Epidemiology of Child Traumatic Stress

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In this article, we present an update on epidemiologic research that addresses the scope and impact of children's exposure to traumatic events in daily living, as well as under special circumstances, such as natural disasters. Toward this end, we provide an overview of the findings of key selected studies that estimate the prevalence of children's exposure to trauma and associated developmental, functional, mental, and physical health problems. Over the past few years, epidemiologic research on child traumatic stress has demonstrated that children's exposure to traumatic events is more common than once thought and that children exposed to multiple traumatic events are at a substantially greater risk for a wide range of adverse mental and physical health problems than children who have not suffered cumulative traumatic experiences. These findings have important implications for the provision of mental health and medical services to children and adolescents who have experienced child traumatic stress.

Introduction

Epidemiologic studies of child traumatic stress (CTS) generally fall into one of four categories [1]. One involves research designed to estimate the prevalence and impact of trauma in general populations of youth. Population studies of CTS often recruit nationally or regionally representative samples of children or youth. A second category is research designed to estimate the prevalence of child maltreatment, which often uses data as reported by governmental entities, such as child protective service (CPS) agencies. A third category of epidemiologic research on CTS involves studies designed to estimate the severity of exposure to and impact of specific disasters on children and youth. Many disaster-focused studies recruit school-based samples. Studies of vulnerable groups of children represent a fourth category that includes studies of the distribution and determinants of CTS among children at high risk for exposures to traumatic events, such as children and youth with severe emotional disorders (SED) and children referred for services in child-serving systems of care.

General Population Studies of CTS

The prevalence of exposure to a range of traumatic experiences has been examined in the general population of children and youth in several countries. For example, the Developmental Victimization Study was a national survey of exposure to violence in a representative sample of youth 2 to 17 years of age in the United States [2]. More than half of the sample experienced a physical assault in the past year, more than one in eight experienced at least one form of child maltreatment, and more than one in three witnessed violence. The National Survey of Adolescents, a representative household probability sample of more than 4000 adolescents 12 to 17 years of age, estimated that 5 million American youth experienced a serious physical assault, nearly 2 million experienced a sexual assault, and nearly 9 million witnessed interpersonal violence [3]. The prevalence of post-traumatic stress disorder (PTSD) in the National Survey of Adolescents was 3.7% for males and 6.3% for females [4].

Findings from a representative longitudinal study of children and youth in rural North Carolina indicated that by age 16 years, nearly 68% were exposed to one or more traumatic events, such as child maltreatment, domestic violence, traffic injury, major medical trauma, loss of a caregiver, or sexual assault [5••]. A strong positive dose–response relationship was found between the cumulative number of traumatic events that children experienced and rates of psychiatric diagnoses. Children who were exposed to four or more traumatic events were far more likely to meet criteria for psychiatric disorders than children exposed to fewer or no traumatic events. For example, the prevalence of major depression was much less than 10% in the population of children who experienced two or fewer traumatic events, whereas more than 25% of the children who experienced four or more events met diagnostic criteria for major depressive disorder.

Findings from community studies of urban American youth reported similarly high rates of exposure. For example, among New York City public school students enrolled

in grades 4 through 12, more than 60% experienced at least one traumatic event before the terrorist attacks on the World Trade Center [6]. Reported events included seeing someone killed or seriously injured (39%) and witnessing the violent/accidental death of a close friend (29%) or family member (27%). Nearly 25% of New York City school children reported exposure to multiple traumatic events before the September 11 attacks [7].

A longitudinal study of a representative sample of youth residing in an unidentified urban metropolitan area of the United States found that by age 23 years, 82.5% were exposed to at least one traumatic event, with males (87.2%) more likely to experience traumatic stress than females (78.4%) [8]. A higher percentage of males (62.2%) than females (33.7%) reported exposure to interpersonal violence. This study found that 7.9% of females and 6.3% of males met lifetime *DSM-IV* criteria for PTSD. The overall conditional probability of PTSD (percentage of trauma-exposed youth who met PTSD diagnostic criteria) for any trauma was 8.8%. The highest conditional probability was 15.1% for young adults exposed to interpersonal violence.

A prospective longitudinal study of adolescents and young adults residing in Munich, Germany, reported that more than 20% of the sample reported at least one event that met the *DSM-IV* A1 criterion for exposure to trauma: 26% for males and 17.7% for females [9]. Applying the *DSM-IV* A2 criterion (ie, feeling or reacting with intense fear, hopelessness, horror, or irritability at the time of the event) to the definition of trauma reduced exposure rates to 17% of the sample (18.6% for males, 15.5% for females). The most prevalent traumatic events among this sample of German youth were physical attacks (7.5%), serious accidents (5.4%), witnessing traumatic events happen to others (3.6%), and sexual abuse as a child (2.0%). The prevalence of PTSD in the general population of adolescents and young adults in Munich was reported at 1% for males and 2.2% for females [9]. The conditional probability of a lifetime PTSD diagnosis among respondents whose reported traumatic events met the *DSM-IV* A1 and A2 criteria was 7.8%.

A study of exposure to traumatic events among 10th grade students in Nairobi, Kenya, and Cape Town, South Africa, found that more than 80% reported exposure to at least one event [10]. The prevalence of students' exposure to traumatic events was comparable in Kenya and South Africa. The most frequently endorsed events were witnessing community violence (63%), being robbed or mugged (35%), and witnessing a family member being hurt or killed (33%). The current prevalence of full and partial PTSD varied by country, however, with rates significantly higher among children in South Africa than those in Kenya.

As described previously, a robust finding from the epidemiologic general population studies of children's exposure to traumatic events is that, unfortunately, such experiences are quite common. Exposure prevalence in the general population ranges from about 20% to more than 80%, depending on factors such as the nation studied, urban versus rural location of the sample, age and gender of the sample, and the criteria used to classify trauma exposure.

Child Maltreatment Studies

Child maltreatment is a generic term for the phenomena of physical abuse, neglect, emotional abuse, and sexual abuse [11]. Neglect, physical abuse, and child sexual abuse are often found in combination with emotional abuse and exposure to domestic violence, such that children who are the victims of one form of maltreatment are more likely to experience other forms of maltreatment and exposure to interpersonal, family, and community violence [12]. In the United States, the total number of maltreated children who also have been exposed to domestic violence is estimated to exceed 3 million cases per year [13–15].

A major source of child maltreatment information is the National Child Abuse and Neglect Data System (NCANDS) [16•]. Since 1990, states annually submit data on child abuse and neglect to the US Department of Health and Human Services through NCANDS. The most recent statistics were published in *Child Maltreatment 2007* [16•]. In 2007, the most recent year for which data are available, about 3.5 million children were investigated or assessed by CPS agencies to determine if they were victims of maltreatment. Of these, 794,000 cases were *substantiated*, a term used to indicate that a disposition concluded that the allegation of maltreatment was supported by state law [16•]. With respect to the general population, this estimate means that 10.6 per 1000 children in the United States are officially substantiated victims of maltreatment. In 2007, most of these children were victims of neglect (59%), whereas 13.1% experienced multiple maltreatments, 10.8% physical abuse, 7.6% sexual abuse, and 4.2% other forms of maltreatment.

From the mid-1990s to 2007, NCANDS documented an overall decrease in the total number of substantiated cases of maltreatment in the United States. The peak year was 1994, when 1,031,000 cases of child maltreatment were substantiated. The overall trend has been a steady decline in the number of officially substantiated cases over time, to a low of 794,000 in 2007. It is important to note that the overall trend for allegations of maltreatment has been more or less stable during this time period (~ 2.8–3.5 million CPS-investigated allegations per year). These disparate trends for alleged versus substantiated cases of maltreatment suggest that the decline in substantiated cases is not related to fewer investigations and assessments by CPS agencies in the United States but may represent a true reduction in the national prevalence of child maltreatment [17].

Commenting on trends by type of maltreatment within the NCANDS data from 1992 through 2006, Finkelhor and Jones [18] noted the following:

> Sexual abuse substantiations declined 5% from 2005 to 2006, capping a downward trend of 53%

that began in 1992. Physical abuse declined 3% from 2005 to 2006, continuing a downward trend that began in 1996. Overall physical abuse is down 48% since 1992. Substantiated neglect cases increased 2% from 2005 to 2006. The long-term trend in neglect has fluctuated during the period since 1992, but without showing a strong trend either up or down.

These striking reductions in the NCANDS prevalence of child sexual and physical abuse over time may represent an important public health outcome for American children with implications for the long-term mental and physical health of the population.

Another major source of information on child maltreatment is the National Incidence Study (NIS) [19]. The NIS was mandated by Congress to establish the national incidence of child maltreatment; findings from three waves of data collection were reported for 1981 (NIS-1), 1988 (NIS-2), and 1996 (NIS-3). Data have been collected and analyzed for a fourth NIS wave, with findings scheduled for release in 2009. The NIS operates under the assumption that official data reported to states through CPS agencies represent only the "tip of the iceberg" of child maltreatment. Therefore, the NIS is designed to provide estimates that not only include maltreated children investigated by CPS agencies but also children identified by a diverse group of professionals in a wide range of child-serving agencies in representative communities throughout the United States. NIS-3 findings indicated that the total number of abused and neglected children was two-thirds higher in the NIS-3 published report than in the NIS-2 report. Specifically, an estimated 1,553,800 children in the United States were abused or neglected in 1993, compared with 931,000 children in 1986. The NIS-3 total reflects a 149% increase since the 1980 NIS-1 estimate of 625,100 children. NIS-4 findings should help to further determine the scope of and trends in child maltreatment in the United States.

A history of child abuse and neglect increases risk for the development of major depression in young adulthood compared with nonabused individuals. As a group, maltreated children manifest significantly higher levels of comorbid psychiatric disorders and behavioral problems than nonabused or non-neglected children [20,21]. Additional problems commonly associated with child maltreatment include PTSD, aggression, conduct disorder, sexualized behaviors, eating problems, somatization, and substance abuse. For example, Widom [22] reported a 37.5% lifetime prevalence of PTSD for adults with substantiated histories of child maltreatment. Children with maltreatment-related PTSD had significant developmental impairments as evidenced by difficulties with attention tasks, abstract reasoning, and executive functioning compared with matched healthy controls [23].

Findings from twin studies provide strong evidence for a significant causal relationship between child maltreatment and major psychopathology [24–26]. For example, among twins discordant for child maltreatment, abused twins have higher rates of depression, suicide attempts, conduct disorder, alcohol abuse and dependence, nicotine dependence, and sexual promiscuity [26–28]. Findings from a recent twin study showed that childhood physical abuse has an environmentally mediated causal effect on the development of antisocial behavior [25].

Kaplow and Widom [29••] reported that adults who were maltreated in early childhood were at greater risk for poor long-term psychological functioning than childhood maltreatment victims who were initially maltreated when they were older. These investigators found that an earlier onset of maltreatment predicted more symptoms of anxiety and depression in adulthood when controlling for gender, race, current age, and other abuse reports. Later onset of maltreatment was predictive of more behavioral problems in adulthood. These findings suggest that age at onset of maltreatment in childhood is associated with long-term variations in the severity and expression of mental health and functional impairments.

Disaster Studies

A disaster is any natural catastrophe (eg, tornado, hurricane, or earthquake) or any fire, flood, or explosion that extensively damages properties and adversely affects lives, exerting a disrupting impact on the fundamental routines of communities, families, and individuals [30,31]. In addition to a loss of property and life, major disasters may affect entire communities and families in terms of evacuation and permanent relocation, such as the extensive displacement of children and families seen in the aftermath of Hurricane Katrina on the US Gulf Coast. Disasters can result from a manmade event (eg, a nuclear reactor explosion), but if the damage is caused intentionally, it may be classified as an act of terrorism or war.

Many epidemiologic studies of children's exposure to natural and manmade disasters are conducted in school settings, and estimates of psychiatric symptoms and disorders were reported in studies of children and adolescents exposed to various types of disasters that affected school-age children in entire communities. For example, Hoven and colleagues [7] assessed the needs of public school students in grades 4 through 12 in New York City after the attacks on the World Trade Center. Six months after the attacks, the estimated prevalence of PTSD was 10.6%, with agoraphobia at 14.8%, conduct disorder at 12.8%, separation anxiety at 12.3%, and alcohol problems (among teenagers) at 4.5%. Importantly, more than 60% experienced at least one major traumatic event before the attacks.

A 28-month follow-up study of students 11 to 21 years of age who were exposed to severe flooding in Poland found that 17.7% met criteria for PTSD, with younger children and older girls at greater risk [32]. McFarlane [33] reported PTSD prevalence estimates of 52.8% at 8 months and 57.2% at 26 months among Australian children exposed to a major brush fire. Assessed in the

aftermath of Hurricane Andrew in Florida, 86% of a sample of elementary school children experienced hurricane-related PTSD symptoms at 3 months, with most reporting moderate to severe symptoms [34].

Goenjian and colleagues [35] reported an 18-month prevalence in excess of 75% for PTSD and major depression among children in an Armenian city that was at the epicenter of a major earthquake. Lower rates of PTSD and depression were reported in studies of child survivors of an earthquake in Taiwan [36] and children in southern Thailand exposed to a major tsunami [37].

High-risk Children and Youth

We know from population studies of CTS that most community residents experience exposure to one or more traumatic events by young adulthood [38,39]. However, although the number of children exposed to trauma worldwide is high, trauma exposure is unevenly distributed within and across populations such that certain groups of children experience dramatically higher rates of trauma exposure than the general population. These groups include children and youth who live in chronic poverty and unstable and violent communities; children who have witnessed major armed conflicts or civil disturbances; juveniles confined to detention centers and jails; and children who require multisystem or residential treatment or hospitalization for severe mental health, emotional, or behavioral problems (eg, substance abuse or suicidal behavior) [39,40].

In one study of high-risk youth, adolescents with SED—defined as having at least one *DSM-IV* diagnosis, severe impairment in multiple domains of functioning (eg, school, home, and with peers), and involvement in multiple youth-serving agencies or systems of care—were found to have extensive histories of exposure to traumatic stress. Most adolescents with SED experienced domestic violence (51%) and the death of a loved one (51%) [41]. Nearly 50% of this sample had a history of physical abuse, and almost 33% were sexually abused. More than 25% of children with SED met criteria for PTSD (28%), with the prevalence among girls (42%) more than twice that among boys (19%).

A large study of youth 10 to 18 years of age held in an urban juvenile detention center reported that 92.5% of detainees experienced at least one traumatic event, with 84% reporting more than one traumatic experience and most exposed to six or more events [42]. More males (93.2%) than females (84.0%) were exposed to trauma, and male and female detainees who were 14 years of age or older reported significantly more trauma than youth 10 to 13 years of age. Abram et al. [42] found that 11.2% of youth in juvenile detention met criteria for PTSD within the past year, with no significant differences in diagnosis by sex or race/ethnicity for males and females. More than half of the participants with PTSD reported that witnessing violence was a precipitating event.

A study of school-age Palestinian children from the West Bank and East Jerusalem reported that 54.7% experienced at least one lifetime traumatic event [43]. Many children reported experiencing trauma associated with armed conflict in their communities, including personal physical injury (22.9%) and the traumatic death of a family member (17.6%) [43].

In May 2009, the Commission to Inquire Into Child Abuse [44] released the findings from a decades-long study of child maltreatment in residential institutions throughout Ireland that were primarily owned and managed by various religious congregations. By interviewing a worldwide sample of hundreds of surviving former child residents, religious and lay staff of residential facilities, and other witnesses and stakeholders, the Commission determined that physical and emotional abuse and neglect were highly prevalent in residential institutions from the 1930s onward, with sexual abuse particularly prevalent in boys' facilities. Specific health and mental health problems were examined in a subgroup of this sample of adults who were maltreated as children while in residential care [45]. All reported experiencing one or more major adjustment problems, including mental health problems (74.1%), unemployment (51.8%), and substance use (38.1%). Other problems included frequent physical health problems (29.6%), frequent hospitalization for physical health problems (28.3%), difficulties controlling anger in intimate relationships (25.9%), nonviolent crime (22.3%), and homelessness (21.1%). Some reported problems with self-harm (17.8%), anger control with children (13.4%), incarcerations for nonviolent crime (13.4%), hospitalizations for mental illness (13%), violent crime (10.1%), and incarcerations for violent crime (7.3%). By attempting to estimate the scope of the problem of child maltreatment in residential treatment facilities nationally, as well as victims' lifetime experiences with problems associated with maltreatment in childhood, the Commission adopted important characteristics of epidemiologic studies in its investigation.

Conclusions

What have we learned about CTS from epidemiologic studies? Several robust findings emerged. First, children's exposure to traumatic events is more frequent than was once believed. The common occurrence of exposure to traumatic events is consistent across epidemiologic studies of children and adolescents. Studies of children and youth in urban populations and at-risk samples suggest that boys may experience more exposure than girls, especially with respect to witnessing interpersonal and community violence. The most impaired children in general population studies are those who have experienced multiple cumulative exposures to CTS [5••,46].

Second, exposure to traumatic events is associated with a diverse array of serious adverse mental health, physical health, developmental, and functional outcomes. Somewhat surprisingly—and a matter of some controversy—is

the finding that PTSD is not as prevalent in population studies of children as it is in population studies of adults. For example, the prevalence of PTSD in the North Carolina study of school-age children was 0.5% [5••], a finding comparable to that of other general population studies of children in Germany [9], Norway [47], and the United Kingdom [48]. Population studies of adults generally have reported higher lifetime rates of PTSD, such as 7.8% [49] and 9.2% [50]. Factors contributing to differential PTSD prevalence in adult and child population studies have yet to be determined. A portion of the variance may be attributable to concerns that current PTSD criteria are insufficiently developmentally informed, leading to elevated false-negative rates among children and youth. However, in contrast to general population studies, high rates of PTSD, depression, and developmental and functional impairments were reported consistently in studies of maltreated children, children who experienced traumatic loss and bereavement associated with natural disasters [33,51], and children in other high-risk groups (eg, youth in residential treatment and juvenile detention) [41,42].

Third, we learned that multiple cumulative exposures to traumatic stress are generally associated with worse outcomes than fewer exposures and that the adverse outcomes of cumulative exposures to trauma during childhood extend well into adulthood. The Adverse Childhood Experiences study addressed this issue by examining the cumulative effects of multiple and chronic adverse childhood experiences, such as physical, sexual, and psychological abuse and exposure to domestic violence and parental mental illness, substance abuse, and criminal behavior, on physical and mental health [52]. Using a 0-to-6 scoring system that counts the number of types of adverse childhood experiences occurring before age 18, the study found that as the number of adverse childhood experiences increased, there was a graded increase in the number of affected study participants [52]. Compared with individuals with no adverse childhood experiences, individuals with four or more were at much greater risk for a range of serious health problems. For example, the presence of four or more adverse childhood experiences increases the risk for alcoholism, drug abuse, and suicide attempts fourfold to 12-fold and the risk for smoking, poor general health, having more than 50 sexual partners, and sexually transmitted diseases twofold to fourfold. There was a 1.4- to 1.6-fold increase in physical inactivity and severe obesity [52]. A recent summary of major Adverse Childhood Experiences study findings noted that adults who experienced four or more adverse childhood experiences as children had higher rates of ischemic heart disease, cancer, stroke, chronic bronchitis, emphysema, diabetes, skeletal fractures, and hepatitis than their counterparts who were not exposed to multiple cumulative adverse experiences as children [53]. These findings are consistent with a growing body of research showing a strong relationship between cumulative exposures to traumatic events in childhood and a wide array of health and mental health impairments in youth and adulthood [54].

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Disclosure

No potential conflicts of interest relevant to this article were reported.

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