

# Adolescents' Exposure to Disasters and Substance Use

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**Abstract** This paper reviews the impact of exposure to man-made or natural disasters on adolescent substance use. It covers empirical studies published from 2005 to 2015 concerning (a) the scope of the problem, (b) vulnerable groups and risk and protective factors, and (c) evidence-based interventions. The review suggests a strong link between adolescent substance use and exposure to either man-made or natural disaster. Vulnerable groups include adolescents with previous exposure to traumatic events, living in areas that are continually exposed to disasters, and ethnic minorities. Risk and protective factors at the individual, familial, community, and societal levels are described based on the bioecological model of mass trauma. Given that mass trauma is unfortunately a global problem, it is important to establish international interdisciplinary working teams to set gold standards for comparative studies on the etiology for adolescent substance use in the context of disasters.

**Keywords** Natural disasters · Man-made disasters · Substance use · Adolescents · Bioecological model · Mass trauma · Social support · PTSD · Interventions

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## Introduction

Greater attention to the behavioral consequences of exposure to disasters has resulted in a growing literature on the impact of exposure to man-made or natural disasters on adolescent substance use [1, 2]. Using substances following mass trauma may be one way in which adolescents attempt to cope with emotional distress [3]. Although experimentation with illicit substances is not uncommon in adolescents, substance use in the context of stressful life events has the potential to develop into abuse [4]. Moreover, substance use in adolescence has a range of adverse psychosocial and physical outcomes including death due to injuries (alcohol use) [5], academic failure [6, 7], and alcohol or other drug dependence beyond adolescence [6, 7]. It is therefore important to fully understand the scope of the problem as well as its underlying mechanisms. While Goldman and Galea's review on the mental health consequences of disasters [8] and Pfefferbaum's recent reviews on the children's reactions to disasters [2, 9] included substance use among many other individual responses to disasters, this review will focus solely on substance use. It covers a critical review of empirical studies published from 2005 to 2015 concerning (a) the scope of the problem, (b) risk and protective factors using the bioecological model of mass trauma, and (c) evidence-based interventions.

## Prevalence of Substance Use in the Context of Disasters

Several studies examined the rates of substance use in the context of disasters including natural disasters, such as tornadoes [10, 11] and bushfires, as well as man-made disasters including war and other types of political violence [12].

**Natural Disasters** A convenient sample of adolescents 18 months following Hurricane Katrina reveals that 37 students (13.8 %) reported problem on substance use [3]. A population-based sample of 2000 adolescents (ages 12 to 17) and their parents recruited from communities affected by the spring 2011 tornadoes in Alabama and Joplin, Missouri found that 0.9 % of the sample had substance use disorder (SUD), 1.1 % had posttraumatic stress disorder (PTSD) and SUD comorbidity, 1.0 % had major depressive episode and SUD, and another 0.7 % had PTSD, depression, and SUD comorbidity [10•]. Thus, prevalence of SUD comorbidity was 2.8 % while the prevalence of SUD as a sole outcome was less than 1 % [10•]. A study conducted among adolescents 13 months before and 7 and 19 months post-Hurricane Rita in the Gulf Coast of the USA found that 15 % among the nonusers at baseline began smoking, 25 % began drinking, and 8–9 % began smoking marijuana at follow-ups. Problematic substance use since the disaster (self-report) was associated with re-experiencing, avoidance, and numbing clusters of PTSD [11].

Notably, while exposure to disasters in the short run is generally associated with increase in substance use, this effect may fade over time. Using a matched control sample, one unique 20-year longitudinal study among adults exposed to an Australian bushfire disaster as children found no significant differences in the total alcohol consumption between the bushfire-exposed group and controls or in the proportion of participants classified as “harmful or hazardous drinkers” or “alcohol dependent.” Other types of substance were not reported in this study [13•].

**Political Violence** Six months after the exposure to the World Trade Center terrorism attack, Wu et al. [14] found that 10.9 % of high school students reported an increase in alcohol use since the attack and 5.4 % reported an increase in cigarette use. Similar results (10 % increase in alcohol and other substance use) are reported by Chemtob et al. [15] among junior and high school students who attended schools close to the WTC shortly after the attack. Thus, the rate of 10 % increase seems to be consistent at least in the first year after the attack, although the prevalence of SUD among war-affected refugee children who experienced war, terrorism, or political violence outside of the USA and were presenting for psychological treatment in the USA was much lower (3.57 %) [12].

Several studies conducted in Israel examined the prevalence of substance use in the past year [16] or 30 days [17, 18] rather than increase in substance use after cumulative exposure to acts of terrorism or a war (the Second Lebanon War). Nonetheless, they all found positive associations between exposure to these man-made disasters and alcohol [16, 19] and cannabis use [20], even a year after the Second Lebanon War [19] and after controlling for PTSD and depressive symptoms [19, 20].

## Vulnerable Groups

While all adolescents are susceptible to the uptake or increase in substance use following exposure to disasters, several vulnerable groups were identified including those who were directly exposed to the disaster [14, 15]. For example, a study that compared adolescents who were directly exposed to Hurricane Ike in Galveston Island (i.e., were not evacuated prior to the storm) to those who were not directly exposed (i.e., were evacuated) found that those directly exposed were more likely to report recent use of excessive alcohol, cannabis, and cocaine than those who were not directly exposed [21]. Adolescents with previous exposure to traumatic events [14, 19] and those who are continually exposed to disasters, such as living in war zone or in places characterized by continuing acts of political violence such as in certain areas in the Middle East, are other two vulnerable groups [22•, 23, 24]. Ethnic minorities are also vulnerable to negative consequences of disasters, including increased substance use. For example, Israeli Arab adolescents report greater associations between exposure to acts of political violence and substance use (other than alcohol) than their Jewish counterparts [18, 19].

## Risk and Protective Factors

The bioecological model [25] and its adaptation to the context of mass trauma [26•] provide a comprehensive conceptual framework for the risk and protective factors for the negative effects of disasters at the individual, familial, community, and societal levels. While this is a general model to all types of negative consequences of exposure to disasters, it might fit well to the specific consequence of substance use. Bronfenbrenner’s ecological model [25, 27] suggests that human development is significantly affected by interactions among nested systems. These systems determine the impact of life events on individuals as well as their responses to such events. Disasters are one type of life event that can be understood using ecological models [26•, 28•]. At the individual’s *biophysical level*, automatic psychological and physiological reactions to traumatic events, including fear reactions to stimuli associated with the traumatic events [29], may lead to PTSD and subsequently substance use as the individual distances him/herself from the fear reaction stimuli. For example, following Hurricane Ike, adolescent boys who experienced posttraumatic stress symptoms (PTS) related to Hurricane Ike were more likely to report alcohol, cannabis, and other types of drug use compared to those who reported no PTS to Hurricane Ike [30]. A study found that PTS partially mediated the association between exposure to acts of political violence and substance use [18]. In another study, the authors found that PTS fully mediated the pathway from political violence exposure to substance use among Jewish Israeli adolescents

but only partially mediated such relationship among Arab Israeli adolescents [31].

Gender and age also play a role in the consequences of exposure to disasters. For example, following the spring 2011 tornadoes in Alabama and Missouri, girls were significantly more likely than boys to meet criteria for SUD-depression comorbidity [10•]. While younger age is a risk factor for greater PTSD, anxiety, and depression [28•], adolescence is a risk factor for initiation or increase the use of alcohol or other drugs following exposure to disasters [1].

Despite evidence supporting a genetic or other biological predisposition to PTSD [32], and to SUD [33, 34], these factors alone do not explain fully why adolescents use substances in the context of disasters. The biophysical factors need to be understood in the context of micro- and macrosystem [26•]. These systems are reviewed below.

*Microsystems* form the next level of the nested systems and include those systems that most directly and immediately impact responses to life events. Core microsystems include the family, friends, neighborhood, and religious groups. The majority of existing research at the microsystem level focuses on how family factors influence trauma recovery. Parental responses to trauma, strength, and continuity of familial relationships and parental monitoring of their children's behavior are considered major protective factors against the negative consequences of disasters on adolescents [35]. Parents who are able to restore a feeling of safety and security serve to decelerate the development of posttraumatic stress symptoms. Parents who themselves manifest symptoms, especially of anxiety, tend to be less available to provide support to their children [36].

Social support is another critical protective factor at the adolescents' microsystems level. Based on a large sample of minority youth who were assessed 36–65 months after Hurricane Katrina, the researchers found that higher levels of social support from family and peers were associated with lower levels of psychological distress (i.e., symptoms of PTSD, anxiety, and depression) [28•, 37•]. Moreover, a large-scale representative sample in Israel found that parental support was associated with lower levels of substance use in the context of accumulative exposure to acts of political violence. Higher levels of parental support were related to lower levels of PTS and psychosomatic symptoms, lower levels of risk behaviors as shown by smoking and youth violence, and higher levels of well-being [24]. Similar results are reported in Dubow et al. review [38]. Lastly, decreased parental supervision was found to be associated with adolescent alcohol use following exposure to Hurricane Wilma [39]. Lower adolescents' perceptions of parental monitoring emerged as a significant risk factor of substance use among 80 adolescents (38 % minorities) who were exposed to Hurricane Katrina [40].

The next level is the *exosystem*, which includes the more immediate networks or systems that affect the individual, such as neighborhood and community systems, health care systems, school systems, and the mass media. Neighborhood and community systems play a significant role in post-disaster recovery or deterioration [26•]. Anxiety at the neighborhood level was the best predictor of PTSD in Palestinian children living in East Jerusalem and the West Bank who were repeatedly exposed to terrorism [41]. A neighborhood that provides greater access to substance use is a risk factor for increase in substance use following exposure to disasters [39]. School has been acknowledged as the right setting to provide interventions following exposure to man-made (political violence) [42] and natural (Hurricane Katrina) disasters [43]. One recent study that examined the relationship between exposure to political trauma and adolescent risk behaviors in Israel suggested that school support could mediate the detrimental effect of exposure to war disasters on adolescent substance use [31]. More studies are needed to understand the impact of school on the negative outcomes of disaster exposure.

*The macrosystem* is the larger sociocultural context that includes societal norms, sociopolitical conditions, cultural subsystem norms, governmental systems, economic factors, and the environmental effects of the disaster [26•]. The media is also considered a macro factor with a large impact on individuals in the context of disaster. Exposure to media coverage of disasters increases adolescents' negative consequences [44], and yet parents often exert little control over media exposure of their adolescent children [45, 46].

## Interventions

Several interventions focused on decreasing substance use behaviors among disaster-affected adolescents have been proposed or tested in the past 10 years; they varied in the ecological levels targeted. A randomized control trial tested the efficacy of a web-based treatment, "Bounce Back Now" (BBN), with a population-based sample of 2000 adolescents living in tornado-affected areas in the USA and their parents [47, 48•]. BBN consisted of four interactive modules, each providing evidence-based strategies to reduce symptoms associated with PTSD, depression, alcohol use, and cigarette use. For example, psychoeducation and strategies to manage anxiety, complete therapeutic exposure to trauma-related stimuli, and decrease avoidance are included in the PTSD module. The tobacco and alcohol modules incorporated integrated brief motivational-enhancement and cognitive behavioral strategies [47]. Families consenting to the study were randomly assigned to one of the three conditions: (1) BBN for disaster-affected adolescent, (2) BBN plus an adult self-help (ASH) intervention with an emphasis on parental mental health and substance

use concerns, and (3) assessment only control [48•]. Relative to those in the control group, adolescents in the intervention groups (BBN and BBN+ASH) had fewer PTSD and depressive symptoms at 1-year follow-up. However, the interventions did not demonstrate a significant effect on decreasing adolescents' alcohol use [48•].

Other than individual-based intervention, scholars have also proposed family- or school-based interventions to reduce substance use among adolescents who were exposed to disasters. Adapting the multidimensional family therapy (MDFT) [49], an empirically tested substance abuse intervention program, Rowe and Liddle [50] proposed a family-based intervention for adolescent (13–17 years of age) disaster victims of Hurricane Katrina who were referred for substance use and related problems. Treating the adolescents, the parents, the family, and other systems such as schools and the juvenile justice system as a whole, the intervention aimed to address adolescent trauma symptoms and substance use. Outcome results have not yet been reported for this intervention. Lastly, Hutchinson et al. [51•] evaluated the effectiveness of school-based health centers on improving adolescent health in the aftermath of Hurricane Katrina. The health center staff consisted of a part-time physician, nurse practitioner, registered nurse, social worker, data coordinator, and in some settings drug and alcohol counselors. Using a quasi-experimental design, the researchers found that students in the intervention schools were less likely to have drunk alcohol and used marijuana and were more likely to be treated for behavioral issues than students in the control schools post-intervention.

## Conclusion

The review suggests a strong link between adolescent substance use and exposure to either man-made or natural disaster. Most risk and protective factors for substance use in the context of disasters were identified in the biophysical and microsystems, probably because they have been studied more, followed by exo- and macrosystems. Whether substance use co-occurs with PTSD or depression in the context of disasters is unclear. Further studies should aim to unpack such relationships. While the bioecological model is comprehensive, it has not been tested as a whole. Given that advanced statistical methods to test complex models do exist, the challenge for future research studies is to test the adequacy of the bioecological model to predict increase in substance use following exposure to disasters over time.

Three substance use interventions that aimed to modify substance use of adolescents affected by disasters were developed in the past 10 years. They ranged from individual-oriented approaches, family-based intervention, to school-based health services. Out of these interventions, one individual-oriented approach, BBN [48•], has shown promise

in improving mental health conditions among adolescents affected by disasters. The only intervention that has demonstrated effects on curbing the menace of substance use and other risk behaviors among adolescents is an interdisciplinary, school-based health care center approach [51•]. Given that adolescents exposed to disasters are prone to substance use issues and the school system is a critical environment where adolescents not only learn and grow but also socialize and receive support, school-based programs that help adolescents decrease substance use uptake in the aftermath of a disaster deserve further attention.

Man-made and natural disasters occur in different regions of the world. However, whether the risk and protective factors would have differential impacts on adolescents across contexts is unclear. Due to a great variability in the types of research designs, variables included, and measurement use, it is difficult to compare findings between events and countries. Given that mass trauma is unfortunately a global problem, it is important to establish international interdisciplinary collaborations and working teams to set gold standards for comparative studies on the etiology for adolescent substance use in the context of disasters. Although few initiatives to such collaborative teams have been established [52], they were focused mainly on interventions rather than research and did not have a substance use focus. Given that disasters affect individuals, families, communities, and societies, standards for research studies with this regard should lean on multilevel-layer conceptual frameworks. Such frameworks can help develop empirical knowledge and interventions that address risk and protective mechanisms at the individual, familial, and community levels.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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