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**NEIGHBORHOOD FACTORS ASSOCIATED WITH MENTAL  
DISORDER AMONG CHILDREN IN THE USA: EVIDENCE  
FROM NATIONAL SURVEY OF CHILDREN'S HEALTH,  
2011/12**

by

SUSHMA DAHAL

A Thesis Submitted to the Graduate Faculty  
of Georgia State University in Partial Fulfillment  
of the  
Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA  
2017

## APPROVAL PAGE

NEIGHBORHOOD FACTORS ASSOCIATED WITH MENTAL DISORDER AMONG  
CHILDREN IN THE USA: EVIDENCE FROM NATIONAL SURVEY OF CHILDREN'S  
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13<sup>th</sup> April, 2017  
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## Author's Statement Page

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Sushma Dahal, 13<sup>th</sup> April, 2017  
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## ABSTRACT

**INTRODUCTION:** Neighborhood factors affect mental health of children. There are not many studies done on neighborhood conditions and common childhood mental disorders using national level data in the US. This study aims to study the association between neighborhood characteristics and mental disorder among children in the US by analyzing nationally representative data.

**METHODS:** Data on children aged 6-17 years from 2011/12 national survey of children's health was analyzed. Primary dependent variable was current diagnosed mental disorder that was based on the diagnosis of at least one of the attention deficit hyperactivity disorder (ADHD), behavioral or conduct problem, depression and anxiety problem among children. Five neighborhood conditions (neighborhood amenities, neighborhood distracting element, supportive neighborhood, neighborhood safety, and school safety) were the independent variables. Analysis was conducted using bivariate and multivariable logistic regression at 95% CI.

**RESULTS:** All the neighborhood conditions were significantly associated with current diagnosed mental disorder among children. In the multivariable model, children living in neighborhood perceived to be not supportive by parents/guardians had greater odds of mental disorder (OR 1.37, 95% CI:1.10-1.71) compared to children living in supportive neighborhood. Other noticeable factors associated with mental disorder among children were father's and mother's mental health, and number of adverse childhood experiences (ACEs).

**CONCLUSION:** Neighborhood level interventions should be a part of broad interventions designed to improve mental health of children. Besides, assessment of conditions of a child's neighborhood, parents' perception of neighborhood social support, father's and mother's mental health, and adverse childhood experiences can be helpful in evaluating childhood mental disorders as well as in planning neighborhood level interventions.

**KEYWORDS:** *Adverse childhood experience, Children, Mental disorder, Neighborhood effect, Social cohesion, Social determinants*

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# CHAPTER I

## INTRODUCTION

Mental disorders are characterized by combination of different presentations like abnormal thoughts, perceptions, emotions, behaviors, and relationship with others<sup>1</sup>. Mental disorders among children affect their ability to perform normal developmental tasks, lead to poor educational performance, poor interpersonal skills<sup>2</sup> and the problem can also continue into adulthood affecting their functioning in the workforce<sup>3</sup>. Moreover, the etiology of most of the mental disorders in the adults have been found to develop during childhood and adolescence<sup>2,4</sup>. Other issues like illicit drug use, alcohol use, violence, engagement in criminal activities, and suicide are also the aspects closely related to childhood mental disorders<sup>2,3</sup>. In fact, in 2015 suicide was third leading cause of death among children aged 10-14 years and second leading cause of death among persons aged 15-24 years in the USA<sup>5</sup>.

Mental disorders among children in the USA are important public health concerns because of the increasing prevalence, early onset, and socio-economic impacts<sup>2</sup>. A total of 13-20% of children below 18 years living in the US have a mental disorder in a given year<sup>3</sup>. Among children 3-17 years, the most common parent reported current diagnosed mental disorder was attention-deficit hyperactivity disorder (ADHD) followed by behavioral or conduct problems, anxiety disorder, depression, and autism spectrum disorder<sup>3</sup>. There was an almost two-fold increase in mental disorder diagnosis among population less than 21 years who visited office-based physicians from 1995-1998 to 2007-2010 in the US<sup>6</sup>. Data on broad range of mental disorders among 13-18-years adolescents has shown the life time prevalence of Diagnostic and Statistical Manual-IV (DSM-IV) mental disorders with severe impairment/distress to be 22.2%<sup>4</sup>. Among the DSM-IV mental disorders, the life time prevalence of anxiety disorder was highest followed by behavioral disorders, mood disorder and substance use disorders<sup>4</sup>.

Mental disorders among children are multifactorial. The risk factors for mental disorders among children and adolescent range from biological factors such as genetic susceptibility, head injury, etc. to social factors such as poverty, family conflict, discrimination, community disorganization, etc<sup>7</sup>. The association between the social factors such as poverty and mental disorders in the



young population is often bidirectional and occurs through a complex pathway<sup>7</sup>. According to World Health Organization (WHO), social determinants of health are “the circumstances in which people are born, grow, live, work, and age, and the systems that are put in place to deal with health and illness; shaped by the distribution of power, money, and resources at local, national and global level”<sup>8</sup>. One of the way to study this social influence on health is by studying neighborhood factors<sup>9</sup>. Neighborhood studies can provide information on both physical and social characteristics of the conditions where people live and grow<sup>10-12</sup>. Several studies have recognized that neighborhood characteristics are associated with the health outcomes of its residents<sup>13,14</sup> including mental health outcomes. It is also recognized that compared to people of other ages<sup>15-17</sup>, children and adolescents who are in rapid process of biological and psychological change<sup>18</sup> may experience the influence of neighborhood factors in specific ways<sup>19-21</sup>. Moreover, the effect of neighborhood on children’s mental health starts before the age of 10 years<sup>17</sup>.

There is a rapid increase in neighborhood and health research in the USA since mid-2000s<sup>22</sup>. Among multilevel neighborhood studies conducted in the USA between 1995-2014, the most commonly studied neighborhood exposures were socio-economic status and deprivation followed by built environment while the most studied health outcome was obesity/body mass followed by mental disorder<sup>22</sup>. Among children and adolescents in specific, the commonly studied neighborhood variables were related to built environment and the outcomes were related to physical activity<sup>22</sup>. Most of the currently available data on neighborhood variables and mental disorders are based on studies conducted among adult population<sup>23</sup>. Also, among young people aged 10-20 years most commonly studied mental disorder in relation to neighborhood factors was depression<sup>17</sup>.

Limited studies have explored the association of neighborhood conditions such as neighborhood resources, detracting physical environments, and social support with common mental disorders among children using nationally representative recent data in the USA. In addition, most of the studies that have been conducted on childhood mental disorder and neighborhood factors have analyzed dataset prior to 2000s and most of those are not based on nationally representative data<sup>24</sup>. The limited available literature suggests the association between common mental

disorders among young people and neighborhood problems such as poor living conditions, economic deprivation, violence, and victimization<sup>17</sup>. Other factors such as social cohesion and organizational participation are also associated with the better mental health of children<sup>15</sup>. A study conducted using national level US data of 2007 has found that children living in neighborhood with poor physical characteristics (litter/garbage, poorly kept housing, vandalism in the neighborhood) and poor social support were at greater risk of both internalizing disorders (anxiety/depression) and externalizing disorders (ADHD/disruptive behavior)<sup>25</sup>.

Improving our understanding of how the neighborhood related factors can shape the mental health of children has implication for both evaluation of mental disorder among children as well as for planning programs at neighborhood level to reduce mental health burden. In this study the central research question is “what is the association of neighborhood conditions and common mental disorders among children?”. The specific questions we are trying to address are:

- i. What is the association of neighborhood resources and mental disorder among children aged 6-17 years?
- ii. What is the association of neighborhood detracting elements with mental disorder among children aged 6-17 years?
- iii. What is the association of parent perceived supportive neighborhood with mental disorder among children aged 6-17 years?
- iv. What is the association of neighborhood and school safety with mental disorder among children aged 6-17 years?
- v. What is the association of neighborhood conditions with ADHD, depression, anxiety problem and behavioral/conduct problems among children aged 6-17 years?

In this study, we have controlled for the effect of factors such as parent’s mental health, and parent’s education etc. that are known to be associated with children’s mental health<sup>4,23,26</sup>.

Besides, we have also adjusted for adverse childhood experiences (ACEs); one of the important determinants for the onset of mental disorders among children<sup>27,28</sup>. This variable has not been adjusted for in the 2007 study. Furthermore, we have also reported the results of association of neighborhood conditions with each of four common childhood mental disorders (ADHD, depression, anxiety problem and behavioral/conduct problem) unlike most of the studies including the 2007 study that have reported result in terms of internalizing and externalizing

disorders. So, this study aims to contribute to the current literature on neighborhood conditions associated with mental disorder among children in the USA. We aim to do this by analyzing data from a more recent nationally representative study from 2011/12<sup>29</sup>.

## **CHAPTER II.**

### **LITERATURE REVIEW**

#### **Epidemiology of mental disorders among children**

Mental disorders are characterized by combination of different presentations like abnormal thoughts, perceptions, emotions, behaviors, and relationship with others<sup>1</sup>. A mental disorder is defined as a syndrome of clinically significant disturbance in cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological or developmental processes underlying mental functioning<sup>30</sup>. There are several effects of mental disorder among children such as inability to perform normal developmental tasks, poor performance in educational domains, poor interpersonal skills etc.<sup>2</sup>. Other issues like illicit drug use, alcohol use, violence, indulgence into criminal activities, and suicide are also the aspects closely related to childhood mental disorder<sup>2,3</sup>. For example, mental health surveillance data<sup>3</sup> from 2005-2011 has shown that approximately 5% of the children 12-17-years having illicit drug use disorder, 4% had alcohol abuse disorder, about 3% had cigarette dependence. In fact, suicide rate was estimated to be 4.5 per 100,000 persons aged 10-19 years<sup>3</sup>. In 2015 suicide was third leading cause of death among children aged 10-14 years and second leading cause of death among persons aged 15-24 years in the USA<sup>5</sup>.

According to global burden of disease study 2010<sup>31</sup>, mental and substance use disorder accounted for 7.4% of total disease burden in 2010 globally and was the leading cause of Years lived with Disability (YLDs). Population aged 10-29 years had highest proportion of total Disability Adjusted Life Years (DALYs)<sup>31</sup>. In the US, according to mental health surveillance report 2005-2011<sup>3</sup>, a total of 13-20% of children have a mental disorder in a given year. Among children 3-17 years, the most common parent-reported current diagnosed mental disorder was attention-deficit hyperactivity disorder (ADHD) (6.8%) followed by behavioral or conduct problems (3.5%), anxiety disorder (3%), depression (2.1%), autism spectrum disorder (1.1%) and Tourette syndrome (0.2% among children 6-17 years)<sup>3</sup>.

Data reflecting the trend in the mental health of US population shows that mental health visits to the office-based physician by young population < 21 years, that resulted in a mental disorder

diagnosis almost doubled from 7.78% in 1995-1998 to 15.30% in 2007-2010<sup>6</sup>. Moreover, this increase was significantly faster for <21-year-olds compared to adults >21 years<sup>6</sup>. The most common mental disorder diagnosis was disruptive behavior<sup>6</sup>. When comparing children (0-13 years) and adolescents (14-20 years), there was a significantly faster increase in the number of visits that resulted in psychotic or developmental disorder diagnosis among children and disruptive behavior diagnosis among adolescents<sup>6</sup>.

According to National Comorbidity Survey- Adolescent supplement (NCS-A)<sup>4</sup>, approximated estimates of the lifetime prevalence of any DSM-IV mental disorder among children 13-18 years was 40%, anxiety disorders 32%, behavioral disorders 19%, mood disorders 14%, and substance use disorders 11%. About 22% of these children had severe impairment/distress as measured by level of impairment in daily activities and distress. The prevalence of severe impairment was highest for mood disorder followed by behavior disorder and anxiety disorder<sup>4</sup>.

### **Definition of neighborhood**

Neighborhood can be thought of as an ecological unit that is nested within larger communities<sup>32</sup>. In health research that link physical and social characteristics of the residential environment with the health of the resident individuals, it is challenging to come to a consensus in defining the neighborhood. In such studies, we can see many terms such as community, area, and the neighborhood being interchangeably used<sup>9</sup>. In most of such studies, administratively defined geographic boundaries like school districts, block group, census tracts, etc. are used as proxy measures for neighborhood, area or community<sup>9,32</sup>. According to an article that reviewed neighborhood risk factors for common mental disorders among young people of 10-20 years, neighborhood was operationally defined in terms of discrete, small geographical area with fixed boundaries<sup>17</sup>. There could also be alternate ways of defining a neighborhood could be based on study's research question for example a neighborhood based on people's characteristics, people's perception, based on geography, etc.<sup>9</sup>. According to Roux<sup>9</sup>, people's perception of neighborhood may be important for the research which is exploring social cohesion in the neighborhood; while for the study evaluating policies, administratively defined neighborhood may be relevant.

## **Effect of neighborhood on health**

According to WHO social determinants of health are “the circumstances in which people are born, grow, live, work, and age, and the systems that are put in place to deal with health and illness; shaped by the distribution of power, money, and resources at local, national and global level”<sup>8</sup> Social determinants of health can be explained in many ways ranging from factors proximal to an individual like family, friends to distal factors like economic or political system in the nation <sup>18</sup>. The proximal factors are the results of social stratification, cultural, religious, and community-related factors <sup>18</sup>. So, studying neighborhood factors can provide us information on both physical and social characteristics of the conditions where people live and grow<sup>10-12</sup>. The study of a neighborhood can also provide relevant information on one of the ways through which social influence on health operates<sup>9</sup>.

Several individual and family level factors like age, gender, household income, adverse family experience, etc. have important role in determining the health of the residents<sup>13</sup>. With the advances in the field of social epidemiology, research studies have shown that physical and social characteristics of a neighborhood also affect the health outcomes of residents<sup>13,14</sup>. Though neighborhood factors are important for the health of people of all ages; children and adolescents who are in a rapid process of biological and psychological change<sup>18</sup> may experience it's influence in specific ways <sup>19-21</sup> than people of other age groups <sup>15-17</sup>.

Diez Roux and Mair<sup>10</sup> have explained how neighborhood factors contributes to health outcomes and health inequality. Several factors like residential segregation by race/ethnicity and socioeconomic position and inequalities in resource distribution interact with each other and affect the physical and social factors in the neighborhood environments. These physical and social factors in the neighborhood also mutually interact among one another and affect the behavioral and stress processes that operate at individual level resulting into changes in health outcomes. The impact of these neighborhood factors may also be modified by individual level characteristics like biological attributes, material and psychological resources<sup>10</sup>. Among children and youth, five theoretical frameworks can explain neighborhood effects on children and youth as explained by Jencks and Mayer: i) neighborhood institutional resource model, ii) collective socialization model, iii) contagion model, iv) models of competition, and v) relative deprivation

model<sup>33</sup>. These five models focus on factors like neighborhood resources (park, library, community centers etc.), social organizations in the neighborhood (social cohesion, adult role model, supervision etc.), influence of negative behavior of neighbors and friends, competition among neighbors for scarce resources in the community, and evaluation/comparison of self with the neighbors<sup>33,34</sup>. Leventhal and Brooks later identified institutional resources, relationship and norms/collective efficacy as three important mechanisms by which neighborhood affects children and adolescents<sup>34</sup>.

### **Neighborhood and mental disorder among children**

Review of studies on common mental disorders and the neighborhood has shown that exposure to a poor material and social neighborhood increases the risk of common mental disorders through a complex process over time<sup>17</sup>. Parental poor perception of neighborhood physical and social environment creates a sense of fear and distrusts of the neighborhood among young children since parental perception is linked with some restrictions to children such as restriction on playing outside<sup>32,35</sup>. Lack of resources and amenities, inadequate housing, violence, lack of playground, etc. in the neighborhood may act as stressors related to mental illness<sup>36,37</sup>. Besides, the neighborhood physical and social characteristics may determine the level of social support and cohesion which in turn is related to mental illness<sup>38</sup>.

A study conducted in Australia<sup>39</sup> showed the relationship between children's conduct problems and neighborhood variables: neighborhood socioeconomic status, neighborhood safety and neighborhood belonging after adjusting for family and demographic variables. Neighborhood safety and neighborhood belonging mediated the association of neighborhood socioeconomic status with children's conduct problems while neighborhood cleanliness and neighborhood belonging had a direct association with pro-social behavior<sup>39</sup>. A study that followed up Swedish-born children for ten years between 2000 to 2010 found that after accounting for individual-level sociodemographic variables, the neighborhood deprivation was associated with conduct disorder, anxiety disorder, mood disorder, and ADHD<sup>40</sup>.

According to a review article<sup>41</sup>, of 45 observational studies, 82% of the studies reported association of at least one neighborhood conditions with depression or depressive symptoms. This study found consistent association of depression with social processes (68% significantly

associated) such as social interaction and violence and structural feature (52% significantly associated) such as neighborhood built environment. Four of the five studies conducted among <18 years population found the association between neighborhood characteristics and depressive symptoms<sup>41</sup>.

In the context of USA, a review of researches conducted prior to 2000<sup>34</sup> suggests the influence of neighborhood factors on different outcomes such as crime, conduct problems and other behavioral problems among children and adolescents. Review of studies that have examined the relationship between childhood mental health and neighborhood factors have shown an adverse effect of a low SES neighborhood<sup>17,34</sup>, poor environmental quality and social stressors on the mental health of children and adolescents<sup>17</sup>.

A study conducted in the USA among children aged 6-17 years analyzing data from 2007 National Survey of Children's Health (NSCH) found that children living in neighborhood with poor physical characteristics such as dilapidated housing and poor social support had greater odds of mental disorders compared to children living in neighborhood with greater social support and no poor physical characteristics<sup>25</sup>. For example, children living in neighborhood with three poor physical characteristics namely litter and garbage in the neighborhood, poorly kept housing in the neighborhood and vandalism in the neighborhood had greater odds of internalizing disorders (anxiety/depression) (adjusted OR 1.58, 95% CI: 1.01-2.46) and externalizing disorders (ADHD/disruptive behavior) (adjusted OR 1.44, 95% CI: 1.04-1.99) compared to children living in neighborhood with no poor physical characteristics. Similarly, children living in neighborhood with poor social support had greater odds of anxiety/depression (adjusted OR 1.71, 95% CI: 1.28-2.30) and ADHD/disruptive behavior (adjusted OR 1.47, 95% CI: 1.19-1.81) compared to children living in neighborhood with greater social support<sup>25</sup>. The social support in the study was measured using four questions rated on a Likert scale of definitely agree, somewhat agree, somewhat disagree, and definitely disagree: i) people in the neighborhood help each other out ii) we watch out for each other's children in the neighborhood iii) there are people I can count on in this neighborhood, and iv) if my child were playing outside and got hurt or scared, there are adults nearby who I trust to help my child.



### **Mental disorders, parental education, parental mental health and ACEs**

Parental education is one of the most reported parental characteristics that is found to be associated with mental disorders among children. According to NCS-A study, children whose parents were not college graduates had higher risk of mental disorder<sup>4</sup>. Similarly, parental history of mental disorders is also reported to be associated with mental disorders in children<sup>25,26</sup>. The risk of mental disorders among children of parents with mental disorder is associated with several factors such as genetic susceptibility, and the mental illness among parents also affects the parent-child interaction<sup>42</sup>. Besides, the risk of child abuse and adverse factors are more likely to be frequent in these families<sup>42</sup>. In a national level study the odds of internalizing disorders (anxiety/depression) and externalizing disorder (ADHD/disruptive behavior) among children of parents with poor/fair mental health was found to be about 3 times the odds among children of parents with good mental disorder<sup>25</sup>. In specific children of mothers with history of depression or current depression symptoms are at increased risk of poor health outcomes and are susceptible to the effect of neighborhood stressors potentially because of risk factors aggregation<sup>23</sup>.

Adverse childhood experiences (ACEs) have been found to be highly co-occurring with mental disorders<sup>28</sup>. In fact, ACEs are important risk factors for most of the childhood mental disorders like ADHD, conduct disorder and adult disorders like depression, anxiety disorders, etc.<sup>27</sup>. The ACEs have been found to range from abuse like sexual, physical, or emotional abuse, to factors such as mother's poor health, early loss of parents, witnessing or experiencing violence, parental mental health problem, war, trauma, etc. Family poverty has also one of the factors contributing to the ACE<sup>27</sup>. ACEs such as parental loss, maltreatment, parental maladjustment, and poor economic condition were found to be associated with approximately 28% of all onsets of mental disorders among adolescents aged 13-17 years<sup>28</sup>. Interestingly, it was also found that occurrence of multiple adversities had sub additive effect<sup>28</sup>.

The current study adds into the literature on neighborhood and children's mental health by analyzing the association between different neighborhood conditions (neighborhood amenities/resources, neighborhood detracting elements, supportive neighborhood, neighborhood safety and school safety) and common mental disorders among children adjusting for variables

like ACEs, parent's mental health, parent's education, etc. Furthermore, the results from this study can also be helpful in exploring the effect of neighborhood conditions on each of common childhood mental disorders that is ADHD, depression, anxiety problem and behavioral/conduct problem.

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## **CHAPTER III**

### **MANUSCRIPT**

#### **Introduction**

Mental disorders among children affect their ability to perform normal developmental tasks, lead to poor educational performance, poor interpersonal skills<sup>1</sup> and the problem can also continue into adulthood affecting their functioning as a productive workforce<sup>2</sup>. In the USA, mental disorders among children are an important public health concerns because of high prevalence, early onset, and socio-economic impacts<sup>1</sup>. According to mental health surveillance report 2005-2011<sup>2</sup>, 13-20% of children aged less than 18 years living in the USA have a mental disorder in a year. Among children 3-17 years, the most common parent reported current diagnosed mental disorder was attention-deficit hyperactivity disorder (ADHD) followed by behavioral or conduct problems, anxiety disorder, depression, and autism spectrum disorder<sup>2</sup>.

The risk factors for mental disorders among children and adolescent range from biological factors such as genetic susceptibility, head injury, etc. to social factors such as poverty, family conflict, discrimination, community disorganization, etc.<sup>3</sup>. Social factors are broad and include the circumstances in which people are born, grow, live, work, and age<sup>4</sup>. One of the ways to assess the social influence on health is through the study of neighborhood factors<sup>5</sup>.

Neighborhood characteristics have been found to be associated with the health outcomes of its residents<sup>6,7</sup> including mental health outcomes. It is also recognized that compared to people of other ages<sup>8-10</sup>, children and adolescents experience the effect of neighborhood in specific ways<sup>11-13</sup> because of their rapid biological and psychological developmental process. Moreover, the effect of neighborhood on children's mental health starts before the age of 10 years<sup>10</sup>.

There is a rapid increase in neighborhood and health research in the USA since mid-2000s<sup>14</sup>. Among multilevel neighborhood studies conducted in the USA between 1995-2014, the most commonly studied neighborhood exposures and health outcomes were socio-economic status/deprivation and obesity/body mass respectively<sup>14</sup>. Among children and adolescents, the commonly studied neighborhood variables were related to built environment and the outcomes were related to physical activity<sup>14</sup>. Most of the currently available data on neighborhood

variables and mental disorders are based on studies conducted among adult population<sup>15</sup>. Also, among young people aged 10-20 years most commonly studied mental disorder in relation to neighborhood factors was depression<sup>10</sup>.

Studies have explored the association of neighborhood conditions such as neighborhood resources, detracting physical environments, and social support with common mental disorders among children using nationally representative recent data in the USA are scarce. In addition, most of the studies that have been conducted on childhood mental disorder and neighborhood factors have analyzed dataset prior to 2000s and most of those are not based on nationally representative data<sup>16</sup>. The limited available literature suggests the association between common mental disorders among young people and neighborhood problems such as poor living conditions, economic deprivation, violence, and victimization<sup>10</sup>. Other factors such as social cohesion and organizational participation are also associated with the better mental health of children<sup>8</sup>. A study conducted using national level US data of 2007 has found that children living in neighborhood with poor physical characteristics (litter/garbage, poorly kept housing, vandalism in the neighborhood) and poor social support were at greater risk of both internalizing disorders (anxiety/depression) and externalizing disorders (ADHD/disruptive behavior)<sup>17</sup>.

Improving our understanding of how the neighborhood related factors can shape the mental health of children has implication for both evaluation of mental disorder among children as well as for planning programs at neighborhood level to reduce mental health burden. This study tries to answer the central research question “what is the association of neighborhood conditions and common mental disorders among children aged 6-17 years?” We have also controlled for the effect of factors such as parent’s mental health, and parent’s education, adverse childhood experiences (ACEs), etc. that are known to be associated with children’s mental health<sup>15,18,19 20,21</sup>. The variable ACE has not been adjusted for in the 2007 study. Furthermore, we have also reported the results of association of neighborhood conditions with each of four common childhood mental disorders (ADHD, depression, anxiety problem and behavioral/conduct problem) unlike most of the studies that have reported result in terms of internalizing and externalizing disorders. So, this study aims to contribute to the current literature on



neighborhood conditions associated with mental disorder among children in the USA. We aim to do this by analyzing data from a more recent nationally representative study from 2011/12<sup>22</sup>.

## **Methods and procedures**

### **Study design**

The data for this study was obtained from 2011/12 National Survey of Children's Health (NSCH), a national cross-sectional telephone survey of 95,677 children aged 0-17 years<sup>23</sup>. The purpose of this survey was to assess the physical and emotional health of children less than 18 years and to explore the factors associated with child wellbeing such as family interactions, parental health, neighborhood characteristics etc.<sup>23</sup>. NSCH 2011/12 was conducted using a list-assisted random-digit-dial (RDD) sample of landline and RDD sample of cell-phone numbers. This survey was a complex sample design study in which stratification was done by state and sample type, and clustering of children was done within households. Sample type included landline and cell phone. A parent or guardian who had knowledge about the health and health care of the sampled child were the respondents. A final sampling weight was produced which when used during analysis would provide the estimates that are representative of all the non-institutionalized children aged 0-17 years nationally and in each state. Other methodologic details of the study are provided elsewhere<sup>22-24</sup>. According to Diagnostic and statistical Manual of mental disorders-V (DSM-V), the clinical diagnosis of common childhood mental disorders such as ADHD and anxiety problem is more prominent during the elementary school years even though the disorders can start in early years. Similarly, for depressive disorder, it is not recommended to apply diagnosis before 6 years of age. So, for this study, we limited the analysis to children aged 6-17 years. The ethical approval for this study was obtained from Georgia State University, Institutional Review Board.

### **Study variables**

Dependent variable in this study was 'current diagnosed mental disorder' that was created with the help of four measures of childhood mental health conditions: Attention Deficit Hyperactivity Disorder (ADHD), depression, anxiety problem and behavioral or conduct disorder. We chose these four mental disorders because of their high prevalence among children aged 3-17 as

reported by mental health surveillance report<sup>2</sup>. Condition such as autism spectrum disorder was not included because of its early age of onset (< 3 years) and genetic susceptibility<sup>25</sup>. We measured each of these conditions by two questions: a) Has a doctor or other health care provider ever told you that child had (the condition)? And b) Does the child currently have (the condition)? The current presence of each of these conditions was identified if the respondent gave ‘yes’ response to both the questions. The child currently having at least one of these mental disorders was identified as having ‘current diagnosed mental disorder’ (Table 1).

The independent variables were five neighborhood conditions: Neighborhood amenities or resources, neighborhood distracting element, supportive neighborhood, neighborhood safety, and school safety. The survey question used for each of these variables are listed in Table 1. We obtained the ‘*Neighborhood amenities score*’ by summing the ‘yes=1’ response to each of the 4 questions (Table 1). This score that ranged from 0 (no amenities) to 4 (all four amenities) was identified as ‘neighborhood amenities count’ and it was calculated for only those households that gave a valid response to all the four questions. *Neighborhood distracting elements* score was obtained by summing the ‘yes=1’ response to each of the three questions (Table 1). The score ranged from 0 (no detracting element) to 3 (all three detracting elements) which was identified as neighborhood distracting element count. This variable also included only those households that gave a valid response to all the three questions.

Four questions on *neighborhood support/cohesion* rated on a Likert scale of strongly agree, somewhat agree, somewhat disagree and strongly disagree were asked (Table 1). To calculate neighborhood cohesion score, only those households that gave a valid response to at least three questions were included. Then, mean point score on neighborhood cohesion was computed. Those households with the score 0-2.25 were categorized as a supportive neighborhood, and those with score 2.25-4 were categorized as not supportive neighborhood<sup>26</sup>. *Neighborhood safety and school safety* were measured by one question in which parent/guardian responded on a Likert scale: never, sometimes, usually, always. The responses ‘usually’ and ‘always’ were combined into one ‘usually/always.’ All the scores were calculated based on NSCH guideline.

Socio-demographic variables included four child characteristics: age, gender, race, and ACE; and five family level characteristics: household poverty level, father’s mental health, mother’s mental health, father’s highest education, mother’s highest education. The variable ACE was an important addition to 2011/12 NSCH compared to previous surveys. Nine questions listed in table 1 were used to create the variable ‘Number of ACEs’. These 9 questions were based on Behavioral and Risk Factor Surveillance System (BRFSS) ACE module which includes 5 of these items: divorce/separation of parents, parent served time in jail, witness to domestic violence, lived with someone who was mentally ill or suicidal and lived with someone who has alcohol or drug problem. Additional four items were added based on a review of life course stressors in children’s lives by a Technical Expert Panel<sup>26</sup>. The ‘yes=1’ responses were summed for each of the nine questions resulting into a score of 0 (no ACEs) to 9 (9 ACEs). These scores were categorized into 0 ACE, 1 ACE, 2 ACEs, 3-4 ACEs and 5-9 ACEs based on the frequency distribution.

The household poverty level was classified as per the federal poverty level (FPL) guideline. We assessed the parent’s mental health separately for mother and father each by question, “*Would you say that, in general, (sample child’s father’s or mother’s) mental and emotional health is excellent, very good, good, fair, or poor?*”. Then we combined the responses excellent, very good and good into ‘excellent/very good/good’, and the responses fair or poor into ‘fair/poor’.

Table 1. Survey questions for different variables

Condition	Survey questions
Current mental disorder	a) Has a doctor or other health care provider ever told you that child had (the condition)? b) Does the child currently have (the condition)? Conditions were: ADHD, depression, anxiety problem, behavioral/conduct problem
Neighborhood Amenities	Please tell me if the following places and things are available to children in your neighborhood, even if (child) does not actually use them: 1. Sidewalks or walking paths? 2. A park or playground area? 3. A recreation center, community center, or boys’ or girls’ club? 4. A library or bookmobile?
Neighborhood Detracting elements	In your neighborhood, 1. Is there litter or garbage on the street or sidewalk? 2. How about poorly kept or rundown housing? 3. How about vandalism such as broken windows or graffiti?

Supportive neighborhood	How much you agree or disagree with each of these statements about your neighborhood or community? 1. "People in this neighborhood help each other out." 2. "We watch out for each other's children in this neighborhood." 3. "There are people I can count on in this neighborhood." 4. "If my child were outside playing and got hurt or scared, there are adults nearby who I trust to help my child."
Neighborhood safety	How often do you feel the child is safe in your community or neighborhood? Would you say never, sometimes, usually, or always?
School safety	How often do you feel (he/she) is safe at school? Would you say never, sometimes, usually, or always?
Adverse childhood experience	1. How often is it hard to get by on your family's income? 2. Did child ever see or hear any parents, guardians, or any other adults in his/her home slap, hit, kick, punch, or beat each other up? 3. Was child ever treated or judged unfairly because of race or ethnic group? 4. Was child ever the victim of violence or witnessed any violence in his/her neighborhood? Did child ever live with a parent or guardian, 5. who got divorced or separated after the child was born? 6. with a parent or guardian who died? 7. with a parent or guardian who served time in jail or prison after the child was born? 8. with anyone who was mentally ill or suicidal, or severely depressed for more than a couple of weeks? 9. with anyone who had a problem with alcohol or drugs?

Source: CDC National Center for Health Statistics. SLAITS-National Survey of Children's Health. 2012

We also estimated the Cronbach's alpha values for the scales that included multiple variable items, to identify the level of internal consistency between the items. Standardized Cronbach's coefficient was 0.64 for neighborhood amenities; 0.86 for supportive neighborhood; 0.61 for neighborhood detracting element, and 0.66 for items in ACE. Cronbach's alpha value  $\geq 0.7$  is widely acceptable while the value between 0.6 and 0.7 are considered moderately reliable in social sciences<sup>27</sup>.

**Data analysis**

To summarize the socio-demographic, neighborhood and mental health-related characteristics of the sample children, tables were produced with frequency and percentage values. Unweighted frequency and weighted percentage values were shown for easy articulation of the tables.

Sampling weight was used to produce results that can be generalizable to all the non-institutionalized children aged 6-17 years nationally. To account for the complex sample design

of the study, domain analysis or subgroup analysis was done. Domain analysis computes statistics for subpopulations as well as for the total study population. Data analysis was done using SAS version 9.4.

Bivariate relationship of current diagnosed mental disorder with neighborhood characteristics, and with other socio-demographic variables were examined by doing unadjusted logistic regression. The unadjusted odds ratios and their corresponding 95% confidence intervals were reported. All those variables that had a significant association with the dependent variable in the unadjusted logistic regression model were included in the first multivariable regression model. In the next step, all those variables that had a significant association with the primary dependent variable in the first multivariable model were included in the final multivariable model and association was examined for current diagnosed mental disorder, ADHD, depression, anxiety problem and behavioral or conduct problem separately.

To account for the complex study design, we estimated variance in the bivariate and multivariable analysis after using state and sample as strata variables and unique household identifier as cluster variable<sup>24</sup>. The variance was estimated using Taylor series variance estimation method.

## **Results**

### **Descriptive statistics**

In the results section, we have presented unweighted frequency counts and the weighted percentage values. Out of total 95,677 children aged less than 18 years, 68.65% (65,680) were of age 6-17 years. Of children aged 6-17 years, 13.56% had a current diagnosed mental disorder, 9.97% had ADHD, 4.16% had anxiety problem, 3.73% had behavioral/conduct problem, and 2.76% had depression. Prevalence of current diagnosed mental disorder was about 9% among 6-8-year-olds and 16% among 15-17-year-olds. Children having a higher percentage of current diagnosed mental disorder were male (17%), Non-Hispanic White (16%), those whose family income was less than 100% FPL (17%), children of high school graduates (13%), children of father with poor mental health (23%) and children of mother with poor mental health (26%). Prevalence of mental disorder increased almost five times among children who experienced 5-9

adverse events (39%) compared to children without any ACEs (8%). Comparing across all variables, children with 5-9 adverse experiences had the highest percentage of mental disorder (39.2%), followed by those whose mother had fair/poor mental health (26.23%) (Table 2). Approximately 4% of children lived in neighborhood with no amenities such as sidewalks/walking paths, park/playground, recreation center and a library/bookmobile or lived in neighborhood with all the three detracting elements namely litter/garbage in street, poorly kept houses and vandalism in the neighborhood. Similarly, about 16% of the children lived in a neighborhood perceived to be not-supportive by the parents. About 87% and 93% of the parents/guardians felt that their child was always safe in the neighborhood and in the school, respectively. Approximately 2% of the parent felt their child was never safe in the neighborhood where as only less than 1% felt their child never safe in school. About 20% percent of children living in neighborhood with three damaging or detracting elements had mental disorder compared to 13% of children in the neighborhood with no detracting elements. Similarly, about 13% of children in neighborhood perceived to be not supportive had mental disorder compared to 18% children living in supportive neighborhood. Children whose parent's/guardian's felt their child was never safe in school had the highest percent of current diagnosed mental disorder (23.39%) (Table 3).

### **Bivariate and multivariable associations between variables**

From the bivariate logistic regression analysis, we found that poor characteristics of all the studied neighborhood factors (three detracting element count, no supportive neighborhood, perceived lack of neighborhood and school safety) were significantly associated with increased odds of mental disorder among children. The unadjusted odds of mental disorder among children living in neighborhood with no amenities was 1.25 times the odds among children living in neighborhood with all four amenities. However, the association with mental disorder was significant only for the neighborhood with one amenity. The unadjusted odds of mental disorder among children living in neighborhood with all three detracting elements was 1.72 (CI: 1.38-2.20) times the odds among children living in neighborhood with no detracting elements. In the same way, the OR for supportive neighborhood was 1.53 (CI: 1.32-1.73). Similarly, higher age, male gender, White Non-Hispanic race, poverty level less than 400% FPL, fair/poor father's or mother's mental health, higher number of ACEs were also significantly associated with greater unadjusted odds of mental disorder among children (Table 4. Unadjusted OR).

Variables that were significantly associated with mental disorder in the bivariate logistic regression were neighborhood amenities, detracting element count, supportive neighborhood, neighborhood safety, school safety, age, sex, race, poverty, father's mental health, mother's mental health, father's education, mother's education, number of ACEs. In the first multivariable analysis, we controlled for these variables and estimated adjusted OR (AOR). We found that not having supportive neighborhood (AOR 1.37 CI:1.10-1.71), being male (AOR 1.97 CI: 1.71-2.27), age greater than 6-8 years, Non-Hispanic White race, fair/poor mental health of father (AOR 1.35 CI:1.01-1.81), fair/poor mental health of mother (AOR 1.84 CI: 1.39-2.43), and higher number of ACEs were significantly associated with mental disorder in child. The highest adjusted OR were among those children having 5-9 ACEs (AOR 6.36 CI: 4.67-8.65), followed by those having 3-4 ACEs (AOR 3.01 CI: 2.30-3.94), and those having 2 ACEs (AOR 2.26 CI: 1.77-2.88) (Table 4. Adjusted OR). The significance association was lost for other neighborhood variables in the adjusted model.

Variables that were significantly associated with dependent variable in the first multivariable model were supportive environment, child's age, child's gender, child's race, father's mental health, mother's mental health and number of adverse childhood experiences. These variables were included in the second model and the association was examined for both current diagnosed mental disorder, ADHD, depression, anxiety problem, and behavioral/conduct problem. Children living in not-supportive neighborhood had significantly higher odds of current diagnosed mental disorder (AOR† 1.32, CI: 1.08-1.61), ADHD (AOR† 1.33, CI: 1.06-1.67) and anxiety problem (AOR† 1.39, CI: 1.02-1.89) compared to children living in supportive neighborhood. We found that for both current diagnosed mental disorder and each category of mental disorders, child having 5-9 ACEs had the highest AOR† compared to the child not having any ACEs. For behavioral/conduct problem and depression, the AOR† were as high as 13 and 10 respectively. Mother's fair/poor mental health was associated with AOR value of about 2 for depression and 3 for anxiety problem. Male were significantly associated with higher odds of ADHD, behavioral/conduct problem, and current diagnosed mental disorder. Similarly, being Non-Hispanic White was significantly associated with greater odds of ADHD, depression, anxiety problem and current diagnosed mental disorder (Table 5).

## **Discussion**

This nationally representative study has addressed the basic question, what is the association between neighborhood conditions and mental disorder among children? This study also highlights the association of common mental disorders namely ADHD, depression, anxiety problem and behavioral/conduct problem with the neighborhood conditions after adjusting for other important determinants of mental disorders among children. We found that neighborhood characterized by higher number of damaging elements such as garbage/litter, poor housing, and vandalism; perceived lack of supportive neighborhood, and perceived lack of neighborhood and school safety were significantly associated with current diagnosed mental disorder among children aged 6-17 years. After controlling for family and child's characteristics, the association of lack of supportive neighborhood with mental disorder among children remained significant.

Resources in the neighborhood like parks, libraries, community centers, etc. promote healthy development of children<sup>28</sup>. However, in our study, neighborhood amenities count was least associated with the mental disorder (in the unadjusted model) compared to the other neighborhood factors. Further we found that having only one neighborhood amenity was significantly associated with the mental disorder. Previous study that has examined anxiety/depression and ADHD/disruptive behavior separately has also shown that having 1 and 3 amenities were significantly associated with greater odds of anxiety/depression<sup>17</sup>.

School environment is an important variable that could mediate or explain the mechanism of neighborhood influence among school going children for whom school environment may be more proximal than neighborhood<sup>28</sup>. In our study, children who went to school perceived to be never safe by parents/guardians were at about 2 times higher odds of mental disorder compared to children who went to school perceived to be usually safe. Similarly, the OR for neighborhood safety was 1.49. After the association was controlled for other neighborhood factors and sociodemographic factors, the AOR for school safety decreased to 1.53 (0.63-3.75) and 1.04 (0.59-1.85) for neighborhood safety. The loss of significance after controlling for other variables including supportive neighborhood, may be due to the protective effect of the supportive neighborhood. The finding was similar in the previous study done in 2007 NSCH data<sup>17</sup> and is comparable with our study because of the same way in which safety variable has been measured.



Besides the effect of neighborhood factors, we found a strong association of father's mental health, mother's mental health and adverse childhood experiences on mental disorder among children. Moreover, the most powerful association of mental disorder among children was with the ACEs. We found that even after controlling for other neighborhood factors, child and family characteristics, those children having 5-9 ACEs had about 6 times the odds of mental disorder compared to children not having any ACEs. Furthermore, there was an increased on AOR with the increase on number of ACEs on a sequential pattern; for example, OR of 1.73 (1.46-2.05) for 1 ACE, 2.26 (1.77-2.88) for 2 ACEs, 3.01 (2.30-3.94) for 3-4 ACEs and 6.36 (4.67-8.65) for 5-9 ACEs. Our finding of the strong association of child mental disorder with ACEs and mother's mental health is consistent with previous studies<sup>20,29</sup>. Comparable with the finding by Kessler et. al.<sup>30</sup> that adverse childhood experiences are strongly associated with all classes of disorders, we also found that children who experienced 5-9 ACEs had highest AOR† value for all the four studied mental disorders categories ranging from 4.96 for anxiety problem to 12.53 for conduct disorder.

Children of parents who are mentally ill or who have the history of mental disorders are at increased risk of mental disorders<sup>17,18</sup>. This increased risk may be associated with several factors such as decreased parent-child interaction because of ill mental health of parents, risk of child abuse and adverse factors in these families including the genetic susceptibility towards mental illness of these children<sup>31</sup>. Children of mothers with a history of depression or depressive symptoms are also found to be susceptible to the effect of neighborhood stressors<sup>15</sup>. In line with these literatures we found that father's and mother's poor mental health were associated with the current diagnosed mental disorder among children. While father's poor mental health was significantly associated with depression and anxiety problem, mother's poor mental health was significantly associated with ADHD, depression, anxiety problem, behavioral and conduct problem.

In our study, after controlling for other neighborhood factors, child and family characteristics, the significant association of mental disorder with neighborhood damaging elements, school and neighborhood safety was lost, and the effect of some variables like ACE and mother's mental health was higher compared to neighborhood factors. This may be because neighborhood

conditions are themselves associated with these sociodemographic variables included in the model leading to underestimation of neighborhood effects<sup>32</sup>.

According to Nazroo, ethnic group concentration is associated with low level of psychiatric symptoms<sup>33</sup>. A study done in East London among adolescents in ethnically diverse setting found that individuals from Asian or Black ethnic group had better health<sup>34</sup>. This better health may be linked to ethnic group solidarity that protects these adolescents from the effect of material deprivation in the neighborhood. However, there are also studies that have explained that Black and Hispanics have less probability and amount of mental service use compared to Whites<sup>35</sup>, high unmet mental health needs among Latinos children compared to other<sup>36</sup>, and more stigma related concerns about mental health care among women of ethnic minority<sup>37</sup>. These studies explain that even if there is mental health problem among ethnic minority group, they are less likely to seek medical care. In our study, Hispanics, Black Non-Hispanics, and Multiracial or other non-Hispanics children were found to be significantly less likely to have mental disorder compared to non-Hispanic Whites. However, we have not explored whether this difference is due to the presence of solidarity factor or because of less use of mental health services.

For current diagnosed mental disorder and each mental disorder categories, males had higher odds compared to females and it was significantly higher for ADHD (AOR† 2.41, CI: 2.05-2.83), conduct disorder (AOR† 2.12 CI: 1.52- 2.96) and overall mental disorder (AOR† 1.90, CI: 1.65-2.18) after controlling for supportive environment, age, race, father's and mother's mental health, and, number of ACEs. A review of several studies<sup>12</sup> has shown similar results, more specifically stronger association were found for externalizing problems like conduct disorder and ADHD. In our study, compared to 6-8 year children, 15-17-year-old children had higher odds of mental disorder in both adjusted and unadjusted model. However, when considering specific mental disorder categories, AOR† increased from 1 for 6-8 years, 2.9 for 9-11 years, 3.11 for 12-14 years and 6.40 for 15-17 years for depression in the second multivariable model. This may indicate that risk of depression increases with age for children aged 6-17 years. Similarly, in the case of conduct disorder, no significant association was found, representing an overall mixed type of association for age which is in line with the findings from a review article<sup>10</sup>.

## **Limitations**

This study has some notable limitations. The primary dependent variable i.e. current diagnosed mental disorder is based on whether children had been diagnosed with at least one of the four mental disorders: ADHD, depression, anxiety problem, and behavioral/conduct problem. It is also more likely that the data on the mental disorder is underestimated because not all children with mental disorder are diagnosed or do receive mental health services. This study cannot draw the conclusion on the cause-effect relationship between neighborhood factors and mental disorders among children because of the cross-sectional nature of the study. It should also be noted that, all the information provided by this study are based on parent's/guardian's report and no biological and physical measurements were taken. Also, the results might have been different had they been reported by children themselves. For example, adolescent children may be able to describe what they perceive about their neighborhood. The data on neighborhood level variables like amenities count and distracting element count included only those households that gave a valid response to all the questions that were used to measure this construct. So, households that provided partial information on the constructs have not been included which may bias the findings.

Variables such as residential instability for family, family conflict, community transitions, and relationship of child with parents and peers are associated with mental disorder among children,<sup>3,10,38</sup>. However, these variables have not been included in this study. Further research can be conducted in this area after controlling for these variables to provide a more precise estimate of the associations.

Despite these limitations, this study is the first study to examine the association of neighborhood conditions with the common mental disorders among children adjusting for adverse childhood experiences in a large nationally representative sample.

## **Conclusion**

Our study indicates that all the five neighborhood conditions were associated with mental disorder among children. After adjusting for other neighborhood conditions, child and family characteristics, supportive neighborhood was found to be significantly associated with mental disorder among children. Besides neighborhood conditions, strong association of mental disorders among children were found for number of ACEs and mother's mental health. Examination of child's demographic characteristics, father's and mother's mental health, adverse childhood experiences and neighborhood conditions can be helpful in evaluating childhood mental disorders as well as in planning neighborhood-level interventions to prevent these disorders. Moreover, future researches with longitudinal design can be planned to establish a temporal relationship between neighborhood conditions and mental disorders among children. Neighborhood level interventions such as improvement of physical characteristics, neighborhood resources, neighborhood cohesion and safety, and school safety should be integrated with broader programs directed towards improving mental health of children.

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Table 2. Socio-demographic characteristics and mental disorder among children (Total unweighted count =65,680 Total unweighted count of children with mental disorder=8,927)

Variable	Total	Mental disorder	
	Unweighted count (Weighted %)	Unweighted count (weighted %) Yes	No
<b>Child's age (years)</b>			
6-8	15420 (24.59)	1449 (9.40)	13909 (90.60)
9-11	15659 (24.77)	2239 (14.32)	13372 (85.68)
12-14	16157 (24.95)	2398 (14.64)	13675 (85.36)
15-17	18444 (25.69)	2847 (16.02)	15508 (83.98)
<b>Child's gender</b>			
Male	33986 (51.21)	5755 (17.02)	28051 (82.98)
Female	31607 (48.79)	3172 (10.06)	28333 (89.94)
<b>Child's Race</b>			
Hispanic	8073 (22.32)	868 (9.55)	7173 (90.45)
White, non-Hispanic	43153 (53.72)	6259 (16.10)	36720 (83.90)
Black, non-Hispanic	6177 (14.22)	787 (13.35)	5361 (86.65)
Multiracial/Other, non-Hispanic	6712 (9.74)	845 (11.09)	5832 (88.91)
<b>Poverty level of this household</b>			
< 100% FPL	9135 (20.66)	1740 (16.91)	7342 (83.09)
100-199 % FPL	11449 (21.42)	1814 (14.63)	9575 (85.37)
200-399 % FPL	20329 (28.86)	2519 (12.80)	17732 (87.20)
400 or more FPL	24767 (29.06)	2860 (11.36)	21815 (88.64)
<b>Father's mental health</b>			
Excellent /very good/good	49441 (94.75)	5505 (11.19)	43759 (88.81)
Fair/poor	2359 (5.25)	529 (23.14)	1798 (76.86)
<b>Mother's mental health</b>			
Excellent /very good/good	56091 (91.79)	6688 (12.13)	49196 (87.87)
Fair/poor	3965 (8.21)	1139 (26.23)	2796 (73.77)
<b>Father's highest education</b>			
Less than high school	3882 (14.06)	460 (10.23)	3390 (89.77)
High school graduate	11353 (24.33)	1539 (13.34)	9772 (86.66)
More than high school	35852 (61.61)	3971 (11.70)	31751 (88.30)
<b>Mother's highest education</b>			
Less than high school	4364 (14.11)	590 (11.85)	3752 (88.15)
High school graduate	10992 (21.86)	1634 (14.78)	9315 (85.22)
More than high school	44026 (64.03)	5537 (13.21)	38325 (86.79)
<b>Number of ACEs</b>			
0	33718 (46.58)	2841 (8.12)	30760 (91.88)
1	15526 (25.89)	2085 (12.93)	13377 (87.07)
2	7026 (12.28)	1341 (17.76)	5638 (82.24)
3-4	6051 (10.86)	1571 (24.59)	4442 (75.41)
5-9	2558 (4.39)	1007 (39.20)	1537 (60.80)
<b>ADHD (Yes)</b>	6497 (9.97)	-	
<b>Depression (Yes)</b>	1744 (2.76)	-	
<b>Anxiety problem (Yes)</b>	3095 (4.16)	-	
<b>Behavioral/Conduct problem (Yes)</b>	2215 (3.73)	-	

ADHD=Attention deficit hyperactivity disorder. FPL=Federal poverty level

Table 3. Neighborhood characteristics and mental disorder among children (Total unweighted count =65,680 Total unweighted count of children with mental disorder=8,927)

Variable	Total Unweight count (Weighted %)	Mental disorder	
		Unweighted count (Weighted %) Yes	Unweighted count (Weighted %) No
<b>Neighborhood amenities count</b>			
0	2385 (3.73)	366 (15.64)	2010 (84.36)
1	4107 (6.28)	637 (16.37)	3449 (83.63)
2	8218 (12.14)	1216 (14.71)	6965 (85.29)
3	15747 (24.33)	2197 (13.97)	13490 (86.03)
4	33427 (53.52)	4317 (12.91)	28969 (87.09)
<b>Neighborhood detracting element count</b>			
0	47425 (71.99)	6151 (12.77)	41086 (87.23)
1	10973 (17.15)	1611 (15.26)	9314 (84.74)
2	4017 (7.11)	682 (15.82)	3308 (84.18)
3	2055 (3.75)	355 (20.15)	1689 (79.85)
<b>Supportive neighborhood</b>			
Yes	56248 (83.60)	7208 (12.89)	48827 (87.11)
No	7965 (16.40)	1566 (18.41)	6340 (81.59)
<b>Neighborhood Safety</b>			
Never	881 (2.04)	179 (18.60)	696 (81.40)
Sometimes	4903 (11.03)	870 (16.30)	4006 (83.70)
Always/Usually	58708 (86.93)	7745 (13.29)	50721 (86.71)
<b>School Safety</b>			
Never	261 (0.61)	71 (23.39)	189 (76.61)
Sometimes	3198 (6.75)	702 (19.87)	2472 (80.13)
Always/Usually	59318 (92.64)	7757 (13.19)	51321 (86.81)

Table 4. Bivariate association (Unadjusted OR) and multivariable associations (Adjusted OR) between neighborhood characteristics, sociodemographic factors and mental disorder among children

<b>Variable</b>	<b>Mental disorder Unadjusted OR (95%CI)</b>	<b>Mental disorder Adjusted OR (95%CI)</b>
<b>Child's age (year)</b>		
6-8	Reference	Reference
9-11	1.61 (1.38-1.90) *	1.47 (1.19-1.81) *
12-14	1.65 (1.42-1.92) *	1.44 (1.17-1.77) *
15-17	1.84 (1.59-2.13) *	1.57 (1.27-1.93) *
<b>Child's gender</b>		
Male	1.83 (1.65-2.04) *	1.97 (1.71-2.27) *
Female	Reference	Reference
<b>Child's race</b>		
Hispanic	0.55 (0.46-0.66) *	0.53 (0.39-0.71) *
White, non-Hispanic	Reference	Reference
Black, non-Hispanic	0.80 (0.69-0.93) *	0.53 (0.40-0.69) *
Multiracial/Other, non-Hispanic	0.65 (0.55-0.76) *	0.48 (0.39-0.60) *
<b>Neighborhood amenities count</b>		
0	1.25 (0.93-1.69)	1.22 (0.78-1.91)
1	1.32 (1.08-1.62) *	1.06 (0.77-1.46)
2	1.16 (1.00-1.35)	1.05 (0.86-1.29)
3	1.10 (0.97-1.24)	0.97 (0.84-1.13)
4	Reference	Reference
<b>Neighborhood detracting element count</b>		
0	Reference	Reference
1	1.23 (1.07-1.41) *	1.03 (0.86-1.23)
2	1.28 (1.04-1.58) *	0.89 (0.64-1.22)
3	1.72 (1.38-2.20) *	0.82 (0.50-1.34)
<b>Supportive neighborhood</b>		
Yes	Reference	Reference
No	1.53 (1.32-1.73) *	1.37 (1.10-1.71) *
<b>Neighborhood Safety</b>		
Never	1.49 (1.10-2.05) *	1.04 (0.59-1.85)
Sometimes	1.27 (1.07-1.51) *	1.00 (0.73-1.37)
Always/Usually	Reference	Reference
<b>School Safety</b>		
Never	2.01 (1.17-3.45) *	1.53 (0.62-3.75)
Sometimes	1.63 (1.35-1.97) *	1.33 (0.97-1.83)
Always/Usually	Reference	Reference
<b>Poverty level</b>		
0-99% FPL	1.59 (1.38- 1.83) *	1.14 (0.89-1.47)
100-199% FPL	1.34 (1.16- 1.54) *	0.96 (0.79-1.18)
200-399% FPL	1.15 (1.00-1.32)	0.91 (0.77-1.07)
400% FPL or more	Reference	Reference
<b>Father's mental health</b>		
Excellent/VG/good	Reference	Reference

Fair/poor	2.39 (1.94- 2.95) *	1.35 (1.01-1.81) *
<b>Mother's mental health</b>		
Excellent/VG/good	Reference	Reference
Fair/poor	2.58 (2.19- 3.03) *	1.84 (1.39-2.43) *
<b>Father's education</b>		
Less than high school	0.86 (0.69- 1.08)	0.77 (0.56-1.07)
High school graduate	1.16 (1.01- 1.34) *	1.03 (0.86-1.24)
More than high school	Reference	Reference
<b>Mother's education</b>		
Less than high school	0.88 (0.73- 1.07)	0.80 (0.57-1.13)
High school graduate	1.14 (1.00- 1.29) *	0.94 (0.77-1.14)
More than high school	Reference	Reference
<b>Number of adverse childhood experience</b>		
0	Reference	Reference
1	1.68 (1.47- 1.92) *	1.73 (1.46-2.05) *
2	2.44 (2.09-2.86) *	2.26 (1.77-2.88) *
3-4	3.69 (3.14- 4.33) *	3.01 (2.30-3.94) *
5-9	7.29 (6.01- 8.86) *	6.36 (4.67-8.65) *

Multivariable model I adjusted for neighborhood amenities, detracting element count, supportive neighborhood, neighborhood safety, school safety, age, sex, race, poverty, father's mental health, mother's mental health, father's education, mother's education, number of ACEs

\*Estimates significant at 95% confidence interval

Variance estimation method: Tayler series variance estimation method

Table. 5 Adjusted OR (AOR†) for different categories of mental disorder and current diagnosed mental disorder

Variables	ADHD OR (95% CI)	Depression OR (95% CI)	Anxiety problem OR (95% CI)	Behavioral/Conduct problem OR (95% CI)	Mental disorder OR (96% CI)
<b>Child's age (year)</b>					
6-8	Reference	Reference	Reference	Reference	Reference
9-11	1.52 (1.20- 1.92) *	2.90 (1.45- 5.81) *	1.64 (1.21- 2.23) *	1.13 (0.75- 1.71)	1.47 (1.20-1.80) *
12-14	1.52 (1.21- 1.90) *	3.11 (1.66- 5.80) *	1.61 (1.16- 2.24) *	0.75 (0.50- 1.13)	1.47 (1.20-1.79) *
15-17	1.28 (1.02- 1.62) *	6.40 (3.54- 11.55) *	1.81 (1.33- 2.47) *	0.95 (0.62- 1.46)	1.63 (1.33-1.99) *
<b>Child's gender</b>					
Male	2.41 (2.05- 2.83) *	1.12 (0.81- 1.54)	1.08 (0.88- 1.33)	2.12 (1.52- 2.96) *	1.90 (1.65-2.18) *
Female	Reference	Reference	Reference	Reference	Reference
<b>Child's race</b>					
Hispanic	0.41 (0.31- 0.56) *	0.81 (0.48- 1.37)	0.38 (0.26- 0.56) *	0.71 (0.43- 1.18)	0.46 (0.35-0.59) *
White, non-Hispanic	Reference	Reference	Reference	Reference	Reference
Black, non-Hispanic	0.57 (0.43- 0.75) *	0.57 (0.32- 1.03)	0.35 (0.20- 0.60) *	0.76 (0.51- 1.13)	0.53 (0.41-0.69) *
Multiracial/Other, non-Hispanic	0.47 (0.37- 0.59) *	0.48 (0.28- 0.84) *	0.50 (0.36- 0.68) *	0.69 (0.46- 1.01)	0.49 (0.40-0.60) *
<b>Supportive neighborhood</b>					
Yes	Reference	Reference	Reference	Reference	Reference
No	1.33 (1.06- 1.67) *	1.07 (0.66- 1.73)	1.39 (1.02- 1.89) *	1.17 (0.79- 1.72)	1.32 (1.08-1.61) *
<b>Father's mental health</b>					
Excellent/VG/good	Reference	Reference	Reference	Reference	Reference
Fair/poor	1.15 (0.84-1.57)	1.71 (1.01-2.88) *	1.57 (1.05-2.33) *	1.43 (0.88-2.33)	1.30 (0.98-1.73)
<b>Mother's mental health</b>					
Excellent/VG/good	Reference	Reference	Reference	Reference	Reference
Fair/poor	1.43 (1.08- 1.89) *	2.39 (1.50- 3.81) *	3.00 (1.98- 4.55) *	2.31 (1.46-3.66) *	1.84 (1.42-2.40) *
<b>Number of ACEs</b>					
0	Reference	Reference	Reference	Reference	Reference
1	1.69 (1.40- 2.02) *	2.76 (1.81- 4.20) *	1.94 (1.50- 2.52) *	3.04 (2.07- 4.46) *	1.73 (1.47-2.03) *
2	2.08 (1.62- 2.67) *	3.95 (2.53- 6.16) *	2.01 (1.49- 2.72) *	4.87 (2.91-8.17) *	2.28 (1.81-2.87) *
3-4	2.79 (2.07- 3.75) *	7.99 (4.75- 13.45) *	2.31 (1.63- 3.27) *	8.49 (5.36- 13.45) *	2.98 (2.31-3.84) *
5-9	4.97 (3.48- 7.10) *	10.31 (6.43- 16.54) *	4.96 (3.45- 7.15) *	12.53 (8.16- 19.24) *	6.07 (4.45-8.29) *

AOR† OR in the multivariable model II adjusted for supportive environment, child's age, child's gender, child's race, mother's mental health, father's mental health, ACEs=adverse childhood experiences \*estimates significant at 95% confidence interval