Health Status among Emergency Department Patients Approximately One Year after Consecutive Disasters in New York City

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Abstract

Objectives: Emergency department (ED) patients with disaster-related experiences may present with vague symptoms not clearly linked to the event. In 2001, two disasters in New York City, the World Trade Center disaster (WTCD) and the subsequent American Airlines Flight 587 crash, presented an opportunity to study long-term consequences of cumulative disaster exposure (CDE) on health-related quality of life (HRQOL) among ED patients. **Methods:** From July 15 to October 30, 2002, a systematic sample of stable, adult patients from two EDs in New York City were enrolled. Participants completed a self-administered questionnaire. The Short Form 36 (SF-36) was used to assess overall health status. Bivariate analyses were conducted to identify individual correlates of worsening health status. Multivariate regression was performed to identify the association between various factors and overall health status, while controlling for relevant sociodemographic variables. **Results:** Four hundred seventy-one patients (54.6% female) participated. The participation rate was 73.4%. One hundred sixty-one participants (36%) reported direct, indirect, or occupational exposure to the WTCD; 55 (13.3%) had direct, indirect, or occupational exposure to the plane crash; 33 (8.1%) had both exposures. In separate multivariate models, CDE predicted lower SF-36 scores for general health ($p < 0.0096$), mental health ($p < 0.0033$), and bodily pain ($p < 0.0046$). **Conclusions:** In the year following mass traumatic events, persons with CDE had lower overall health status than those with one or no disaster exposure. Clinicians should consider the impact that traumatic events have on the overall health status of ED patients in the wake of consecutive disasters. **Key words:** cumulative disaster exposure; September 11th; airplane crash; health-related quality of life; emergency department. ACADEMIC EMERGENCY MEDICINE 2005; 12:958–964.

Some patients seek medical care in the emergency department (ED) for worrisome, yet nonurgent, complaints. These nonurgent visits account for a majority of visits to the ED.[1–6] Several factors may influence nonurgent visits to the ED, including barriers to access to health care, perception of urgency, cultural beliefs, and other psychosocial issues.[1,2] In the setting of a natural or man-made disaster, overall ED volumes can often increase because of direct disaster event exposure.[7–11] However, it is possible that disaster exposure impacts ED census through an increase in the number of nonurgent visits.[12–14] For example, exposure to flash flood conditions in Puerto Rico was associated with a high prevalence of medically unexplained somatic symptoms.[14] Following the Enschede firework factory disaster in The Netherlands, the most common complaints among individuals directly affected were neck pain, shoulder pain, fatigue, and lethargy.[15] These somatic complaints were more prevalent than in a nonexposed comparison group.

The health toll on persons exposed to disasters can be significant.[15–23] Studies suggest that the long-term sequelae of serial traumatic exposures may be even worse than those of a single disaster alone.[24–26] Health status declined in a dose–exposure pattern in relation to multiple objective hurricane-related experiences in a study of adolescents.[27] The cumulative exposure to political violence,[28] as well as direct combat,[29] has been shown to have a dose–response effect on overall health status. In one study, successive exposures to an earthquake and subsequent political violence were associated with severe psychological decline.[30] These problems persisted three years after the initial evaluation.[31] In the year after an airline disaster, prior traumatic exposures were shown to be associated with greater crash-related stress.[32]

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Although there is a well-documented association between traumatic event exposure and mental health, there is a paucity of work that has assessed the impact of consecutive disasters on overall health-related quality of life (HRQOL) in clinical populations, such as the ED setting. In a nondisaster situation, researchers found that lower self-reported HRQOL was associated with frequent ED visits.[33] Reports from other clinical settings have shown that individuals with lower self-reported measures of HRQOL had increased health care costs, hospitalizations, and mortality.[34–36] Also, individuals with comorbid somatic conditions had lower self-reported HRQOL.[37] Investigating the long-term consequences of disasters on HRQOL may be an important first step in helping to define the extent of the problem and directing public health interventions.

The attacks on the World Trade Center on September 11, 2001, was the worst act of terrorism in the history of the United States.[38] The World Trade Center disaster (WTCD) has profoundly affected residents of New York City (NYC).[16–20] In the uncertain times following September 11, NYC experienced another airplane-related disaster. On November 12, 2001, American Airlines Flight 587 crashed shortly after taking off from JFK Airport.[39] We were interested in assessing the relation between exposure to these two disasters and HRQOL, and in investigating the factors that may be associated with poor HRQOL among local ED patients in the year following these disasters.

METHODS

Study Design. We conducted a cross-sectional study among adult patients (18 years of age or older) at two participating NYC EDs from July 15, 2002, to October 30, 2002. Data were collected from a systematic sample of patients, selecting every fifth person who presented for care with a nonurgent complaint. Participants were recruited by trained research staff and completed a 20-minute self-administered questionnaire after giving written consent. Logistic constraints limited participant recruitment to the hours between 10 AM and 10 PM.

Patients were excluded if they did not speak English or Spanish, were unable to give written consent, or were deemed by the physician on duty in the ED to have an urgent or emergent medical condition (i.e., to be unstable or have a life-threatening condition). Based on standard triage protocols, a person was deemed nonurgent if he or she had stable vital signs in the triage area and did not exhibit extreme distress or pain. The institutional review boards of all participating institutions approved the study protocol.

Study Setting and Population. This study was conducted in the ED of two urban hospitals: one is a large public teaching hospital located on Manhattan's Lower East Side, with an annual ED volume of approximately 90,000. It is considered the oldest public hospital in the United States. The other institution is a private, tertiary care university teaching hospital situated in northern Manhattan, with an annual ED volume of approximately 60,000. It is situated in a neighborhood with the largest Dominican population outside of the Dominican Republic.

Survey Content and Administration. The questionnaire inquired about the participants' demographics (age, gender, annual income, municipality of origin, etc.). The disaster exposure status of the respondents was determined by asking about their direct or indirect contact to one or both events. Respondents were classified as ''exposed'' to one of the disasters if they reported being personally exposed to an event, had a loved one who experienced a serious injury or was killed as a result of an event, or had been exposed to the victims of an event because of their occupations (firefighters, emergency medical services workers, police officers, construction workers, etc.). ''Exposure'' status entailed being in the vicinity of either disaster: south of Canal Street (WTCD) or in the Belle Harbor neighborhood of Rockaway, Queens (Flight 587). Exposed individuals were further divided into two outcome groups: ''single exposure'' and ''combined exposure.'' We asked about panic symptoms in the hours after the disasters consistent with the criteria for panic attacks in the *Diagnostic and Statistical Manual of Medical Disorders, 4th Edition*.[40]

We evaluated overall health status using the Short Form 36 (SF-36) instrument. The SF-36 is divided into eight component health measure scales. Health measures derived from the SF-36 are scored on a scale from 0 to 100, with higher numbers reflecting better health status.[33,41] The instrument has been validated and used extensively in a variety of clinical settings, and normative values have been estimated for the U.S. population.[41–48] We used three components of the SF-36 [general heath perception (GH), mental health (MH), and bodily pain (BP)] as surrogates of overall health status. The SF-36 has been shown to have a high reliability coefficient (>0.80) as well as having content, criterion, and construct validities. For comparison, we used the baseline mean SF-36 scores for GH (71.9), MH (74.7), and BP (75.2) for the U.S. population, which have been described elsewhere.[33,41] We scored these individual health measures according to the SF-36 interpretation manual.[41] We had the questionnaire translated from English into Spanish, and back-translated from Spanish into English. The survey was pilot-tested on English- and Spanish-speaking patients to verify grammar and syntax prior to starting the study.

Data Analysis. We used standard statistical software packages to carry out statistical analysis (SAS, Version 8, SAS Institute, Cary, NC). We identified a set of factors a priori that we thought were likely predictors of overall health status: age, gender, ethnicity, educational

level, income, exposure to one or both disasters, and having experienced a panic attack at the time of one of the disasters. Continuous independent variables were stratified. We conducted bivariate analyses to identify individual correlates of worsening health status, as quantified by the individual health measures of the SF-36 instrument. We calculated individual parameter estimates as well as overall estimates of association for each demographic variable using linear regression. In multivariate analyses, we included only those independent variables that were significant in bivariate analyses using an alpha of 0.1. Overall, we sought to identify the association between disaster exposure and overall health status (determined by component health measure scores of the SF-36), while controlling for relevant sociodemographic variables.

RESULTS

Five hundred ninety eligible patients were originally approached to participate. Of these, 471 patients (256 [54.6%] were female, 213 [45.4%] were male, and two withheld gender data) completed the questionnaire. The participation rate was 73.4%. There was no significant difference between the participants and nonparticipants on the basis of gender, age, or ethnicity. The respondents' mean age was 38.4 years (standard deviation ±16.2). Hispanics represented 52.3%, African Americans, 24.2%, whites, 13.7%, and others, 9.9% of the sample. Among the respondents, 243 (52.4%) had more than a high school education. One hundred nineteen (25.8%) reported being currently married. Of the respondents who answered questions about panic attack symptoms in the wake of one of the disasters ($n = 424$), 177 (41.8%) reported experiencing symptoms consistent with a peri-event panic attack.[40]

Table 1 summarizes the sample demographics and presents measures of bivariate associations. All results of bivariate analyses were evaluated using an alpha of 0.1 and are presented with 90% confidence intervals. Female gender, income level, higher educational level, peri-event panic attacks, and cumulative

TABLE 1. Demographic Data and Measures of Association between Variables and Bodily Pain (BP), General Health (GH), and Mental Health (MH) Short Form 36 Indexes

	MH			GH			BP		
	n	(%)	p-value	*n*	(%)	p-value	*n*	(%)	p-value
Gender	402		0.070	396		0.436	413		0.046
Female	217	(54.0%)		213	(53.8%)		222	(53.8%)	
Male	185	(46.0%)		183	(46.2%)		191	(46.2%)	
Age	388		0.635	383		<0.001	399		0.118
18–24 yr	50	(12.9%)		50	(13.1%)		51	(12.8%)	
25–34 yr	119	(30.7%)		120	(31.3%)		121	(30.3%)	
35–44 yr	89	(22.9%)		86	(22.5%)		92	(23.1%)	
45–54 yr	52	(13.4%)		52	(13.6%)		54	(13.5%)	
55–64 yr	43	(11.1%)		43	(11.2%)		44	(11.0%)	
65+ yr	35	(9.0%)		32	(8.4%)		37	(9.3%)	
Ethnicity	402		0.013	396		0.037	413		0.380
White	57	(14.2%)		58	(14.6%)		59	(14.3%)	
African American	98	(24.4%)		98	(24.7%)		99	(24.0%)	
Hispanic	207	(51.5%)		202	(51.0%)		214	(51.8%)	
Other	40	(10.0%)		38	(9.6%)		41	(9.9%)	
Income level	358		0.014	354		<0.001	363		0.006
<$20,000/yr	162	(45.3%)		159	(44.9%)		163	(44.9%)	
$20,000–29,000/yr	45	(12.6%)		45	(12.7%)		48	(13.2%)	
$30,000–39,000/yr	37	(10.3%)		36	(10.2%)		37	(10.2%)	
$40,000–49,000/yr	36	(10.1%)		36	(10.2%)		36	(9.9%)	
$50,000+/yr	78	(21.8%)		78	(22.0%)		79	(21.8%)	
Education	401		0.343	396		<0.001	411		0.034
Less than a high school degree	90	(22.4%)		87	(22.0%)		94	(22.9%)	
High school graduate or equivalent	88	(21.9%)		86	(21.7%)		90	(21.9%)	
More than a high school education	223	(55.6%)		223	(56.3%)		227	(55.2%)	
WTCD* and Flight 587 exposure	343		0.001	337		0.049	350		0.003
Not exposed to either event	195	(56.9%)		191	(56.7%)		196	(56.0%)	
Exposed to one disaster but not both	120	(35.0%)		119	(35.3%)		123	(35.1%)	
Exposed to both disasters	28	(8.2%)		27	(8.0%)		31	(8.9%)	
Peri-event panic attack	399		<0.001	393		<0.001	406		<0.001
Did not experience a panic attack	233	(58.4%)		226	(57.5%)		238	(58.6%)	
Experienced a panic attack	166	(41.6%)		167	(42.5%)		168	(41.4%)	

*WTCD = World Trade Center disaster.

TABLE 2. Disaster-related Events Experienced by the Respondents

Exposures	Total		Not Exposed		Exposed	
	n	(%)	*n*	(%)	*n*	(%)
World Trade Center (WTC) exposure						
Directly exposed to WTC attacks (in vicinity)	458	(97.24%)	375	(81.88%)	83	(18.12%)
Friends or family killed in WTC attacks	441	(93.63%)	394	(89.34%)	47	(10.66%)
Occupationally exposed to victims of WTC attacks	427	(90.66%)	361	(84.54%)	66	(15.46%)
Directly exposed *or* death of friend or family member *or* occupationally exposed to victims as a result of WTC attacks	447	(94.9%)	286	(63.98%)	161	(36.02%)
Flight 587 exposure						
Directly exposed to Flight 587 (in vicinity)	434	(92.14%)	411	(94.70%)	23	(5.30%)
Friends or family killed in Flight 587 crash	409	(86.84%)	378	(92.42%)	31	(7.58%)
Occupationally exposed to victims of Flight 587 crash	425	(90.23%)	414	(97.41%)	11	(2.59%)
Directly exposed *or* death of friend or family member *or* occupationally exposed to victims as a result of Flight 587 crash	414	(87.9%)	359	(86.71%)	55	(13.29%)
WTC *and* Flight 587 exposure						
Directly exposed *or* death of friend or family member *or* occupationally exposed to victims as a result of WTC attacks *and* Flight 587 crash	407	(86.41%)	374	(91.89%)	33	(8.11%)

disaster exposure were associated with lower BP scores. Age, African American race, income level, higher educational level, peri-event panic attacks, and cumulative disaster exposure were associated with lower GH scores. Ethnicity, income level, peri-event panic attacks, and cumulative disaster exposure were associated with lower MH scores.

Table 2 summarizes the number and nature of disaster-related events experienced by the respondents in our study. Overall, 161 (36%) respondents were exposed to the WTCD; 55 (13.3%) respondents were exposed to the Flight 587 crash; 194 (44.8%) were exposed to one of the two disasters; and 33 (8.1%) were exposed to both.

TABLE 3. Mean and Median Scores for Selected Short Form 36 Measures among Persons Exposed to Both Disasters, Persons Exposed to One Disaster, and Unexposed Persons

	n	Mean	95% CI	Median
Persons exposed to both disasters				
Mental health status	28	49.36	(39.79, 58.93)	52.00
General health perception	27	49.52	(38.16, 60.87)	47.00
Bodily pain	31	39.65	(29.65, 49.64)	41.00
Persons exposed to one disaster				
Mental health status	120	63.36	(59.41, 67.32)	64.00
General health perception	119	59.27	(54.62, 63.92)	60.00
Bodily pain	123	54.52	(49.25, 59.79)	52.00
Persons not exposed to either disaster				
Mental health status	195	65.93	(62.99, 68.87)	68.00
General health perception	191	62.35	(58.71, 65.99)	67.00
Bodily pain	196	58.92	(54.67, 63.17)	57.50

Table 3 presents selected SF-36 scores stratified by the degree of disaster exposure. Among individuals with cumulative disaster exposure, the mean SF-36 scores for GH (49.52, 95% CI = 38.16 to 60.87), MH (49.35, 95% CI = 39.79 to 58.93), and BP (54.52, 95% CI = 49.25 to 59.79) were considerably lower than the scores for those with a single exposure or no disaster exposure ($p < 0.0001$ for all). Although not directly comparable, the scores for those with cumulative disaster exposure were also considerably lower than published norms for the U.S. population.[33,41]

The results of regression models are shown in Table 4. In separate multivariate models, cumulative trauma ($p = 0.0046$ and $p = 0.033$, respectively), having a peri-event panic attack ($p = 0.005$ and $p < 0.0001$, respectively), and income ($30,000–$39,000 [$p = 0.011$] and $40,000–$49,000 [$p = 0.012$]; $30,000–$39,000 [$p = 0.027$] and $50,000+ [$p = 0.009$], respectively) predicted lower scores for BP and MH. Cumulative trauma ($p = 0.0096$), having a peri-event panic attack ($p = 0.081$), being 55 to 64 years old ($p = 0.0053$), and having more than a high school education ($p = 0.014$) predicted lower scores for GH.

DISCUSSION

In this study of ED patients from two large teaching hospitals in NYC one year after two successive disasters, a substantial number of participants had low overall health status according to their scores on the SF-36. Our data suggest that those with cumulative disaster exposures had poorer HRQOL scores compared with normative data for the general U.S. population. Individuals who reported cumulative disaster exposure had an appreciably lower overall HRQOL than those who did not. In separate linear regression models, cumulative disaster exposure and having a

TABLE 4. Regression Model with Explanatory Variables Predicting Mental Health (MH), General Health (GH), and Bodily Pain (BP) Short Form-36 Score

	MH			GH			BP		
	n	(%)	p-value	*n*	(%)	p-value	*n*	(%)	p-value
Overall model	306	(65.0%)	<0.001	297	(63.1%)	<0.001	309	(65.6%)	<0.001
Gender	306						309		
Female	169	(55.2%)	—				169	(54.7%)	—
Male	137	(44.8%)	0.600				140	(45.3%)	0.926
Age				297					
18–24 yr				40	(13.5%)	—			
25–34 yr				103	(34.7%)	0.967			
35–44 yr				65	(21.9%)	0.093			
45–54 yr				35	(21.9%)	0.232			
55–64 yr				32	(21.9%)	0.005			
65+				22	(21.9%)	0.336			
Ethnicity	306			297					
White	44	(14.4%)	—	44	(14.8%)	—			
African American	72	(23.5%)	0.893	71	(23.9%)	0.944			
Hispanic	160	(52.3%)	0.636	153	(51.5%)	0.606			
Other	30	(9.8%)	0.126	29	(9.8%)	0.543			
Income level	306			297			309		
<$20,000/yr	133	(43.5%)	—	129	(43.4%)	—	133	(43.0%)	—
$20,000–29,000/yr	37	(12.1%)	0.096	36	(12.1%)	0.384	39	(12.6%)	0.113
$30,000–39,000/yr	35	(11.4%)	0.027	33	(11.1%)	0.023	35	(11.3%)	0.011
$40,000–49,000/yr	31	(10.1%)	0.865	31	910.4%)	0.367	31	(10.0%)	0.012
$50,000+/yr	70	(22.9%)	0.009	68	(22.9%)	0.096	71	(23.0%)	0.122
Education				297			309		
Less than a high school degree				63	(21.2%)	—	66	(21.4%)	—
High school graduate or equivalent				56	(18.9%)	0.175	60	(19.4%)	0.472
More than a high school education				178	(59.9%)	0.014	183	(59.2%)	0.071
Disaster-related exposure	306			297			309		
Not exposed to either event	172	(56.2%)	—	167	(56.2%)	—	173	(56.0%)	—
Exposed to one disaster but not both	109	(35.6%)	0.899	106	(35.7%)	0.150	111	(35.9%)	0.198
Exposed to both disasters	25	(8.2%)	0.003	24	(8.1%)	0.010	25	(8.1%)	0.005
Peri-event panic attack	306			297			309		
Did not experience a panic attack	281	(91.8%)	—	168	(56.6%)	—	179	(57.9%)	—
Experienced a panic attack	25	(8.2%)	<0.001	129	(43.4%)	0.008	130	(42.1%)	<0.001

peri-event panic attack predicted lower GH, MH, and BP scores. Additionally, certain income levels predicted lower scores for BP and MH, while certain levels of income, being 55 to 64 years of age, and having more than a high school education predicted lower scores for GH.

The mean SF-36 component scores for this sample were lower among those with cumulative disaster exposure than those without any exposure. Importantly, those with exposure to both disasters had worse HRQOL scores than those with one disaster, and the latter had worse scores than the general population. These observations are broadly consistent with published research.[42–47] Among Hispanic immigrants in Los Angeles, California, individuals who had been exposed to political violence had lower scores in terms of overall general health perception, mental health, and chronic pain.[49] Even six years after the disaster at the Chernobyl nuclear power plant, persons exposed to the disaster had considerably lower scores on the SF-36 than those who did not.[50] In a population-based study evaluating the effects of psychological sequelae of an earthquake on HRQOL, worsening psychological dysfunction predicted worsening health measure scores on the SF-36.[51] In addition to cumulative disaster exposure, we found that experiencing panic attack symptoms during one of the disasters was associated with lower HRQOL measures on the SF-36 instrument. Our findings are in accord with those of other authors.[52–54] For example, in one study individuals suffering from panic attacks had lower overall SF-36 domain scores, and had significantly higher rate of unemployment, than age- and gender-adjusted population control subjects.[54]

LIMITATIONS

There are a number of limitations to this study. Since a cross-sectional study design determines both exposures and outcomes simultaneously, the issue of causality cannot be established.[55] Furthermore, a cross-sectional study design allowed only a snapshot

of an ongoing situation. However, the information gleaned from a cross-sectional study can help to focus attention and future resources on important public health issues, thereby aiding in long-term public health planning.[55,56] Also, the possibility of recall bias might have occurred, such that those with lower quality of life were more likely to have recalled exposure to these disasters. The participants in this study were enrolled via systematic sampling through an ED. Although our methods minimized any potential selection bias, our findings may not be generalizable to a different population.

Also, the ethnic and racial composition of our study population may affect the generalizability of the results. For example, we are uncertain whether the responses from our largely Dominican population reflect those of other Hispanic groups, or other ethnicities. In addition, we report population norms, which may not reflect those of immigrants in this country. For some questions, a small proportion of total sample was represented (e.g., only 306 respondents answered a given question from a sample population of 471). This potential respondent bias may create a problem in modeling and inference. Also, it is possible that participants drawn from a clinical setting may exaggerate the magnitude of health status differences between separate groups than would a nonclinical sample[55,56]; however, we were primarily concerned with the impact of disasters on an ED population. We suggest that this study, therefore, has particular relevance to practitioners in an ED setting.

CONCLUSIONS

A substantial number of ED patients in our sample had exposure to one or both consecutive disasters in NYC. Nearly a year later, the group exposed to both events scored lower with regard to overall health status compared with those with only one exposure, as well as with population norms. Cumulative disaster exposure and having a peri-event panic attack predicted lower overall health status. Clinicians should consider the impact that traumatic events have on the overall health status of ED patients in the wake of consecutive disasters.

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