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Long Term Mortality and Morbidity Related to Degree of Damage Following the 1988 Earthquake in Armenia

Haroutune K. Armenian,[1] Arthur K. Melkonian,[2] and Ashot P. Hovanesian[3]

To assess the relation of increased mortality and morbidity to personal loss and damage following the 1988 earthquake in Armenia, the authors conducted a prospective study of mortality and a nested case-control analysis of incident morbidity. Employees of the Armenian Ministry of Health and their immediate families (n = 35,043) who survived the disaster formed the study population. Two sets of interviews with the employees, carried out over a period of 4 years of follow-up, were used as the primary source of data for this study. The highest numbers of deaths from all causes and from heart disease were observed within the first 6 months following the earthquake. The nested case-control analysis of 483 cases of newly reported heart disease and 482 matched non-heart-disease controls revealed that people with increasing levels of loss of material possessions and family members had significant increases in heart disease risk (odds ratios for "loss scores" of 1, 2, and 3 were 1.3, 1.8, and 2.6, respectively). The findings were similar with regard to the relation of damage and loss to newly reported hypertension, diabetes mellitus, and arthritis. The findings of this study support the hypothesis that longer term increased rates of heart disease and chronic disease morbidity following an earthquake are related to the intensity of exposure to disaster-related damage and losses. People sustaining such losses should be closely monitored for increased long term morbidity. *Am J Epidemiol* 1998; 148:1077–84.

heart diseases; morbidity; mortality; natural disasters; stress

Investigators who have studied mortality and morbidity resulting from earthquakes have limited their investigations to the period immediately following the disaster and have studied primarily injuries and their effects (1–5). Katsouyanni et al. (6) compared death rates within the first week after the 1978 earthquake in Thessalonika, Greece, with predisaster mortality using death registration records. They reported a threefold increase in cardiac deaths and a 1.6-fold increase in risk for deaths from all causes following the earthquake (6). Similar results were reported following the Athens earthquake of 1981 (7). Trevisan et al. (8, 9), comparing employees of an Olivetti factory before and after the 1980 earthquake in Naples, Italy, reported higher heart rates and serum cholesterol and triglyceride levels within the first few weeks after the earthquake in the exposed sample. Although higher rates of morbidity and mortality, particularly from coronary heart disease, have been reported following a number of earthquakes, the direct relation of such increases in mortality and morbidity to damage and personal loss, as well as to various exposures incurred during the earthquake, has not been demonstrated (10–12).

On December 7, 1988, at 11:41 a.m., an earthquake registering 6.9 on the Richter scale hit the northern part of the Armenian Republic (13). Half a million to 700,000 persons were made homeless, with deaths estimated at 25,000. More than 21,000 residences were destroyed (14). To document health and illness patterns in the affected population in the aftermath of the earthquake, we initiated a number of epidemiologic studies that investigated determinants of mortality and morbidity resulting from the disaster (15). Our initial case-control study, conducted in the summer of 1989 in the city of Gumri (known as Leninakan at the time of the earthquake), identified a number of structural and behavioral characteristics that put individuals at higher risk of injury during the earthquake (16). On the basis of the findings from the case-control study in Gumri, a larger cohort study involving the whole of the region exposed to the earthquake was started to monitor the long term health effects of the earthquake. This paper presents the findings of the larger cohort

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[1] Department of Epidemiology, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, MD.
[2] Department of Public Health, American University of Armenia, Yerevan, Armenia.
[3] Republican Information and Computer Center, Ministry of Health, Yerevan, Armenia.
Reprint requests to Dr Haroutune K Armenian, Department of Epidemiology, Johns Hopkins School of Hygiene and Public Health, 615 North Wolfe Street, Baltimore, MD 21205