



Risk Factors for Depression in the Survivors of the 1988 Earthquake in Armenia

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ABSTRACT *Most studies of psychopathology following disasters are concerned with posttraumatic stress disorder (PTSD). The present analyses sought to assess the rate and determinants of depression in adult survivors of the 1988 earthquake in Armenia. Unlike previous studies of earthquakes, the present analyses derive from a well-defined cohort of survivors who underwent diagnostic interviewing to characterize psychiatric morbidity. As part of a cohort study of 32,743 survivors of the 1988 earthquake in Armenia, a stratified population sample of 1,785 persons was interviewed about 2 years following the disaster using a special questionnaire based on the National Institute of Mental Health (NIMH) Disaster Interview Schedule/Disaster Supplement. 52% met the criteria for major depression. Of these, a total of 177 cases of depression with no other psychiatric diagnosis or comorbidity were compared with 583 controls from the same interviewed group who did not fulfill the criteria for any psychiatric disorder. Cases and controls were compared as to data obtained independently at the aftermath of the disaster on a number of exposures and characteristics related to the earthquake. More of the cases involved females (odds ratio [OR] for males 0.7 [95% confidence interval [CI] 0.5–0.9]) and from the city of Gumri, which had some of the worst destruction (OR for residents of Gumri 5.9 [95% CI 4.0–8.8]). Being with someone in the same building at the moment of the earthquake was protective for depression (OR for presence of other people 0.5 [95% CI 0.3–0.6]), and the risk of depression increased with the amount of loss that the family sustained as a result of the earthquake (OR for highest level of loss 2.5 [95% CI 1.3–4.8]). The use of alcohol was protective for depression (OR for those who drink 0.5 [95% CI 0.3–0.8]). In various models of multivariate adjustment and analysis, the increased risk of depression with loss, geographic location, and female gender was maintained. Also, being with someone during the disaster, receiving assistance and support after the earthquake, and alcohol use were protective for depression in these multivariate analyses. Depression is a common sequel to an earthquake. As with our previous study of PTSD, we were able to relate intensity of the disaster and loss to the risk of depression in a general population sample. The role of social support during and after the disaster as a protective mechanism against adverse psychological outcome was highlighted again.*

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Whereas alcohol use in our previous study was not related to PTSD outcome, it is noteworthy that in the present analyses it emerged as a protective factor for depression.

KEYWORDS *Alcohol Use, Depression, Disasters, Epidemiological Studies, Loss, Post-traumatic Stress Disorder, Social Support.*

INTRODUCTION

Psychiatric sequelae, particularly posttraumatic stress disorders (PTSD) and depression, are among the most important problems for populations exposed to natural disasters. Although PTSD, as a long-term consequence of various disasters, has been extensively studied over the past few decades, there have been relatively few population-based studies of depression following natural disasters. In studies involving selected groups following disasters,¹⁻⁴ the prevalence of depression has been estimated to vary between 10% and 50%. Such variability could only be partially explained by differences in definitions and study design. Differences in personal experiences, the nature of the disaster and its social context, and various epidemiological parameters need to be considered to account for a large component of such variation.

A number of the previous studies of depression in disaster situations have been based on clinical case material or ad hoc samples of the affected population, and very few have related the outcome to an actual assessment of the amount of loss.^{1,5,6} A review of psychiatric epidemiologic research on disasters by Bromet and Dew⁷ highlights the following as questions that need to be addressed: (1) Are the predictors of PTSD different from predictors of other disaster-related psychopathology? (2) Is social support an important moderator of the long-term psychological impact of disasters? In our previous publication about PTSD in Armenia, we found that intensity of loss was a determinant of PTSD, and that early support to survivors reduces the risk for PTSD.⁸

The December 7, 1988, earthquake in Armenia, which registered 6.9 on the Richter scale, hit the northern part of the Armenian Republic, making over a half million homeless, with about 25,000 estimated dead.^{9,10} As part of a special project for the Armenian Relief Society that collected data about the population in the aftermath of the earthquake, we initiated a number of epidemiologic studies that would provide the necessary intelligence about structural risk factors and appropriate protective behavior in the immediate period following the earthquake.^{11,12}

A case-control study that was conducted in the summer of 1989 in the city of Gumri identified a number of structural and behavioral risk factors for injuries during the earthquake.¹³ Following this case-control study, a large-scale cohort study was initiated to investigate various outcomes from a population perspective and to monitor the long-term health effects of one of the worst natural disasters of the 20th century.^{14,15} In addition, a stratified sample of the study population was independently ascertained for the presence of psychologic morbidity 2 years following the disaster. Thus, it became possible to relate psychological outcomes in this subsample to the detailed epidemiological database of the family and personal experiences during the earthquake. This article presents the findings of this population-based cohort study as to disaster-related determinants of depression following the 1988 earthquake of Armenia.

METHODS

Following a search for an appropriate study population that could provide a listing of membership to the day preceding the earthquake, it was decided to use the employees of the Ministry of Health who were living in the earthquake region on December 6, 1988, and their families as our study population for the longitudinal cohort. Listings of these employees were obtained from payroll and personnel sections as well as from the Republican Information and Computer Center of the Ministry of Health in Yerevan. From an initial list of 9,017 employees, 7,016 were located, primarily at their workplace. A comparison of the available information from the original listings revealed that persons that could not be traced included a larger proportion of physicians and employees who were posted in the city of Gumri compared to those that could be located. Following a definition of the variables of interest, an epidemiological questionnaire was developed in Armenian and pretested in Armenia. For exposures related to the earthquake, this epidemiological questionnaire inquired about lifestyle and habits of the individuals, including details about smoking and drinking before and after the earthquake. The questionnaires were administered to all 7,016 employees and were coded and entered for processing and analysis.

In addition to the epidemiological questionnaire, an interview instrument was developed in Armenian to assess the presence or history of psychiatric morbidity in this population. The instrument was based on the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition (DSM-III-R)* diagnostic criteria for five common psychiatric disorders: PTSD, major depression, panic disorder, general anxiety disorder, and phobias.¹⁶ As described elsewhere,⁸ the relevant probes about the key features of these disorders were adapted into Armenian from the Disaster Supplement of the National Institute of Mental Health Diagnostic Interview Schedule.^{17,18} Two of the investigators (H. S. A. and K. A.), in collaboration with local psychiatrists, developed a structured questionnaire on the mental and behavioral terminology in "popular" Eastern Armenian language best understood by the local inhabitants. This was tested on 25 individuals with and without exposure to the earthquake and modified in light of feedback given by them. As we were interested in defining depression in its entire range of severity, criteria for both major depressive and dysthymic symptomatology were extracted from *DSM-III-R*. We thereby developed a checklist of 17 items for depression. For the purposes of the current analysis, *major depression* was defined by the presence of 5 (of which depressed mood and/or decreased interest were obligatory) of the signs and symptoms for characterizing depression.

From our initial study population of 32,743 employees and their families, a geographically stratified sample of 1,785 persons between the ages of 16 and 70 years were interviewed using the special psychiatric questionnaire starting in June 1991 and lasting for about a year. Stratification aimed at including a larger representation from Spitak, the area closest to the epicenter of the earthquake, and Gumri, the urban agglomeration most affected by the earthquake. Thus, of the eligible population in Spitak, Gumri, and other parts of the earthquake zone, 32.4%, 11.6%, and 6.2% were interviewed, respectively. There were no major differences in the initial demographic and other characteristics of the subsample that underwent the psychiatric interview and the total study cohort of the same age range. The average interview time was compared for the various regions of the earthquake to assess variability in the use of the instrument. There was no statistically significant differ-

ence in interview time among these various regions within the earthquake zone. Also, there were no differences in interview time between the cases and the controls in this analysis. The same group of interviewers was used for the whole project.

From the interviewed sample, there were 929 persons (52.0%) who satisfied the *DSM-III-R* criteria for depression listed above. Considering that the majority of these 929 persons also satisfied the criteria for at least one more psychiatric disorder and to prevent major errors of diagnostic misclassification, for our case-control analysis a *case* was defined as a person who, in addition to depression, did not satisfy the criteria for any of the four other psychiatric conditions that were investigated in this study. A *control* was a person who did not satisfy the criteria for any psychiatric conditions examined in the interview. On the basis of these definitions, 177 “pure” depressive cases and 583 controls were included in the current analysis.

Three types of measures were used in this study to quantify the impact of the earthquake in material damage: (1) cumulative family loss as a scale of four components (loss of furniture, car, other commodities, and money); (2) maximum damage to residence; and (3) estimated total losses in rubles to provide a monetary value for loss.

Simple frequency distributions and cross tabulations provided an initial approach to the analysis. To adjust for the various factors, multivariate logistic regression analysis was used. Age was introduced in the models as a continuous variable. In addition to the adjustments, various other multivariate models were used to test potential interactions among the different variables.

RESULTS

Bivariate Analyses

Cases and controls were compared as to a number of personal characteristics at baseline interview (Table 1). Except for gender, there were no significant differences between the study groups. Males had a lower risk for depression compared to the females (odds ratio [OR] 0.7, 95% confidence interval [CI] 0.5–0.9). Another variable that was protective for depression was alcohol use (OR 0.5, 95% CI 0.3–0.8). The comparison of the study groups as to the different variables related to the earthquake and its intensity and damage revealed that persons from Gumri had an increased risk for depression (OR 5.9, 95% CI 4.0–8.8) (Table 2). None of the variables that measured building characteristics, location, and individual behavior during the earthquake showed any differences between the study groups except for the presence of other people in the building during the earthquake. The presence of another person at the moment of the earthquake was protective for depression (OR 0.5, 95% CI 0.3–0.6).

A relationship was observed between material loss and the odds of depression. Of the different measures of loss as a result of the earthquake, the summary measure of total loss of the family reflected best this relationship to the risk of depression (OR for severe loss 2.5, 95% CI 1.3–4.8). The presence of injury in the family, but not death, as a result of the earthquake was also significantly related to depression in the bivariate analysis only.

Multivariate Analysis

In various models of multivariate adjustment and analysis, the increased risk of depression with loss, geographic location, and female gender were maintained. Al-

TABLE 1. Frequency distributions of the cases of depression and the controls as to personal characteristics and odds ratios for these characteristics in the Armenian earthquake of 1988

Variables	Cases (n = 177)	Controls (n = 583)	Odds ratio	95% Confidence interval
Age, years				
16–22	36	46	1.0	
23–39	78	291	0.3	0.2–0.6
40–59	40	155	0.3	0.2–0.6
≥60	23	33	0.9	0.4–1.0
Gender				
Female	111	306	1.0	
Male	66	277	0.7	0.5–0.9
Education				
≤Secondary	57	180	1.0	
≥Secondary	120	403	0.9	0.7–1.4
Smoking				
No	138	411	1.0	
Yes	39	171	0.7	0.5–1.0
Drinking				
No	149	428	1.0	
Yes	27	155	0.5	0.3–0.8
Body mass index				
<30	139	465	1.0	
>30	36	113	1.1	0.7–1.7

so, being with someone during the disaster, receiving assistance and support after the earthquake, and alcohol use were protective for depression in these multivariate analyses. Considering that there was a very strong level of collinearity between geographic location and degree of loss and support received, geography was excluded from models in which these last variables were studied in the model (Table 3). Using stratified and multivariate logistic models, a search was made for interactions between the different variables. None of the models that were studied showed a significant effect modification.

Our analysis relating severity of depression to the severity of loss in the family as a result of the disaster showed that the gradient of the association between the level of loss and depression was maintained across different levels of severity of depression (Table 4).

DISCUSSION

From our estimate of the prevalence of depression in this population-based study following the 1988 earthquake in Armenia, we can state that depression is a major public health problem under such circumstances, as are other manifestations of psychiatric morbidity, including PTSD. Half the adult participants in this study were identified as fulfilling the criteria for major depression in the 2 years following the disaster. It is important to note here that the high levels of the frequency of the

TABLE 2. Frequency distributions of the cases of depression and the controls as to variables related to the earthquake and its impact and the odds ratios for these variables in the 1988 Armenian earthquake

Variables	Cases (n = 177)	Controls (n = 583)	Odds ratio	95% Confidence interval
Geographic location				
Kirovakan	78	457	1.0	
Spitak	10	37	1.6	0.7–3.5
Gumri	89	80	5.9	4.0–8.8
Presence of others				
Nobody	110	248	1.0	
With someone	67	336	0.5	0.3–0.6
Location at the time of the earthquake				
Outside a building	34	119	1.0	
Inside a building	143	464	1.1	0.7–1.7
Maximum damage				
Don't know	33	107		
Little	69	176	1.0	
Moderate	54	240	0.6	0.4–0.9
Severe	21	59	0.9	0.5–1.7
Cumulative family loss score				
0	25	109	1.0	
1	52	216	1.1	0.6–1.9
2	68	203	1.5	0.9–2.5
3+	32	56	2.5	1.3–4.8
Total family loss in rubles				
None	82	211	1.0	
<5,000	55	268	0.5	0.4–0.8
5,000–20,000	25	70	0.9	0.5–1.6
>20,000	15	33	1.2	0.6–2.4
Postdisaster assistance				
None	17	50	1.0	
Yes	160	534	0.9	0.5–1.6
Death within the family				
None	170	566	1.0	
Yes	6	17	1.2	0.4–3.2
Injuries in the family				
None	143	516	1.0	
Yes	33	67	1.8	1.1–2.9

condition compared to previous studies may be due to differences in methods of ascertainment as well as the time frame covered by these studies in the postdisaster period. The estimates of the frequency of depression and other psychiatric disorders derived from this study are cumulative and thus are bound to be closer to the upper limit of the true values. It is important to note that most of the cases fulfilling the criteria of depression were persons that had additional comorbidity. In particular, 73.4% of these persons also had PTSD. In addition to the earthquake, the popula-

TABLE 3. Best multivariate logistic regression model for depression as an outcome adjusting for all the other variables in the model for the 1988 Armenian earthquake

Variables	β	Odds ratio	95% Confidence interval
Gender			
Female		1.0	
Male	-.4	0.7	0.4–1.0
Drinking			
No		1.0	
Yes	-.6	0.6	0.3–0.9
During the earthquake			
Alone		1.0	
With someone else	-.8	0.5	0.3–0.7
Postdisaster support			
Low-none		1.0	
Yes	-.5	0.6	0.4–0.9
Postdisaster space			
No change		1.0	
Decreased	-.4	0.7	0.5–1.0
Cumulative loss			
Low		1.0	
High	.4	1.5	1.0–2.2

TABLE 4. Dose-response relationship between depression severity and disaster impact in the 1988 Armenian earthquake—expressed in odds ratios (95% confidence interval)

	Depression severity as measured by length of symptoms		
	<6 months	6 months–<1 year	1+ year
Family loss			
Little	1.0	1.0	1.0
Moderate	1.2 (0.5–3.0)	1.5 (0.6–3.7)	2.3 (1.2–4.4)
Severe	0.9 (0.2–4.1)	3.4 (1.2–9.7)	4.7 (2.2–10.1)
	Depression severity as measured by number of symptoms		
	5	6	>6
Family loss			
Little	1.0	1.0	1.0
Moderate	1.3 (0.7–2.4)	0.9 (0.4–2.0)	1.9 (1.0–3.6)
Severe	1.8 (0.8–4.3)	1.5 (0.5–3.9)	3.9 (1.9–8.0)

tion in Armenia has endured a major “civil” war with neighboring Azerbaijan, as well as overwhelming economic shortfalls since 1988 due to a large extent to a blockade applied by both Azerbaijan and Turkey. These have acted as independent stressors that predispose to depression. Recent population-based cross-sectional surveys in two regions of Armenia have estimated that over half the adult population fulfills the criteria for possible and probable depression.¹⁹ In at least one previous study,^{20,21} individuals exposed to the Lebanese civil war (in which material loss and death of family members was highly prevalent) were found to have high rates of bereavement depression, ranging from 16% to 41%.

The observation that the risk of depression is linked to the amount of loss that the person has sustained is an important finding that needs to be incorporated in the development of any effective preventive strategy. The more severe the condition—or the more stringent the criteria for diagnosis—the stronger was the relationship of depression with loss (Table 4). Persons with higher levels of loss should be specially targeted for remedial and preventive action. Our finding that the risk of depression was higher with injury of family members as well as with severe material loss emphasizes that a summary measure of loss may be as predictive of depression as specific types of loss. The relationship between loss and the risk of depression further affirms the need to consider the impact of such loss on psychiatric morbidity other than PTSD.

Although one may consider that the variation in risk for depression among the various townships of the earthquake region may be a reflection of the intensity of the disaster and the ensuing destruction and loss, the effect of the geographic location as a determinant of the disorder may be due to local variations in the social and subcultural milieu as well as group interactions in time of need. In the case of several of the geographic regions exposed to earthquake in Armenia, there was a “double disaster” or “double loss” because many survivors had not only survived the earthquake, but also had survived persecution and deportation from Azerbaijan.

The current study also identified factors that are protective against the development of depression in this population. Male gender and alcohol use were two such variables for which the effect was maintained following multivariate adjustment. One possible interpretation of this finding is that there are some subgroups of the population for whom learned behavior or habits may act as defense mechanisms against the development of depression. Alcohol itself may have reduced the impact of the emotional shock of the earthquake and its aftermath, thereby hypothetically reducing the cascade of psychobiological processes that could lead to depression. By contrast, the finding that it had no protective effect on PTSD in our previous study can be explained by the fact that alcohol, in promoting avoidance behavior, might have contributed to one of the cardinal features of PTSD. Avoidance is well known for being an early predictor of later PTSD, as shown in the Oklahoma federal building bombing.²² The association of alcohol use and psychopathology during disasters needs further study.

In assessing the results of this study, it is important to point to the fact that the current analysis dealt with cumulative incidence of depression. It is well known that the incidence of this condition may fluctuate over time. Thus, a cumulative incidence approach would identify the people who are at risk across, in this case, a 2-year period. The use of the epidemiological database, which was collected independently from the psychiatric questionnaire and that has the characteristics of the individuals and their families going back to the pre-earthquake period, was a major

strong point for this study. As a result of the linkage of the two data sets, it was possible to make some observations that have not been identified before.

The current study identified a group with a higher risk profile for depression and provides some approaches for planning a preventive strategy in disaster situations. Although depression and PTSD have different clinical characteristics, in a disaster situation PTSD is often associated with depression²³; indeed, depression is associated with PTSD in two thirds of the cases in the present study. In brief, loss might be a common mediating mechanism for both PTSD and depression. That a cumulative loss measure was best predictive of depression in the current analyses is a reflection of the fact that loss through death of family members was so prevalent in Armenia following the earthquake it did not by itself seem to make a specific contribution to depression. On the protective side, it can be said that social support represents a nonspecific, but powerful, mechanism of prevention of both depressive and PTSD morbidity, and social network disruption may have a deleterious effect.^{7,24}

To summarize, the main finding of the present study is that depression is a common sequel to an earthquake disaster and is strongly predicted by a cumulative loss measure. We had removed the cases of depression that were associated with PTSD. Therefore, the etiologic effect of loss in this analysis is independent of coexisting PTSD. The same can be said about the protective role of social support. Comparing the recent analyses with our previous study, alcohol use did distinguish depression from PTSD in that it was protective in the former and not associated with the latter.

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