doctor, nurse, or go to the emergency room BUT did NOT go?
- Do you have a doctor or nurse you usually see if you need a checkup or you are feeling sick?
- In the past 12 months, have you seen a doctor or a nurse?

There were no significant differences in health service use by age. Significant associations with race and gender along with corresponding percentages of responses are reported below:

Table 11. Differences by Race

<i>Variable</i>	<i>White</i>	<i>African-American</i>	<i>Other</i>	<i>Chi Square (df=2)</i>	<i>P value</i>
Being unable to go to a doctor/nurse/emergency room when needed in the past 12 months	7.6%	15.9%	15.9%	22.7948	<.0001
Not having a doctor or nurse to see when ill	5%	13.2%	7.6%	19.9881	<.0001
Not seeing a doctor or nurse in the past 12 months	3.8%	7.1%	7.6%	8.1948	0.0166

Table 12. Differences by Sex Category

<i>Variable</i>	<i>Male</i>	<i>Female</i>	<i>Chi Square</i>	<i>P value</i>
Being unable to go to a doctor/nurse/emergency room when needed in the past 12 months	7.1%	11.3%	9.6622	0.0019

Area-level differences

State designated Medically Underserved Areas (MUAs) were used to examine differences in reported symptoms of mental health, violence exposure, and health service utilization patterns. According to the Pennsylvania Department of Health, 22 municipalities (listed in Appendix A) were determined to have a significant lack of medical providers and services compared to other municipalities in the County.

Chi-square tests were used to determine differences in proportion among the variables mentioned above. Binary logistic regression models were used to determine associations if any between MUA status and these variables. All results that were significant or approached significance are reported below:

Table 13. Differences by MUA Status

<i>Variable</i>	<i>Non-MUA</i>	<i>MUA</i>	<i>Chi Square</i>	<i>P value</i>
Depression	15.9%	22.2%	5.6877	0.0171
Physical threat or injury with weapon/firearm	4%	8%	7.1203	0.0076
Experience murder of close ones	7.6%	19.7%	33.8244	<.0001
Perceived unsafety in school environment	2.5%	5.2%	5.8197	0.0158
Engaging in physical aggression	14.4%	15.8%	6.4074	0.0114

The differences tabulated above are graphically represented below:

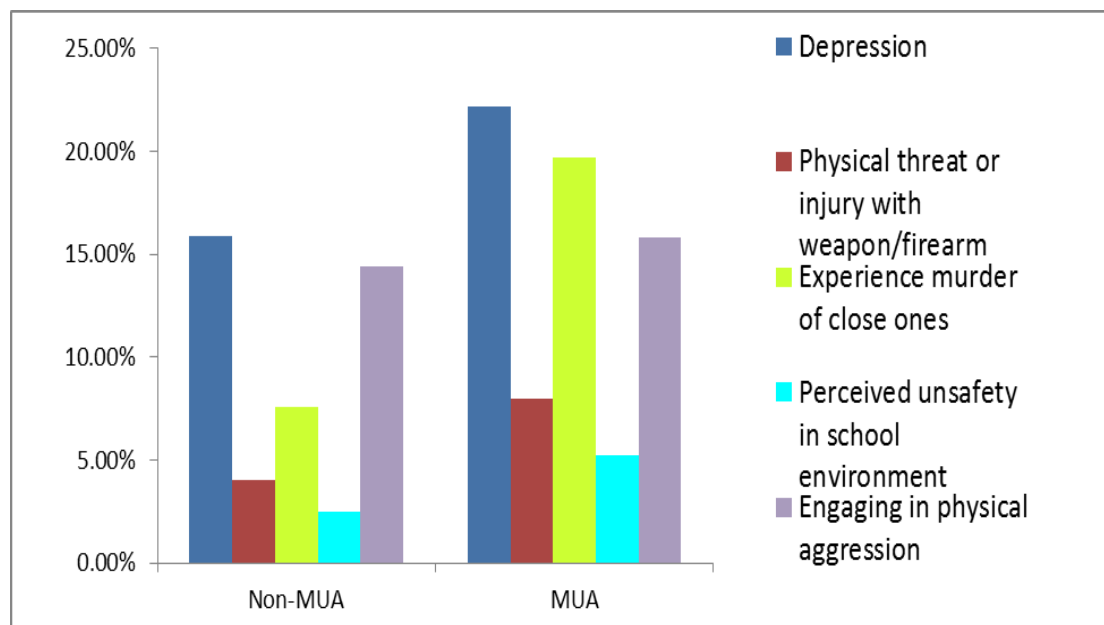


Figure 13. Differences by MUA Status

MUA areas which reported these differences in health outcomes and behaviors are visually represented on the map of Allegheny County below: (blue circles)

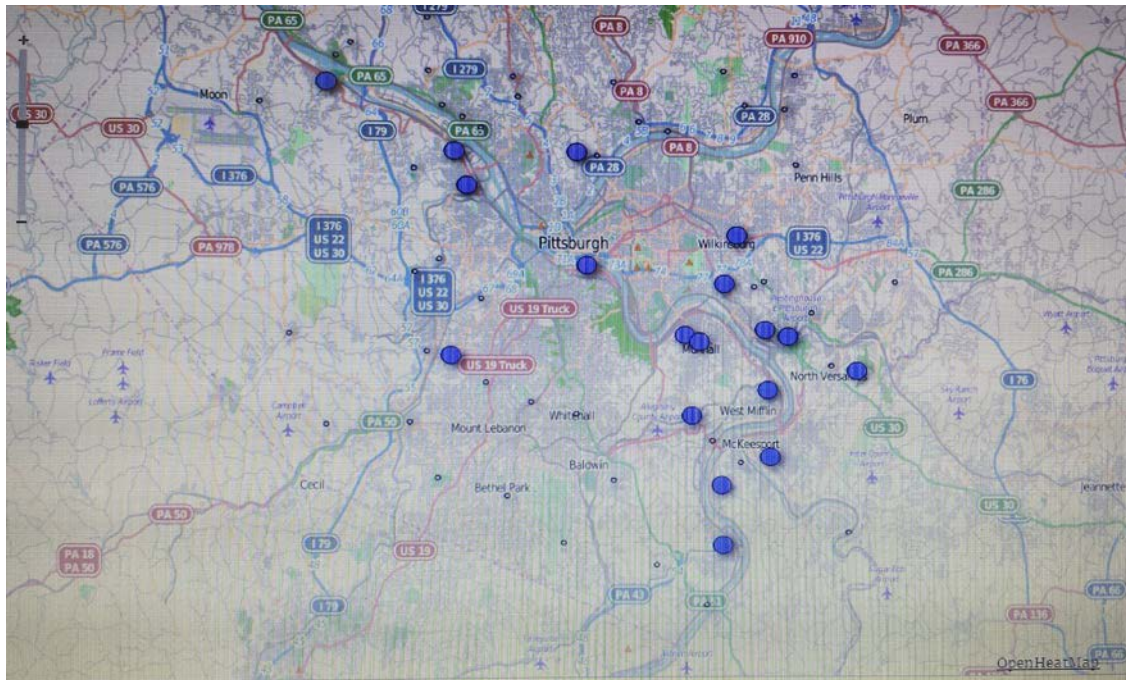


Figure 14. Map of MUAs in Allegheny County

Comparison between perceived safety and municipality violence prevalence rates:

Municipality homicide rates for Allegheny County were used to examine any association between perceived reports of safety, physical violence, and other related measures and counties with high and low homicide rates. Sixteen municipalities from the Allegheny County Health Department were determined to have the highest homicide rates per 100,000 and homicide counts (measured from 1997-2007) (Dalton, Yonas, Warren, & Sturman). These municipalities are listed in Appendix B.

For the purpose of this exploratory analysis, these municipalities were categorized as “Homicide Municipalities” (HM) and assigned a dummy score of 1. Other municipalities were categorized

as “Non-Homicide Municipalities” and received a dummy score of 0. Chi-square tests were used for categorical data and the Wilcoxon Sum Rank test was used for ordinal data.

The results yielded a modest association approaching significance between HMs and endorsing engaging in physical fights ($p=0.052$). A strong association between HMs and a higher perception of feeling unsafe in their school ($z = 2.6, p<0.0001$) was found. Other associations examined did not reach significance. This could be attributed to very small frequencies when respondents were classified by HM, and a considerable proportion of missing and refused responses. Among those endorsing experiencing the murder of family members/friends/neighbors, approximately 40% were in HMs versus 8.74% in non-HMs ($\text{Chi}=32.3, p<0.001$).

Wilcoxon Sum Rank tests revealed significant differences between HMs and non-HMs for the item measuring perceived neighborhood trust ($z=-3.8, p <0.01$). The median score for non-HMs was 2 (“Agree”) compared to 4 for HMs (“Disagree”). Significant associations were also found between HM status and perception of the extent to which people in their neighborhood get along with each other. They rated the extent to which they agreed or disagreed with the statement “People in this neighborhood generally don’t get along with each other”. Respondents from HMs reported a median score ≈ 3 (“Neutral”) vs 4 (“Disagree”) for those from non-HMs ($z=-3.9, p<0.01$).

Table 14. Differences by HM status

<i>Variable</i>	<i>Non-HM</i>	<i>HM</i>	<i>Chi Square</i>	<i>P value</i>
Experience murder of close ones	8.7%	40.7%	32.2652	<.0001
Having health insurance	2.1%	6.7%	2.8336	0.0923
Engaging in physical aggression	15.2%	28.6%	3.7697	0.0522
Perceived safety in school environment	1.9%	17.2%	31.8882	<.0001

These differences are graphically represented below:

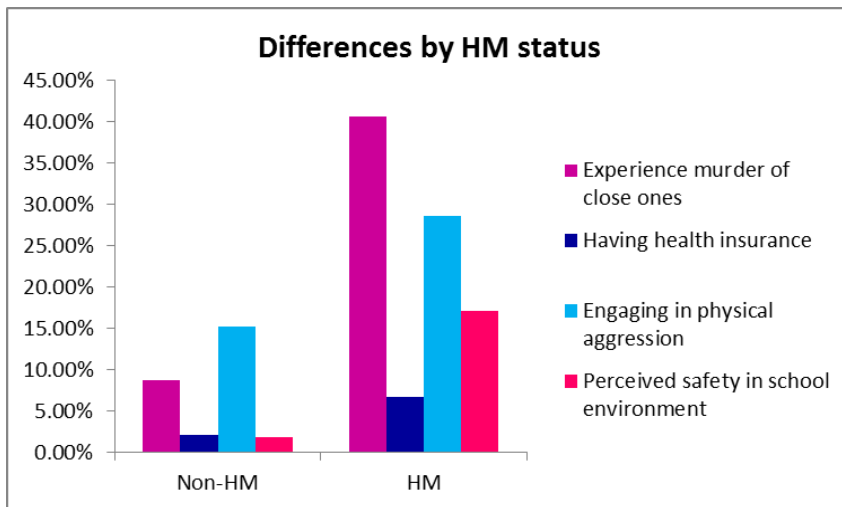


Figure 15. Differences by HM status

Binary logistic regression models were used to assess the presence of an association between type of municipality (MUA/non-MUA and HM/non-HM) and mental health symptoms, safety, violence, and access to health services. There were no significant associations between area-level variables and measures for depression and suicide. Adjusting for race, age, and gender, significant associations were found between MUA and HM status and physical aggression and presences of weapons. HM status was also significantly associated with dating violence.

Significant beta coefficients, Wald Chi squares, and p values are reported below (Odds ratios are not reported due to too few observations in some categories)

Table 15. Logistic Regression Model with Independent Variable: MUA

<i>Dependent Variable</i>	<i>Beta Coefficient</i>	<i>Wald Chi Square</i>	<i>P value</i>
Physical Aggression	.33	5.1	0.02
Carrying weapons during the past 30 days	.45	7.13	.008
Perceived safety in school environment	0.55	5.3	0.03
Experienced murder of loved ones	0.61	15.1	<0.01

Table 16. Logistic Regression Model with Independent Variable: HM

<i>Dependent Variable</i>	<i>Beta Coefficient</i>	<i>Wald Chi Square</i>	<i>P value</i>
Physical aggression requiring medical care	6.3	726.9	<0.01
Dating Violence	7.2	631.1	<0.01
Carrying weapons during the past 30 days	1.1	7	0.008
Perceived safety in school environment	1.3	9.6	0.002

HM areas with significantly different health outcomes are visually represented in the map below:

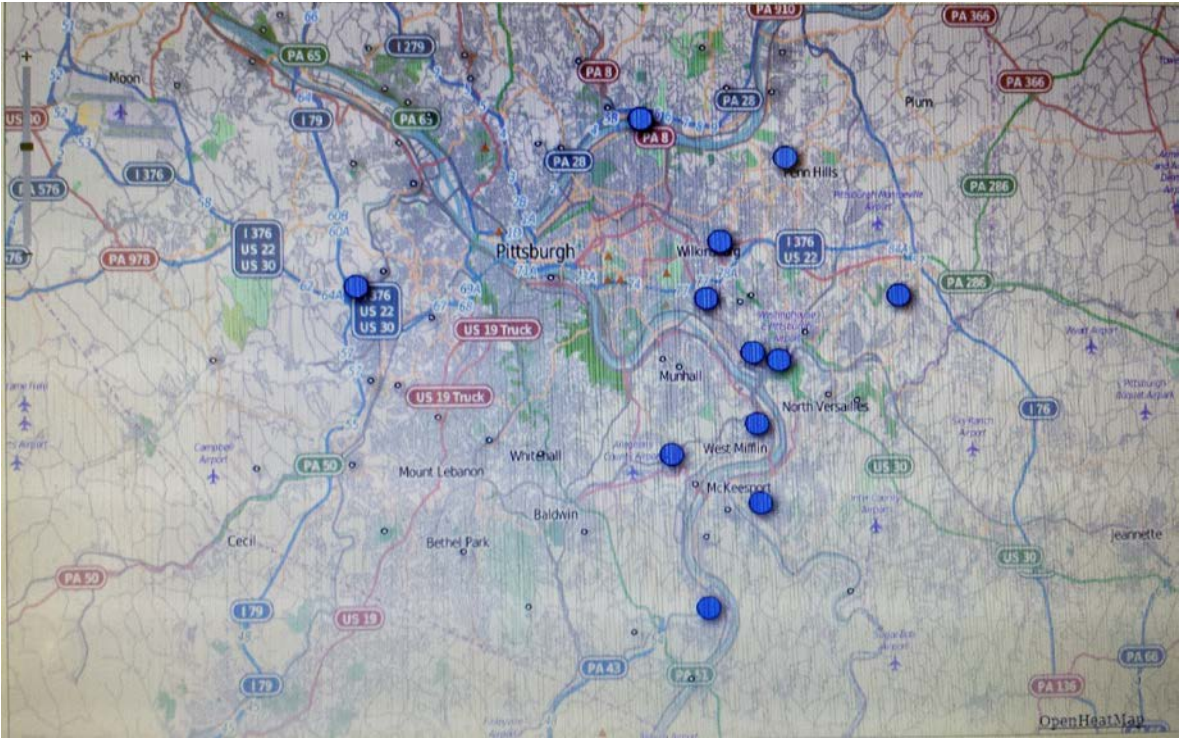


Figure 16. Map of HMs in Allegheny County

4.0 DISCUSSION

4.1 AGE-RELATED DIFFERENCES

The results presented above revealed several distinct characteristics and patterns of health behavior and outcomes among this sample of adolescents. Among age-related differences in endorsed experiences with violence and ACES, a higher proportion of younger respondents reported being bullied than respondents in older age groups. Older adolescents reported a higher proportion of sexual abuse, involvement in physical fights, and homelessness for more than two nights than younger adolescents. Adolescents aged 16-19 reported a higher proportion of physical abuse and witnessed domestic violence than the youngest age group (14-15 years). Age-related patterns have also been found in other studies which suggest the possibility of specific critical age periods during the developmental span where children are at higher risk of being exposed to certain forms of violence and adverse events (Khan et al., 2015).

4.2 DIFFERENCES BY RACE/ETHNICITY:

Differences by race were also found for several variables. Consistent with the original hypotheses and previous research, African-American and teenagers belonging to other ethnic minority groups reported higher mental health symptoms than White teenagers. African

Americans were significantly more likely to have experienced the murder of someone close and witness domestic violence compared to other groups.

With regard to health service use, African-American and other ethnic groups were more likely to be unable to receive healthcare when needed, and not have a doctor or nurse or visit a doctor recently, compared to their White counterparts. However, causation cannot be implied in a cross-sectional study such as this. There are certainly multiple exposures affecting this association. Research suggests that experiencing violence on multiple levels ranging from domestic violence within the home, to violence within the community are largely interactive experiences. There are likely other factors involved that contribute to the severity of violence exposures and ACES among some ethnic groups over others (DuRant, Cadenhead, Pendergrast, Slavens, & Linder, 1994; O'Keefe & Sela-Amit, 1997).

4.3 DIFFERENCES BY SEX CATEGORY:

Among sex differences, female participants reported a higher proportion of almost all outcomes on measures of mental health, violence, and ACEs except physical aggression and endorsing carrying weapons (where males > females). Research has shown that such differences exist due to the role of important social determinants of health such as social support, which have differential effects on males and females (Afifi, 2007). The importance of the diathesis stress model in such associations is emphasized by Nolen-Hoeksema and colleagues who found that girls are more likely to possess characteristics that place them at higher risk for depression before

puberty. However, the differences emerge with the onset of developmental challenges experienced during adolescence (Nolen-Hoeksema, 1994).

4.4 AREA-LEVEL DIFFERENCES

Medically Underserved Areas:

Fewer respondents from MUAs reported visiting a doctor recently than those from non-MUAs. These findings are consistent with previous research which showed that those living in low-income areas were more likely to use the ER and less likely to have visits to the doctor than those in higher income areas. However, this research does not consider the availability of medical services in the community. Teenagers living in Medically Underserved Areas (MUAs) reported significantly higher physical aggression, presence of weapons, experience of close ones being murdered, and lower perceived safety in school environment, than those living in non-MUAs. These differences remained significant even after adjusting for age, race, and gender. These findings suggest that although MUAs by definition lack adequate medical providers and facilities, these areas may also be characterized by the implication of violence and low safety as suggested by the participants' responses. Although these findings may be preliminary, they clearly illustrate a greater need to better understand the characteristics of these areas. It is possible that having low access to medical services influences the residential nature of these municipalities and could potentially affect the mental health symptoms of teenagers living in these areas.

Municipalities with high homicide rates (“Homicide” Municipalities):

Teenagers living in municipalities with high homicide rates reported significantly higher levels of physical aggression requiring medical care, dating violence, presence of weapons, and low perceived safety in their school environment. Although a small proportion of participants were sampled from these areas, it is important to note that their reports of actual and perceived violence correspond with the known prevalence of violence in these areas. These findings also remained significant after adjusting for demographic measures such as age, race, and gender. The findings on measures of violence and perceived safety are consistent with previous research that found greater aggression, higher delinquency, and lower social support in low-income neighborhoods.

Currently, there exists limited literature on the area-level effects on mental health in teenagers. These results, although preliminary and primarily exploratory in nature, are promising as they form an initial step towards further characterizing disadvantaged areas. Several models proposed by Jencks and Mayer are useful in conceptualizing the effects of area-level characteristics on health (Leventhal & Brooks-Gunn, 2000). The “Neighborhood Institutional Resource Model suggests that resources offered by the neighborhood affect behavior and health. The “Contagion Model” suggests that problem behavior occurs as a “ripple effect” and is transmitted through influential peers and neighbors. The findings presented in this study along with previous research suggest that certain community-level structural dimensions are important for promoting and maintaining health among the youth. A combination of ecological and sociological approaches is needed to explore whether individual level factors moderate or mediate the effect of area on health.

5.0 CONCLUSIONS

What are the contributions of the findings to public health research and practice?

The findings described above present a summary of health behaviors and outcomes reported by a sample of teenagers within Allegheny County. They also provide a geographic perspective of area-level differences by classifying municipalities by medical service availability and homicide rates. Reported disparities inform our understanding of these areas and help characterize them further. It is known that certain areas lack medical services and have high rates of violent crimes. However, our findings on mental health disparities, violence exposure, adverse childhood experiences, perceived violence, and health service utilization extend this beyond existing knowledge about these municipalities.

As mentioned before, this study is a preliminary exploration of health outcomes among adolescents within Allegheny County. There still remains ample scope for further investigation within this area using the Healthy Allegheny Teens Survey. Future public health research can continue area-level exploration using more well-defined and accurate measures of location available from the survey such as school neighborhoods, zip codes, and street-intersections. This will allow for a more refined assessment of residential characteristics that may contribute to the health disparities reported by this sample of adolescents. Public health practitioners can use these findings to design or modify tailored interventions targeted at this specific population.

Specifically, interventions aimed children and families to attenuate the severity of mental illness, reduce violence exposure, and minimize adverse childhood experiences in specific areas of the County may be an important first step in improving health at the community level.

Limitations:

There are several limitations of the findings to be acknowledged. Firstly, the area-level classifications occasionally resulted in fewer respondents per category which does not allow us to generalize these findings to the larger population of adolescents. Secondly, as this was a cross-sectional survey, we cannot establish a temporal alignment of experiences with violence, mental health symptoms, etc. Therefore, we can only point to an associative relationship without specific directionality.

There was significant proportion of missing or refused responses specifically for questions on depression, suicide, and ACEs that were of a more sensitive nature. It is possible that the high non-response rate yielded skewed results that should be interpreted with caution. Data for some of the sensitive items mentioned above were collected using an automated response system to preserve confidentiality. There may have been possible errors in responses using this system. For example, respondents may have mistakenly recorded the wrong response or not responded at all to these questions.

Strengths:

There are several strengths of this study as well. This study is the first step (to our knowledge) towards characterizing adolescent health within Allegheny County. It is also the first

examination of MUAs and municipalities with high homicide rates to see if there are existing health disparities on a wide range of measures. Using the Interactive Voice Response (IVR) system was also useful in collecting large volumes of responses with a secure and confidential process.

This analysis provides a unique perspective of examining health outcomes and associations between them at a local population level. As mentioned earlier, this study has the potential to be scaled up and replicated at the state level to look at adolescent health outcomes across a wide range of domains across different counties.

Implications for public health policy:

These findings can potentially guide and inform local public health policy with regard to mental health, safety, and health service availability. Area-level findings can help channel resources to specific municipalities where there is the greatest need. This would lead to more informed decision-making in terms of disseminating funds and efficient allocative policy practices.

APPENDIX A: LIST OF MUNICIPALITIES

Table 17. List of Municipalities

Code Municipality/Township
110 Stowe Township
111 Borough of Swissvale
122 Borough of West Homestead
123 Borough of West Mifflin
125 Borough of Whitaker
129 Borough of Wilkinsburg
13 Borough of Braddock
23 City of Clairton
25 Borough of Coraopolis
30 City of Duquesne
33 Borough of East Pittsburgh
47 Borough of Glassport
55 Borough of Homestead
68 City of McKeesport
69 Borough of McKees Rocks
75 Borough of Munhall
77 North Braddock Borough
79 North Versailles Township
89 City of Pittsburgh
93 Borough of Rankin
94 Reserve Township
99 Scott Township

APPENDIX B: LIST OF MUNICIPALITIES WITH HIGH HOMICIDE RATES

Code Municipality/Township
104 Borough of Sharpsburg
111 Borough of Swissvale
123 Borough of West Mifflin
129 Borough of Wilkinsburg
13 Borough of Braddock
130 Borough of Wilmerding
23 City of Clairton
30 City of Duquesne
33 Borough of East Pittsburgh
55 Borough of Homestead
68 City of McKeesport
71 Municipality of Monroeville
77 North Braddock Borough
85 Municipality of Penn Hills
86 Pennsbury Village
93 Borough of Rankin

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