CHAPTER 7

THE 1980 EARTHQUAKE IN SOUTHERN ITALY - MORBIDITY AND MORTALITY

by

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Earthquakes are of great public health importance and yet, there is a considerable lack of data on which preparedness and relief management can be based. In this paper, the results of a study of the effects on health of the 1980 earthquake in Southern Italy are presented.

The aims of the study were : (1) to study risk factors for injury and death; (2) to identify the most appropriate type and timing of rescue. Some problems of rescue of trapped victims and mortality have been reviewed elsewhere.

METHODS

Sampling: The reference population comprised those people living in the region most affected by the earthquake within which seven villages, covering an area of 261 km^2, were selected for study according to criteria such as a crude injury rate of over 50 per thousand and a mortality rate of over 20 per thousand.

One in three households were chosen randomly using the population registers as the sampling frame. Thus, the sample was composed of 1 300 households (total 3619 people), whose members were in the study area on the day of the disaster.

Definitions: The "injured" were classified as those who reported themselves as being injured and could describe the type and part of the body affected. People who died immediately as a consequence of impact, or people who were found dead when extricated, were classified as "early deaths from impact". A "casualty" was defined as a person either dead

or injured from impact. A person was classified as "trapped" when he/she had been trapped underneath debris or locked into an enclosed space and needed intervention from outside to be freed, alive or dead.

Collection of Data: The survey was performed 18 months after the quake. Local interviewers, trained on site, completed a standard questionnaire during home visits.

Data collected in the field were transferred directly from the questionnaire onto a microcomputer.

RESULTS

Trapping: The casualty rates (deaths and injuries) were 80% in trapped people and 9% in the non-trapped, giving a total of 19.7% among the 3619 people surveyed. Death rates were 35.0% in trapped versus 0.3% in non-trapped individuals; injury rates varied similarly according to trapping, 45.0% and 8.7%. The ratio of injuries to deaths was respectively 1.3 injured to 1 death in trapped and 26.6 injured to 1 death in non-trapped individuals.
Age-specific death rates were similar in all age groups and there were no statistically significant differences in overall rates of death and injury between the sexes.

The probability of being alive at extrication from the debris declined sharply over time. During the first day, 333 (93%) of the trapped people who survived were rescued. Among the people who died before being extricated from the debris, 17 (9%) were reported to have shouted for help.

Time at which injuries were sustained: Nearly all injuries (97%) observed in survivors were sustained at the time of impact or within half an hour, irrespective of whether or not the victim had been trapped.

Location at the time of the earthquake: At the time of impact (7.34 p.m. Sunday 23rd November, 1980) most of the people (83.1%) were inside their houses (Table 1). The mortality was similar for the people inside their

houses and for those how were outside in the open air (5.5%). The mortality amongst people in bars and dancing places was significantly higher (9.3%) ($p<0.01$).

Although the proportion of people trapped was higher among people caught by the tremor inside the house (15.8%) than among those outside (9.7%), death rates were higher in the people trapped outside (53.3%) than in those trapped inside (32.8%). Of those in public places 19.8% were trapped and about half (46.9%) of those trapped died.

The proportion of trapped victims and the death rates increased significantly according to the number of floors in buildings ($p<0.01$). The occupants of the ground floor experienced, on average, a lower risk of trapping (8.5%) and death (3.0%) than those on any higher floor, of whom 26.6% were trapped and 9.2% died. However, there is no evidence of variation in rates of trapping or death above the ground floor.

Physical damage to houses was classified into three degrees: house habitable; house uninhabitable but reparable; house inreparable. There was a highly significant association ($p<0.01$) between degree of damage, on one hand, and proportion of trapped and early death and injury on the other. This association was independent of the association with the numbers of floors in the building.

Level of education and occupation: Level of education did not influence the mortality of injury rates. Similar rates of injury were observed for people of different occupations. However, the mortality of farmers was significantly lower (1.8%) irrespective of whether they were indoors or out at the time of impact.

Behaviour: In all 1.850 of the survivors (55%) ran outside immediately, while 14.8% waited until the end of the tremor or stayed inside. A much higher proportion of people were injured among those who had stayed inside (38.9%) than among those who had run outside (27.8%).

Age, sex, the number of floors and part of the building occupied did not significantly influence the behaviour of the surviving population.

Of the population who escaped death, 606 (18%) were recorded as having assisted in rescue work, three quarters of them being men. The overall proportions of injured and uninjured survivors who assisted in rescue work were similar. However, uninjured survivors from irreparably damage houses participated more in the rescue work than the injured, while the reverse was observed for the less damaged houses. It has also been shown that of the trapped victims who were evacuated for medical care elsewhere, 90% were extricated by inhabitants of the village itself.[1] Thus, the stricken population itself carried out most of the rescue work.

Absence of Company: Individuals alone at the time of the impact experienced a significantly higher mortality than those in houses in which there were two or more occupants (Table 5). People living alone lived in houses which were more often irreparably destroyed, they were more often trapped in the debris, tended to be extricated later and their death rate was higher. All these differences were statistically significant.

Injuries: In almost half of the cases (233/514) more than on part of the body was affected. Therefore, classification was made according to the most severe lesion. Lacerations were the most frequently observed (42.2%), followed by contusions (26.5%), fractures (18.9%) and cuts (9.7%). Amongst people with one reported site of injury, the legs were the most frequently injured (39%), followed by the head (23.2%), chest (18.9%), arm (16.4%) and pelvis (2.5%).

The ability to walk was used as a screening test to assess the severity of injuries; 44.5% of all injured victims could walk without help, 22.8% needed help and 32.7% could not walk at all. The same proportions were observed within each age group.

Sequelae over 18 months: The use of tranquillizers was investigated; 9% of the surviving inhabitants started taking tranquillizers after the earthquake and this was noted three times more frequently amongst injured survivors (22.5%) than amongst physically unharmed inhabitants (7.5%). Half of the survivors still used them 18 months later.

A significant association was found between the ability to walk after injury and subsequent death or other physical sequelae. Of those entirely unable to walk 4.8% died and 23.6% experienced other sequelae as compared to 0.9% and 6.5% respectively among those able to walk without help.

The mortality of the injured victims surviving impact and extrication was compared to the mortality of the uninjured. The mortality rate of the 2903 uninjured was 14.1 per thousand, 15.8 per thousand when adjusted for the age structure of the injured. Of the 514 injured victims, 13 (25.3 per thousand) died. Of these 13 deaths, three occurred within 24 hours and three others on the second day. When these six cases are excluded, the mortality rate of the injured victims becomes 13.7 per thousand (7/508). Thus, from two days after the earthquake onwards, there was no significant difference in mortality between injured and uninjured victims.

DISCUSSION

In the seven villages studied, all the deaths and injuries which occurred within 48 hours of the impact were associated with the collapse of houses. No casualties from other causes were reported among the population exposed to the earthquake. A similar observation was made after the major earthquake in Guatemala in 1976, which also caused massive destruction and high rates of mortality and injury.

As might be expected, trapping was the major factor associated with casualties. Death rates were one hundred times, and injury rates more than five times, higher in trapped than in non-trapped people. Although it is not possible to determine whether a trapped person died immediately or survived for some time under the debris, the substantial proportion (9%) of trapped people who reportedly shouted for help but who died before being resuced, indicates that more people might have been saved if they had been extricated sooner.

The declining proportion of people found alive associated with increasing delay in extrication, which parallels the observation made in China after the Tangshan earthquake in 1976 (Wenkui Mai, personal

communication), shows that relief efforts should concentrate on the rescue of trapped victims.

It is generally accepted that the ratio of the injured to the dead following earthquakes approximates 3.5. Use of this ratio is advocated for the rapid assessment of medical needs after earthquakes. The Italian resultst show that this ratio depends on the proportion of people trapped; the more trapped victims, the smaller the ratio.

The proportion of victims trapped, and consequently the casualty rate, depends on the type of building. Death and injury rates are also associated with the number of floors in the house (Table 2). This has implications for prevention in earthquake-prone areas, where old houses with several floors should either be reinforced whenever possible or abandoned. The much higher death and injury rates among those whose houses were irreparably destroyed, confirms the risk presented by dilapidated buildings.

Retrospective comparison of behaviour between injured and non-injured survivors suggests that running out of the house decreases the casualty rates. However, it is not known how many people were trapped and died while attempting to escape from their homes. The injury rate amongst the surviving population who escaped from the house would be expected to be lower, since it may be supposed that only those individuals who were the fittest and who found it easiest to make good their escape were apt to run quickly. Injury itself could also have influenced the victim's behaviour. However, the lower mortality rate (3%) of the occupants of ground floors, and this irrespective of the number of storeys in the building, supports the idea that the possibility of escape is crucial for survival. Construction of safe emergency exists, especially in higher buildings, should be strongly recommended.

It has been suggested that the most effective rescue work immediately following an earthquake is carried out by the survivors, external help arriving too late to have a significant effect on death rates. In this survey, nearly all injured victims who received medical care were rescued by the inhabitants.

However, a surprisingly low proportion (18%) of the surviving population were engaged in rescue work. The people had not been trained in rescue work, and the means used to extricate victims were not always appropriate.

The proportion of survivors performing rescue work increased with the degree of damage to their own homes, which suggests that rescue was concentrated on those sharing the same dwelling. The considerably higher death rates in individuals who were alone at the time of impact provides further evidence that survivors did not tend to engage in rescue work outside their own narrow circle. This has obvious implications for education towards self-help rescue work in earthquake-prone communities.

In this survey, about 90% of the victims were treated on site or admitted to medical centres within three days of the impact. Thus, a found in Central America, it appears that the duration of the emergency phase is a crucial issue in the preparations to send medical relief teams.

For the 18 months following the second day after the earthquake, mortality rates in injured and uninjured people were similar. Possibly explanations for this apparently surprising observation could be the effectiveness of the immediate medical care, and/or differential survival such that only the cases with comparatively slight injuries survived under the debris.

A substantial proportion of people complained of post-traumatic physical sequelae many months after the earthquake. Thus, in order to assess the overall adequacy of care, it is necessary to obtain estimates of the prevalence of disaster-related handicaps according to severity, in addition to the figures on mortality and injury. This would indicate whether there is a need for specialists in traumatology both to collaborate with the team giving immediate medical relief and to follow-up the injured victims in the longer term.

These results point to the need to establish, in each disaster-prone area, a health evaluation system from which not only could those organizing outside help obtain first-hand information, but also through which

data could be collected in view of improving the preparedness and self-reliance of the stricken community itself. In this way, each disaster would not be a new one.