

Flood-Related Work Disruption and Poor Health Outcomes Among University Students

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Abbreviation:

PTSD: posttraumatic stress disorder

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Abstract

Introduction: Globally, floods are the most common and among the most devastating of natural disasters. Natural disasters such as floods impact local businesses, increasing local unemployment by up to 8.2%. Previous research has linked individual losses from disasters with symptoms such as posttraumatic stress disorder. However, little is known about the impact of work disruption and job loss on post-disaster psychological symptoms. University students, who are often living far away from family support structures and have limited resources, may be particularly vulnerable. This study examines student psychological health following a large flood at a university.

Hypothesis: Students who experienced flood-related job loss or disruption had a higher proportion of psychological symptoms than those who did not experience job loss or disruption, controlling for individual loss such as injury, home loss or evacuation.

Methods: On June 8, 2008, a major flood affected seven US Midwestern states. A total of two dozen people were killed and 148 injured, although no deaths or serious injuries were reported in the population used for this study. At the study university, operations were closed for one week, and 20 buildings were severely damaged. A cross-sectional survey of all students enrolled during the semester of the flood was conducted. Students were sent an online survey six weeks after the flood. In addition to questions about damage to their homes, the survey asked students if their work was disrupted because of the floods. Symptoms of PTSD were measured through the modified Child PTSD Symptom Scale.

Results: Of the 1,231 responding students with complete surveys, 667 (54.2%) reported that their work was disrupted due to the floods. Controlling for gender, ethnicity, grade, and damage to the student's home, students reporting work disruption were more than four times more likely to report PTSD symptoms (95% CI, 2.5-8.2). Work disruption was independently associated with decreases in general mental and physical health following the floods, as well as with increases in alcohol use.

Conclusion: Disaster research has focused on damage to individuals and homes, but there has been little focus on work losses. Individuals who lose their jobs may be a vulnerable population post-disaster.

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Introduction

Floods are the most prevalent natural disaster found throughout the world, and affected an average of approximately 1.5 million people each year from 2000 through 2007.^{1,2} In 2008, the midwestern United States experienced the worst floods in recorded history, affecting more than 11 million people.² The University of Iowa was also severely affected by these floods, and was closed for one week. More than a dozen university buildings, including student residential halls, and major roadways into and out of campus were flooded. Two large dormitories were evacuated, and an unknown number of students lost their jobs because of the floods.

Little is known about the role of work loss on psychological recovery from disasters. While flood recovery efforts must focus on human health in the critical phase, long-term effects from income loss and reduced job availability could hinder psychological recovery. Sarmiento (2007) found that flooding in the United States between 1997 and 1999 increased local unemployment by an average of 3.4%; in areas with high property damage, the average unemployment increased by 8.2%.³ In one study of >10,000 flood-affected households in China, income loss accounted for 40% of total economic losses.⁴

While no studies have directly examined the psychological effects of flood-related work loss, several studies have identified a relationship between property and material losses in a disaster and poor psychological recovery. Property losses have been consistently related to poor psychological outcomes in studies of victims of volcanoes, floods, earthquakes, and hurricanes.⁵⁻¹¹ Only one of these studies measured work loss as “loss of livelihood,” and the study did not find a statistical relationship with psychological symptoms.⁹

No studies have examined the effects of natural disasters on work loss and psychological recovery among university students. University students are a vulnerable population because students are often living away from home for the first time, with reduced access to their families as a support structure. Most students work, usually part time, to support themselves and pay school bills, and often work in jobs that do not have extensive benefits or services. Students may not have financial reserves to rely on when their income is disrupted. Stresses associated with work loss may play an important role in the psychological recovery from a disaster. The goal of this analysis was to identify the role of work loss on symptoms of posttraumatic stress disorder (PTSD) six to nine weeks following the flooding.

Methods

Study Design and Population

A Web-based cross-sectional survey of University of Iowa students enrolled in the summer 2008 term was conducted. E-mail addresses were obtained from the Registrar's office after Institutional Review Board approval. E-mail requests to respond to the survey were sent out on three separate occasions, following the Dilman method.¹² Surveys were first sent six weeks after the apex of the flood in June 2008, with reminders sent through nine weeks. Although response to Web surveys is often low, the authors opted to use a Web-based survey because e-mail was thought to be the most effective method to reach students.¹³ Due to the high number of students who were evacuated and displaced following the floods, it was not anticipated that address lists would have accurate information about current residence locations. This survey was approved by the University of Iowa Human Subject Protection Committee.

Study Variables

The survey included questions about student demographics; flood experiences including evacuation; damage to buildings including the student's home; damage to belongings; displacement; and post-flood access to services (see Appendix in supplementary material online). Home was defined as students' campus-area residences. The primary exposure measure for this analysis was a question that asked “Was your job disrupted because of the floods?” A “job” was defined as any paid employment, whether through the university or externally. The survey did not include a question about whether or not the student worked prior to the flooding. Thus, students who responded “no” to the above question could either have not been working or had suffered no disruption to their jobs. Non-working students would be expected to have similar experiences with the floods as those who worked but had no disruptions. Thus, this study compared students who reported that their work was disrupted with those who either had no disruption or did not work.

The outcomes for this analysis were self-assessed health measures. Physical and mental health were assessed using a 5-point

	Student Population n (%)	Sample n (%)
Total	10,956 (100)	1,404 (100)
Gender ^a		
Male	5,155 (47.1)	466 (33.6)
Female	5,801 (52.9)	922 (66.4)
Missing	0	16
Grade ^a		
Freshman	140 (1.3)	15 (1.1)
Sophomore	704 (6.4)	81 (5.8)
Junior	1,542 (14.1)	178 (12.8)
Senior	2,274 (20.8)	378 (27.3)
Graduate	5,410 (49.4)	697 (50.3)
Other	886 (8.1)	38 (2.7)
Missing	0	17
International Student		
Yes	964 (8.8)	92 (6.7)
No	9,992 (91.2)	1,276 (93.3)
Missing	0	36

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Table 1. Characteristics of Enrolled Students and Student Survey Participants, University of Iowa, 2008

^aSignificant at $P < .05$ level.

Likert scale that ranged from poor to excellent. Posttraumatic stress disorder symptoms were measured with a modified Child PTSD Symptom Scale, which maps onto DSM-IV criteria.^{14,15} Participants must have been exposed to a traumatic event and have met the criteria for three subsets of symptoms: re-experiencing, numbing, and hyperarousal. Participants were asked to report the frequency (0 = not at all, 1 = once in a while, 2 = half the time, 3 = almost always) of experiencing 17 items that correspond to the three clusters of PTSD symptoms (i.e., re-experiencing, numbing and hyperarousal) (Cronbach's $\alpha = 0.89$). A total score was calculated (range 0-51), with scores >13 indicating PTSD symptoms.^{15,16} Students were also asked if their alcohol use increased following the floods.

Statistical Analysis

Using chi-square tests of independence, comparisons of demographic characteristics were made between the overall student population and the survey participants, and between participants who reported work disruption and those who reported no work disruption. Health outcomes, including PTSD, declines in physical and mental health, and increased alcohol consumption were compared by work disruption status. Odds ratios were calculated using logistic regression to predict health outcomes, with work disruption being the main exposure. Models were

	Work Disrupted n (%)	Work Not Disrupted n (%)	χ^2	P Value
Total ^a	667 (54.2)	564 (45.8)		
Gender			0.116	.73
Male	223 (33.8)	184 (32.9)		
Female	436 (66.2)	375 (67.1)		
Missing	8	5		
Grade			2.44	.49
Freshman/ Sophomore	46 (7.0)	37 (6.7)		
Junior/Senior/Graduated	265 (40.0)	234 (42.2)		
Graduate	336 (50.8)	264 (47.7)		
Other	15 (2.3)	19 (3.4)		
Missing	5	10		
Ethnicity			13.4	.01
White	517 (77.5)	482 (85.5)		
Hispanic	29 (4.3)	19 (3.4)		
Black	15 (2.2)	11 (2.0)		
Asian/Pacific Islander	56 (8.4)	22 (3.9)		
Other	6 (0.9)	3 (0.5)		
Missing	44	27		

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Table 2. Characteristics of Student Survey Participants by Reported Flood-Related Work Disruption, University of Iowa, 2008
^aExcludes 173 students who did not report information on work disruption.

controlled for damage to the respondent's home, which is one of the main predictors of PTSD in disaster literature, as well as gender, ethnicity (white and non-white), and grade (undergraduate and graduate).

Results

Of the 10,956 enrolled students who were sent survey emails, 1,404 responded (a response rate of 12.8%). These students were compared to the overall enrolled student population by gender, grade, and international student status. Responses with missing information on the primary exposure or outcome variables ($n = 173$, 12%) were excluded from analysis, and the remaining 1,231 respondents were included in this analysis.

Two-thirds of the survey respondents were female, compared with 52.9% of the enrolled student population ($P < .05$) (Table 1). Approximately half of the survey respondents and enrolled students were graduate students, which is typical for the summer semester. Seniors comprised over 27% of the survey participants, compared with 20.8% of seniors in the enrolled population. Fewer than 10% of participants and enrolled students were international students.

Of the 1,231 participants with complete data, 667 (54.2%) reported that they experienced flood-related work disruption and 564 (45.8%) did not (Table 2). Work disruption did not vary by

gender or grade. A higher proportion of non-white students, particularly Asian/Pacific Islander and Hispanic students, experienced flood-related work disruptions ($P = .009$).

For all students, the mean PTSD score was 3.88, with 7.8% meeting criteria for PTSD (Table 3). Among students reporting work disruption, the mean PTSD score was 5.1, with 11.8% meeting criteria for PTSD. The mean PTSD score (2.4) and proportion meeting PTSD criteria (3.0%) were much lower for students not reporting work disruption. A decline in physical health was reported by 14.9% of students with work disruption and 6.9% of those without. A larger proportion of students reported decline in mental health than reported a decline in physical health. More than a quarter of students with work disruption reported a decline in mental health, compared with 14.1% of those without work disruption. Increased alcohol use following the flood was reported by 9.2% of students with work disruption and 4.1% of students without.

Controlling for gender, ethnicity, grade, and damage to the home (one of the strongest predictors of psychological stress following a disaster), disruption to a student's work was independently associated with every type of negative health outcome measured after the flood (Table 4). Students with work disruption were 4.5 times more likely to meet criteria for PTSD than those without (95% CI, 2.5-8.2). Damage to the student's

Outcomes	Work Disrupted n (%)	Work Not Disrupted n (%)	Total n (%)
PTSD			
Yes	77 (11.8)	16 (3.0)	93 (7.8)
No	578 (88.2)	526 (97.0)	1104 (92.2)
Mean (SD) PTSD score	5.09 (7.76)	2.42 (4.16)	3.88 (6.52)
Missing	12	22	
Decline in physical health			
Yes	98 (14.9)	38 (6.9)	136 (11.2)
No	561 (85.1)	513 (93.1)	1079 (89.2)
Mean (SD) physical health score before the flood	4.2 (0.87)	4.1 (0.86)	4.1 (0.86)
Mean (SD) physical health score after the flood	4.0 (0.99)	4.0 (0.89)	4.0 (0.95)
Missing	8	13	
Decline in mental health			
Yes	164 (25.3)	77 (14.1)	241 (20.1)
No	485 (74.7)	470 (85.9)	955 (79.9)
Mean (SD) mental health score before the flood	4.2 (0.85)	4.2 (0.84)	4.2 (0.85)
Mean (SD) mental health score after the flood	3.9 (1.11)	4.0 (0.95)	3.9 (1.04)
Missing	18	17	
Increase in alcohol consumption			
Yes	60 (9.2)	23 (4.1)	83 (6.9)
No	593 (90.8)	531 (95.9)	1124 (93.1)
Missing	14	10	

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Table 3. Student Health Outcomes by Reported Flood-Related Work Disruption, University of Iowa, 2008

home had a stronger effect estimate of 7.1, and both work and home damage had independent effects on PTSD. Gender, ethnicity, and grade were not associated with PTSD.

Students with work disruption were more than two times more likely to report declines in physical health (OR = 2.2; 95% CI, 1.5-3.3) and mental health (OR = 2.0; 95% CI, 1.5-2.8) than students without work disruption. Home damage led to increased odds of 3.5 for decline in physical health and 5.0 for decline in mental health. Non-white ethnicity was associated with decline in physical, but not mental health. Undergraduates were more likely to report declines in both physical and mental health than graduate students.

Students with work disruption were 2.4 times more likely to report increased post-flood alcohol use (95% CI, 1.4-4.0). Male students, undergraduates, and those with home damage were also more likely to report increased alcohol use.

Discussion

Unlike the Great Midwest Flood of 1993, which caused 48 deaths, the Iowa floods of 2008 did not result in any known

fatalities, and few injuries were reported.¹⁷ However, the widespread infrastructure damage provided an ideal setting in which to examine predictors of poor health outcomes in the absence of large-scale physical trauma. University students, who may be a particularly vulnerable population, were studied.

More than half of the students in this large university sample reported that their work was disrupted as the result of the summer 2008 flooding. Overall, 7.8% of students reported symptoms of PTSD, while more than 11.8% of students reporting work disruption had PTSD symptoms. Work disruption was independently associated with poorer outcomes for all four measures of flood-related health outcomes.

The survey did not measure exactly how each participant's work was disrupted; loss of income, which could be the primary contributing cause to disaster-related stress regarding work, was not specifically measured. Of working students, approximately two-thirds of employed students reported working for the university, and the other third worked outside the university. Many of those who worked outside the university were employed by local small businesses, which were disproportionately affected

	PTSD		Physical Health		Mental Health		Increase in Alcohol Use	
	Crude OR (95% CI)	Adj. OR (95% CI) ^a	Crude OR (95% CI)	Adj. OR (95% CI) ^a	Crude OR (95% CI)	Adj. OR (95% CI) ^a	Crude OR (95% CI)	Adj. OR (95% CI) ^a
Work Disruption	4.40 (2.53-7.64)	4.52 (2.50-8.19)	2.34 (1.58-3.47)	2.20 (1.45-3.33)	2.06 (1.53-2.78)	2.03 (1.48-2.78)	2.30 (1.40-3.78)	2.35 (1.39-3.97)
Home Damage	6.37 (3.57-11.35)	7.14 (3.84-13.29)	3.54 (2.01-6.23)	3.52 (1.93-6.43)	4.86 (2.92-8.08)	5.02 (2.94-8.58)	3.84 (2.00-7.40)	4.81 (2.40-9.67)
Gender								
Male	1.23 (0.79-1.91)	1.33 (0.82-2.15)	0.93 (0.63-1.37)	1.00 (0.67-1.51)	0.92 (0.68-1.25)	1.01 (0.73-1.39)	2.03 (1.29-3.18)	2.26 (1.40-3.66)
Female	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ethnicity								
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-white	1.49 (0.86-2.57)	1.28 (0.72-2.29)	2.01 (1.30-3.11)	2.02 (1.27-3.21)	1.35 (0.92-1.98)	1.27 (0.85-1.90)	0.62 (0.29-1.31)	0.57 (0.26-1.23)
Grade								
Undergrad	1.01 (0.66-1.54)	1.22 (0.77-1.95)	1.36 (0.94-1.97)	1.61 (1.09-2.39)	1.31 (0.99-1.75)	1.41 (1.04-1.92)	1.85 (1.16-2.96)	1.86 (1.13-3.05)
Graduate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

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Table 4. Association of Student Flood-Related Work Disruption with Poor Health Outcomes, University of Iowa, 2008^aOdds ratios mutually controlling for gender, grade, work disruption, and home damage.

by the floods. Employees of the university did not have disruptions in their pay, even if they were unable to work.

Other mechanisms, however, may have contributed to post-flood stress. Because many of the roads, businesses, and university buildings were flooded, students may have been unable to access their workplaces. Regardless of economic losses, inability to get to work may have led to reductions in work-related social support and concerns about inability to perform work duties. At the university, for example, it was unclear for several days exactly which employees were supposed to report to work. Problems communicating with employees to convey flood-related work expectations could also have added to stress. Studies have found that uncertainty, although not tied specifically to work, is a predictor of PTSD and symptoms of depression in post-disaster populations.⁹ Future research should examine the causal pathways for work-related stress in post-disaster settings.

For most disasters, post-disaster resources focus far more on home and personal recovery than on work recovery, and this was true for the Iowa floods. In Iowa, post-flood unemployment insurance was provided for a shorter duration than standard unemployment, despite the fact that many workers permanently lost their jobs because of flood damage to businesses (such as local restaurants) and many small and medium businesses were closed temporarily or permanently. Resources to rebuild businesses are usually provided as loans, while FEMA resources for home recovery do not require re-payment.¹⁸ Studies of post-disaster loan programs have found that many businesses do not qualify, interest rates are too high for many businesses to repay,

and delays and red tape prohibit applications from many eligible businesses.¹⁸ Of the more than \$790 million in FEMA Individual Disaster Assistance funds approved six months following the flood, only \$89.2 million was for businesses, all of which was through loans.¹⁹

This study helps fill in the gap in knowledge about work-related stressors following natural disasters. Few studies have examined disaster-related work disruption, especially in the absence of damage to individual's homes.¹⁴ The available studies focus more on long-term financial loss at the community level or business-level recovery rather than individual effects of disaster-affected work.²⁰⁻²² Disaster victims who have work loss, even in the absence of home loss, may be a vulnerable population in need of both financial and mental health services following a disaster.

Ultimately, these psychological health effects will create a burden for both the individual and the workplace, as PTSD is associated with reduced work performance. The work environment, and occupational health providers in particular, may be able to play a key role in identifying and providing assistance to workforces affected by disasters. Following a disaster, employers must locate their workforces and assess their readiness for work. Part of this process could involve psychological screening and referral. Since a large proportion of the population is engaged in the workforce, employers can be essential in reaching victims that might not have access to other services. The potential involvement of businesses in the disaster response cycle is currently an untapped and poorly understood resource.

Limitations

This study had several limitations. The response rate was 12.8%, which, although low, was within expected online survey response rates.²³ Although response to Web-based surveys is often low, the responses can be representative if the base population is large and the sampled respondents are representative. Survey participants were more likely to be female and seniors than the overall student body, but otherwise characteristics of the sample were similar. The results of this study could overestimate the association with poor health outcomes if these over-represented groups were at higher risk for poor health.

Conclusion

More than half of the responding students reported that their work was disrupted due to the floods. Controlling for gender, ethnicity, grade, and damage to the student's home, students reporting work disruption were more than four times more likely to report PTSD symptoms. Work disruption was independently associated with decreases in general mental and physical health following the floods, as well as increases in alcohol use. Enhanced linkages and collaborations between the emergency response community and local employers have been identified as important factors for rapid response, and these links may also be helpful in long-term recovery efforts.

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