



Published in final edited form as:

Am J Disaster Med. 2011 ; 6(4): 201–206.

Teen Dating Violence and Substance Use Following a Natural Disaster: Does Evacuation Status Matter?

Jeff R. Temple, PhD[Assistant Professor],

Department of Obstetrics and Gynecology, UTMB Health, Galveston, TX

Patricia van den Berg, PhD, MPH[Assistant Professor],

Department of Obstetrics and Gynecology, UTMB Health, Galveston, TX

John F. “Fred” Thomas, PhD[Assistant Professor],

Department of Preventive Medicine and Community Health, UTMB Health, Galveston, TX

James Northcutt, OTR, MOT[Clinical Research Coordinator],

Department of Obstetrics and Gynecology, UTMB Health, Galveston, TX

Christopher Thomas, PhD[Professor], and

Department of Psychiatry, UTMB Health, Galveston, TX

Daniel H. Freeman Jr, PhD

Department of Preventive Medicine and Community Health, UTMB Health, Galveston, TX

Abstract

Objectives—In September of 2008 the Texas coast was directly hit by Hurricane Ike. Galveston was flooded by 14 feet of storm surge, affecting most of the Island’s housing and infrastructure. The purpose of the present study is to examine whether youth who did not evacuate (11%), and subsequently were exposed to Hurricane Ike, exhibit higher rates of substance use and physical and sexual teen dating violence (both perpetration and victimization), relative to adolescents who did evacuate.

Setting—Public high school in southeast Texas that was in the direct path of Hurricane Ike.

Participants—An anonymous survey was administered in March 2009 to 1,048 high-school students who returned to Galveston post-storm (41% Hispanic, 23% African-American, 27% White).

Main Outcome Measures—Teen dating violence and substance use.

Results—Mantel-Haenszel odds ratios, adjusting for age and ethnicity, were computed. Compared to boys who evacuated, non-evacuating boys were more likely to perpetrate physical dating violence and sexual assault, and to be a victim of sexual assault. Non-evacuating boys and girls were more likely than those who did evacuate to report recent use of excessive alcohol, marijuana, and cocaine.

Conclusions—School personnel, medical personnel, and mental health service providers should consider screening for evacuation status in seeking to identify those adolescents who most need services after a natural disaster. Further, in addition to addressing internalized emotions and psychological symptoms associated with experiencing trauma, intervention programs should focus on reducing externalized behavior such as substance use and teen dating violence.

Accumulating evidence suggests that children and adolescents exposed to natural and man-made disasters are at an increased risk of developing psychological problems.¹⁻³ In a series of studies following Hurricane Andrew, school-aged children exposed to the destruction of the storm exhibited acute and persistent symptoms of posttraumatic stress disorder,

depression, and anxiety.⁴⁻⁷ Similar findings were reported after Hurricane Katrina.⁸⁻¹¹ For example, Scheeringa and Zeanah¹² found high rates of PTSD in young children who did (43.5%) and did not (62.5%) evacuate from Hurricane Katrina.

Although the negative effects of traumatic experiences on children's and adolescent's psychological health have been well documented, much less is known about the effect of large scale disasters on youths' *behavior*.¹³⁻¹⁵ Most of what we do know regarding exposure to trauma and resulting behavior comes from research on childhood maltreatment, exposure to violence, and sexual abuse, which indicates that youth exposed to traumatic experiences are at a heightened risk of developing risky health behaviors such as substance use and aggressive behavior.^{16,17} With respect to disaster, Wu and colleagues¹⁸ found that adolescents in New York City exhibited increased rates of cigarette smoking and drinking after the 9/11 terrorist attacks. Similarly, in a rare study containing pre- and post-disaster data, exposure to Hurricane Rita was associated with increasing substance use among high school students, particularly with respect to marijuana.¹⁵ A Dutch study evaluating the impact of a café fire that killed 14 and wounded 250 adolescents found that youth exposed to (or in schools associated with) the traumatic event had significantly higher rates of depression, anxiety, aggression, and alcohol use, relative to matched controls.² Although limited research on adult samples reveals an association between exposure to natural disasters and intimate partner violence,^{19,20} we are unaware of a study that examined the relationship between catastrophic events and teen dating violence.

Unlike tornadoes, earthquakes, terrorist attacks, and other disasters, hurricanes generally offer an opportunity for people to evacuate and thus avoid direct exposure to the traumatic event. This is important as most trauma data suggest that the degree of exposure to the trauma is the single most important predictor of psychological harm.^{4,21,22} And although the stress of losing one's home and possessions, and experiencing secondary stressors associated with a disaster (loss of employment, loss of routine) are meaningful,¹¹ actually experiencing the life threatening event may be especially damaging. Thus, the purpose of the present study is to examine whether youth who did not evacuate, and subsequently were exposed to Hurricane Ike, exhibit higher rates of substance use and physical and sexual teen dating violence (both perpetration and victimization), relative to adolescents who did evacuate. This is one of only a few studies to examine post-disaster substance use among adolescents, the first to specifically examine post-disaster teen dating violence, and among the first to examine the psychological impact of Hurricane Ike.

METHODS

The traumatic event

On September 13, 2008 the Texas coast was directly hit by Hurricane Ike, one of the largest and costliest hurricanes in US history. Galveston Island was flooded by 12 to 14 feet of storm surge, affecting a vast majority of the island's housing stock and rendering a third of the houses destroyed or uninhabitable. The city was closed for two weeks due to dangerous conditions and lack of vital services (potable water, sewer, power, medical facilities). Despite mandatory evacuation orders, including the threat of "certain death" issued by the National Weather Service, many Galvestonians, including children and adolescents, were unable to evacuate or chose not to before the storm made landfall. It is estimated that 40% of the city population remained on the island during the storm.²³ These individuals endured rising storm surge (75% of the city was submerged), destructive winds, fires, and after the storm had passed, deplorable conditions.

Participants and Procedure

In March of 2009, seven months after Hurricane Ike, an anonymous biennial risk behavior survey was administered to 1,134 primarily low-income high-school students who returned to Galveston island post-storm (41% Hispanic, 23% African American, 27% white, and 9% other non-Hispanic) and attended Galveston's only public high school.²⁴ With a pre-storm enrollment of 1,921 students, we were able to recruit and assess 59% of all students, including those students who were displaced and never returned post-storm.²⁵ When we include only those students still attending the high school post-storm and present on the day of data collection ($n=1,478$), we had a participation rate of 76%. Participants were excluded if they did not report gender, age, race/ethnicity, or evacuation status, if they were younger than 14 years old, or if they had inconsistent responses on key variables (e.g., reported evacuating and also reported that they never left the Island). Asian-American adolescents were also excluded because their sample size was too small for analysis. The final analytic sample included 1048 participants.

Students were informed that their responses would be entirely anonymous and were instructed to not place identifying marks on the questionnaire. Tests were distributed by teachers. This study received approval from the Institutional Review Board of the University of Texas Medical Branch at Galveston.

Measures

Physical dating violence victimization was assessed with the following yes/no question: *During the past 12 months, did your boy/girlfriend ever hit, slap, or physically hurt you on purpose?* and sexual assault was assessed with the following question: *Has a boy/girlfriend ever physically forced you to have sexual intercourse when you did not want to?* These questions were repeated for perpetration. Students also reported their past month use of alcohol (including binge drinking), cigarettes, marijuana, cocaine, and inhalants. Finally, participants were asked whether or not (yes/no) they evacuated from Galveston Island for Hurricane Ike. Participants also reported their age, gender, and race/ethnicity.

Data Analysis

The number and percentage of participants who evacuated, by demographic characteristics, are reported in Table 1. Unadjusted frequencies and percentages of adolescents who engaged in or experienced teen dating violence and substance use are reported for those who did and did not evacuate. Mantel-Haenszel odds ratios, adjusting for race/ethnicity and age and stratified by gender, were computed to compare adolescents who did and did not evacuate.

RESULTS

In the surveyed sample, 11.3% of students reported that they did not evacuate prior to the storm, with boys ($n = 76$, 16%), significantly more likely than girls ($n = 42$, 7%) to report not having evacuated ($p < .0001$). As shown in Table 2, non-evacuating boys had 3 times the odds of reporting that they had perpetrated physical violence (OR = 3.19) and had sexually assaulted dating partners (OR = 3.73) compared to boys who did evacuate (all confidence intervals and significant levels are reported in the table). While no difference was found for physical violence victimization, non-evacuating boys were significantly more likely to be sexually assaulted by their dating partners than were their evacuating male counterparts (OR = 2.47). No differences on dating violence variables were found for adolescent girls. As shown in Table 3, non-evacuating boys and girls were more likely to report episodic heavy (binge) drinking (OR = 1.83 and 2.45, respectively), marijuana (2.10; 2.97), and cocaine (5.41; 4.73) compared to youth who did evacuate. In addition, non-evacuating girls were also more likely to be current smokers than were girls who evacuated (OR = 3.01). Non-

evacuating boys were more likely to have used any amount of alcohol (OR = 1.96) and inhalants (OR = 3.69) than were their evacuating male counterparts. Among boys, no differences in smoking were found, whereas among girls no differences were found for overall (non-binge drinking) alcohol use and inhalant use.

DISCUSSION

Compared to youth who evacuated, adolescents directly exposed to a major natural disaster were more likely to report using a variety of licit and illicit substances (girls and boys) and experience physical and sexual teen dating violence (boys). Several explanations for this finding, including those accounting for the limitations of this study, are possible. An obvious explanation is that greater exposure to a traumatic stressor may lead to a greater prevalence of health risk behaviors. Because adolescents who did not evacuate were exposed to a life threatening event, they had, by definition, an increased chance of developing symptoms of PTSD and other comorbid psychiatric problems.^{26,27} Although we did not thoroughly assess psychiatric problems in the current study, previous research has supported a positive relationship between degree of trauma exposure and impact on mental health.^{7,28} It is possible that adolescents used substances to self-medicate the psychological sequelae resulting from direct exposure to the hurricane.²⁹ Consistent with existing research, the increased teen dating violence reported by boys in the current study may be a byproduct of their increased substance use,³⁰ however longitudinal disaster research is needed to establish a temporal relationship between these factors. Correlates of posttraumatic stress such as hypervigilance, reactive aggression, and emotional dysregulation may also contribute to interpersonal aggression among adolescents exposed to a traumatic experience.¹⁴

As with most studies on the effects of unexpected disaster, we did not have information on pre-storm levels of individual behavior. From previous studies with students in this region, we know that the non-evacuating adolescents exhibited relatively high rates of substance use and dating violence.^{24,30} However, it is also possible that adolescents who did not evacuate were already engaging in more health risk behaviors. In fact, in a study of adolescents exposed to Hurricane Andrew, Khoury and colleagues¹³ found that pre-hurricane behavior was a better predictor of post-hurricane behavior than the stressors associated with the trauma. It is possible that not evacuating before a natural disaster is itself a risk behavior/ marker, which would be expected to correlate with other risk behaviors such as substance use and dating violence. Alternatively, not evacuating may be a marker of a type of family or social environment that is associated with a greater prevalence of health risk behaviors.

As with any cross-sectional study and most studies of natural events, our results should only be considered in light of several limitations. Foremost among these limitations is our lack of pre-disaster data. As mentioned above, we are unable to ascertain whether the increased health risk behaviors exhibited by non-evacuees relative to evacuees were related to increased exposure or if the differences existed prior to the hurricane. Although this problem is inherent with disaster research (see La Greca et al.⁵ and Reijneveld et al.² for notable exceptions), future studies would benefit by obtaining retrospective pre-disaster reports of behavior from multiple informants (adolescent, parents, teachers). In addition, because the current questionnaire is part of a biannual standardized risk behavior survey, our questions on dating violence were predetermined and ask about behavior over the previous 12 months. Thus, some of the violence likely predated the hurricane. Future disaster research will benefit from querying specifically about the time since the traumatic event.

Another major limitation of this study is the fact that we do not have information on where students were displaced during or after the storm (e.g., with families, mass shelters, hotels), or the substantial number of students who did not return after the storm (~23% of the pre-

storm student body). It could be that non-returning students (and their families) experienced the most trauma and were forced (house destroyed; loss of employment) to leave or chose to not to return out of fear for future hurricanes. Alternatively, it could be that families with the most resources had the financial means to permanently leave. This study would have been strengthened had we been able to obtain information on these individuals.

Conclusions

Despite these limitations and regardless of the explanation for the findings, our results indicate that non-evacuating adolescents are at greater risk for engaging in substance use and experiencing teen dating violence in the year after a disaster. While previous research has demonstrated that adolescents' internalized psychological health is impacted after a natural disaster, these data, along with accumulating research,^{14,18,21} indicate that catastrophic events may also relate to externalizing behavior among adolescents. Further, these results support previous research showing that the intensity of exposure is of primary importance in predicting subsequent health. Indeed, by dichotomizing the sample into evacuees and non-evacuees we were better able to disentangle the effect of the trauma itself from the secondary stressors associated with the trauma (e.g., life disruption).^{4,12} Although additional research accounting for pre-disaster behaviors and post-disaster living situations are needed, these findings have implications for screening and the provision of mental health and health promotion services after a natural disaster. First, school personnel, medical personnel, and mental health service providers should consider screening for evacuation status in seeking to identify those adolescents who most need services after a natural disaster. Second, in addition to addressing internalized emotions and psychological symptoms associated with experiencing trauma, intervention programs should focus on reducing externalized behavior such as substance use and teen dating violence.

REFERENCES

1. Norris FH, Friedman MJ, Watson PJ, Byrne CM, Kaniasty K. 60,000 disaster victims speak: Part I An empirical review of the empirical literature 1981–2001. *Psychiatry*. 2002; 65:207–239. [PubMed: 12405079]
2. Reijneveld SA, Crone MR, Verhulst FC, Verloove-Vanhorick SP. The effect of a severe disaster on the mental health of adolescents: A controlled study. *Lancet*. 2003; 362:691–696. [PubMed: 12957091]
3. Weisler RH, Barbee JG, Townsend MH. Mental health and recovery in the Gulf Coast after Hurricanes Katrina and Rita. *JAMA*. 2006; 296:585–588. [PubMed: 16882968]
4. La Greca AM, Silverman WK, Vernberg EM, Prinstein MJ. Symptoms of posttraumatic stress in children after Hurricane Andrew: A prospective study. *J Consult Clin Psychol*. 1996; 64:712–723. [PubMed: 8803361]
5. La Greca AM, Silverman WK, Wasserstein SB. Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *J Consul Clin Psychol*. 1998; 66:883–892.
6. Shaw JA, Applegate B, Schorr C. Twenty-one-month follow-up study of school-age children exposed to Hurricane Andrew. *J Amer Acad Child Adol Psychiatry*. 1996; 35:359–364.
7. Vernberg EM, La Greca AM, Silverman WK, Prinstein MJ. Prediction of posttraumatic stress symptoms in children after Hurricane Andrew. *J Abnormal Psychol*. 1996; 105:237–248.
8. Drury SS, Scheeringa MS, Zeanah CH. The traumatic impact of Hurricane Katrina on children in New Orleans. *Child Adol Psychiatric Clinics North America*. 2008; 17:685–702.
9. Hensley L, Varela RE. PTSD symptoms and somatic complaints following Hurricane Katrina: The roles of trait anxiety and anxiety sensitivity. *J Clin Child Adol Psychol*. 2008; 37:542–552.
10. McLaughlin KA, Fairbank JA, Gruber MJ, Jones RT, Lakoma MD, Pfefferbaum MD, et al. Serious emotional disturbance among youths exposed to Hurricane Katrina 2 years postdisaster. *J Amer Acad Child Adol Psychiatry*. 2009; 48:1069–1078.

11. Overstreet S, Salloum A, Badour C. A school-based assessment of secondary stressors and adolescent mental health 18 months post-Katrina. *J of School Psychol.* 2010; 48:413–431.
12. Scheeringa MS, Zeanah CH. Reconsideration of harm's way: Onsets and comorbidity patterns of disorders in preschool children and their caregivers following Hurricane Katrina. *J Clin Child Adol Psychol.* 2008; 37:508–518.
13. Khoury EL, Warheit GJ, Hargrove MC, Zimmerman RS, Vega WA, Gil AG. The impact of Hurricane Andrew on deviant behavior among a multi-racial/ethnic sample of adolescents in Dade County, Florida: A longitudinal analysis. *J Traumatic Stress.* 1997; 10:71–91.
14. Marsee MA. Reactive aggression and posttraumatic stress in adolescents affected by Hurricane Katrina. *J Clin Child Adol Psychol.* 2008; 37:519–529.
15. Rohrbach LA, Grana R, Vernberg E, Sussman S, Sun P. Impact of Hurricane Rita on adolescent substance use. *Psychiatry.* 2009; 72:222–237. [PubMed: 19821646]
16. Danielson CK, Macdonald A, Amstadter AB, Hanson R, de Arellano MA, Saunders BE, Kilpatrick DG. Risky behaviors and depression in conjunction with-or in the absence of-lifetime history of PTSD among sexually abused adolescents. *Child Maltreatment.* 2010; 15:101–107. [PubMed: 19926627]
17. Kilpatrick DG, Ruggiero KJ, Acierno R, Saunders BE, Resnick HS, Best CL. Violence and risk of PTSD, major depression, substance abuse/dependence, and comorbidity: Results from the National Survey of Adolescents. *J Consult Clin Psychol.* 2003; 71:692–700. [PubMed: 12924674]
18. Wu P, Duarte CS, Mandell DJ, Fan B, Liu X, Cordelia J, et al. Exposure to the World Trade Center attack and the use of cigarettes and alcohol among New York City public high-school students. *Amer J Pub Health.* 2006; 96:804–807. [PubMed: 16571705]
19. Anastario M, Shehab N, Lawry L. Increased gender-based violence among women internally displaced in Mississippi 2 years post-Hurricane Katrina. *Disaster Med Pub Health Preparedness.* 2009; 3:18–26.
20. Harville EW, Taylor CA, Tesfai H, Xiong X, Buekens P. Experience of Hurricane Katrina and Reported Intimate Partner Violence. *J Interpers Violence.* 2010 May 21. [Epub ahead of print] PMID: 20495099.
21. Schroeder JM, Polusny MA. Risk factors for adolescent alcohol use following a natural disaster. *Prehospital and Disaster Medicine.* 2004; 19:122–127. [PubMed: 15453169]
22. Xiong X, Harville EW, Mattison DR, Elkind-Hirsch K, Pridjian G, Buekens P. Hurricane Katrina experience and the risk of post-traumatic stress disorder and depression among pregnant women. *Am J Disaster Med.* 2010; 5:181–187. [PubMed: 20701175]
23. CNN. [Accessed September 9, 2010] Ike wears itself out beating up on Texas. Available at: <http://www.cnn.com/2008/US/weather/09/13/hurricane.ike.texas/?xid=site-cnn-partner>.
24. Freeman DH, Temple JR. Social factors associated with lifetime history of sexual assault victimization among adolescents. *J Fam Viol.* 2010; 25:349–356.
25. Meyers, R. [Accessed September 9, 2010] GISD takes huge leap toward normalcy. Galveston County Daily News. Available at <http://www.galvnews.com/story.lasso?ewcd=c4fea7215f225506>.
26. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed., text rev.. Washington, DC: Author; 2000.
27. Bolton D, O’Ryan D, Udwin O, Boyle S, Yule W. The long-term psychological effects of a disaster experienced in adolescence: II: General psychopathology. *J Child Psychol Psychiatry.* 2000; 41:513–523. [PubMed: 10836681]
28. Baren JM, Mace SE, Hendry PL. Children’s mental health emergencies—Part 3: Special situations: Child maltreatment, violence, and response to disasters. *Ped Emerg Care.* 2008; 24:569–577.
29. Rowe CL, Liddle HA. When the levee breaks: Treating adolescents and families in the aftermath of Hurricane Katrina. *J Marital Family Therapy.* 2008; 34:132–148.
30. Temple JR, Freeman D. Dating violence and substance use among ethnically diverse adolescents. *J Interpersonal Violence.* 2011; 26:701–718.

Table 1

Percentage of adolescents not evacuating by age and race/ethnicity

	Male (n=76) % (n)	Female (n=42) % (n)
Age	<i>p</i> = .405	<i>p</i> = .443
14	15.6% (5)	12.2% (6)
15	12.9% (12)	6.6% (9)
16	18.6% (22)	7.1% (11)
17	12.9% (15)	4.8% (7)
≥18	21.2% (22)	9.1% (9)
Race/ethnicity	<i>p</i> = .014	<i>p</i> = .031
African-American	22.6% (23)	8.6% (12)
Hispanic	10.2% (20)	3.8% (9)
White	21.3% (26)	8.6% (14)
All other non-Hispanic	16.3% (7)	14.6% (7)

Notes:

1. Excluded Asian-American adolescents because there were too few participants for analysis
2. *p* values show association with evacuation status (e.g., we did not find a difference between evacuating and non-evacuating males with respect to age)

Table 2

Teen Dating Violence (TDV) by evacuation status among male and female adolescents.

	Males (n = 464)			Females (n = 584)		
	Unadjusted % (n)		Adjusted OR ^a (95% CI)	Unadjusted % (n)		Adjusted OR ^a (95% CI)
	Evacuees (n = 388)	Non - Evacuees (n = 76)		Evacuees (n = 542)	Non - Evacuees (n = 42)	
TDV Victimization	14% (54)	19% (14)	1.53 (0.78–3.01)	15% (79)	12% (5)	0.62 (0.22–1.77)
TDV Perpetration	6% (25)	18% (14)	3.19*** (1.50–6.80)	19% (101)	14% (6)	0.68 (0.28–1.64)
TDV Sexual Victimization	8% (31)	17% (13)	2.47* (1.17–5.23)	5% (27)	7% (3)	1.27 (0.33–4.86)
TDV Sexual Perpetration	4% (16)	13% (10)	3.73*** (1.50–9.28)	3% (19)	2% (1)	0.48 (0.06–3.64)

Note: Ns for specific analyses may differ due to missing data on individual dating violence variables.

* $p < .05$

** $p < .01$

^a Adjusted for race/ethnicity and age

Table 3

Substance use by evacuation status among male and female adolescents.

	Males (n = 464)				Females (n = 584)		
	Unadjusted % (n)		Adjusted OR ^a (95% CI)	Unadjusted % (n)		Adjusted OR ^a (95% CI)	
	Evacuees (n = 388)	Non - Evacuees (n = 76)		Evacuees (n = 542)	Non - Evacuees (n = 42)		
Cigarette Use	21% (78)	28% (20)	1.55 (0.84–2.85)	15% (79)	33% (14)	3.01 ^{**} (1.34–6.75)	
Alcohol Use	44% (163)	55% (40)	1.96 [*] (1.11–3.49)	44% (236)	49% (20)	1.25 (0.64–2.44)	
Episodic Heavy Drinking	29% (110)	41% (31)	1.83 [*] (1.05–3.19)	25% (137)	40% (17)	2.45 [*] (1.19–5.06)	
Marijuana Use	27% (104)	42% (30)	2.10 [*] (1.20–3.67)	19% (100)	39% (16)	2.97 ^{**} (1.46–6.04)	
Cocaine Use	3% (10)	16% (12)	5.41 ^{***} (2.06–14.22)	2% (13)	14% (6)	4.73 ^{***} (1.45–15.50)	
Inhalant Use	4% (15)	15% (11)	3.69 ^{**} (1.52–8.92)	3% (18)	15% (6)	2.85 (0.93–8.76)	

Note: Ns for specific analyses may differ due to missing data on individual substance use variables

* p < .05

** p < .01

*** p < .0001

^a Adjusted for race/ethnicity and age