Health Sector Implications of the 1988 Earthquake in Yunnan Province, China

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Earthquakes are a major source of concern in China. More than 32 per cent of its landmass is at high seismic risk and frequent earthquakes cause significant mortality and structural damage. Six major earthquakes have occurred in China since January 1988, in addition to the devastating 1976 Tang Shan earthquake which killed over a quarter of a million people. The government gives serious support to immediate emergency response, but less attention has been paid to the critical role of the health sector in mitigating or preventing the effects of earthquakes. Certain epidemiological characteristics of earthquake related morbidity and mortality have very clear emergency preparedness implications. For example, in Tang Shan (1976), the proportion of persons extricated alive dropped from 81.0 per cent within the first 24 hours to 33.7 per cent in the days that followed. In fact, over 70 per cent of all extrication occurred within 24 hours of the earthquake's impact. This underscores the critical importance of local preparedness over dependence on external assistance (Table 1).

BACKGROUND

Yunnan province (population: 36,000,000) is located in the south of China, bordering Laos and Vietnam to the south and Burma to the east (Figure 1). It is largely mountainous (94 per cent) with a poor telecommunications network. The region is mineral-rich and self sufficient in food production. Yunnan enjoys temperate weather for year round active agriculture. Altitudes vary from 14 metres above sea level (near the Vietnam border) to 6,700 metres in the Tibetan Autonomous Region.

Yunnan recently moved up from 24th to 13th in the ranking of provinces by Gross National Product per Capita. Progress in the health sector parallels this change in the GNP. In 1949, Yunnan had 96 health units and 961 medical staff, and today there are 3,000 health units with more than 120,000 health personnel. Life expectancy has increased from 44 to 61.7 years in the same period.

The province is vulnerable to a wide array of disasters with forty-seven major events recorded since 1949 (Table 2). The most frequent of these have been earthquakes, from which serious damage has resulted. Seismic activity is associated with three separate fault lines which stretch across the province (Figure 2).

THE 1988 EARTHQUAKE

On November 6, 1988 two earthquakes measuring 7.6 and 7.2 on the Richter scale struck West Yunnan province at 21.03 and 21.06 hours respectively. The epicentres were located at 22.9° North and 100.1° East (Figure 3). The epicentre (shock impact)

TABLE 1
People extricated after the 1976 Tang Shan earthquake

Time after the earthquake	*People extricated*	*People extricated alive*	*Percentage alive*
30 minutes	2377	2357	99.3
24 hours	5573	4513	81.0
48 hours	1638	562	33.7
72 hours	348	128	36.7
96 hours	395	75	19.0
120 hours	495	34	7.4
Totals	10789	7669	71.1

Source: Bureau of Public Health, Province of Hebei, December 1977

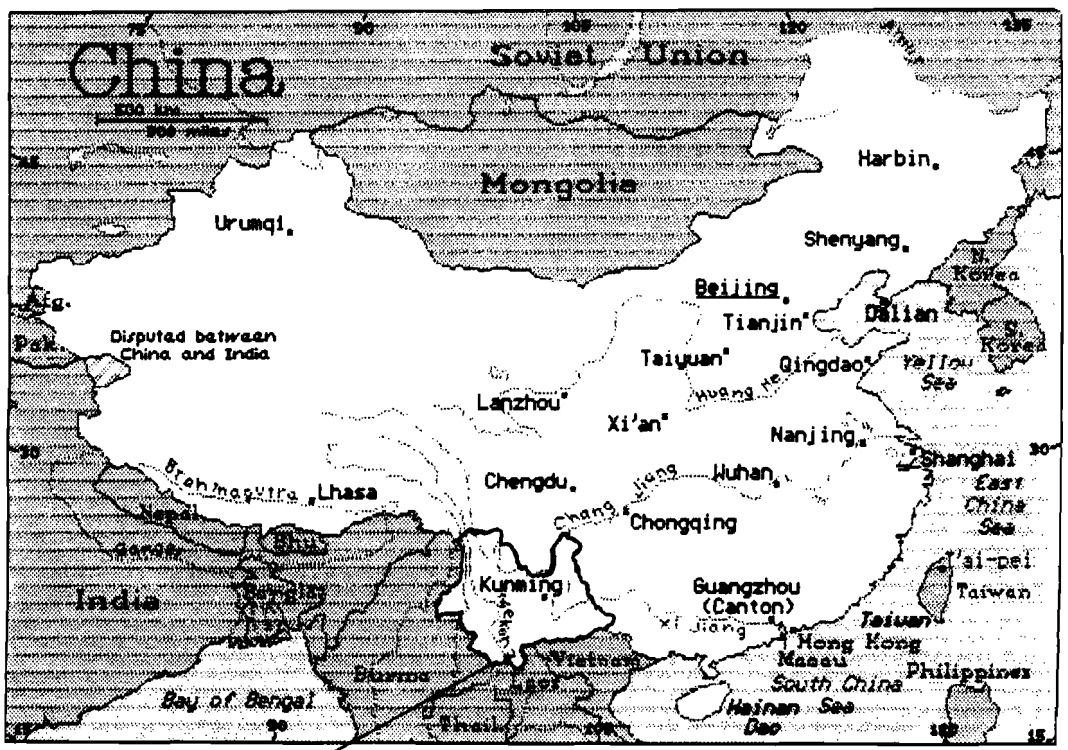


FIGURE 1 *Location of Yunnan Province (adapted from Software Toolworks, World Atlas, 1990)*

TABLE 2
Health impact of disasters in Yunnan Province, 1949–89

Disaster type	*Deaths*	*Minor Injuries*	*Serious Injuries*	*Total events*
Earthquake	642	8827	749	19
Landslide	206	376	115	5
Toxic	1732	519	402	14
Flood	16048	20402	6111	6
Fire	1424	1222	448	2
Hailstorm	98	89	461	1
Totals	20150	31435	8286	47

Source: Ministry of Public Health, Beijing, Disaster Events Data Base (preliminary data)

covered a rectangle of 150 by 50 kilometres. Strong effects of the main shocks were experienced more than 400 kilometres away in the provincial capital of Kunming. Following the main shocks, approximately 200 aftershocks occurred ranging between 3 and 6.9 on the Richter scale. Three of these aftershocks varied between 6.0 and 6.7 and seven others between 5.0 and 5.9.

The official statistics reported 748 dead, 7,751 injured, approximately one millon homeless and 5.3 million residents affected. Direct economic losses were estimated at 2.5 billion Yuan (approximately 500 million US dollars). Of the 400,000 homes and buildings destroyed, 1,300 were school buildings and 98 were hospitals and clinics.

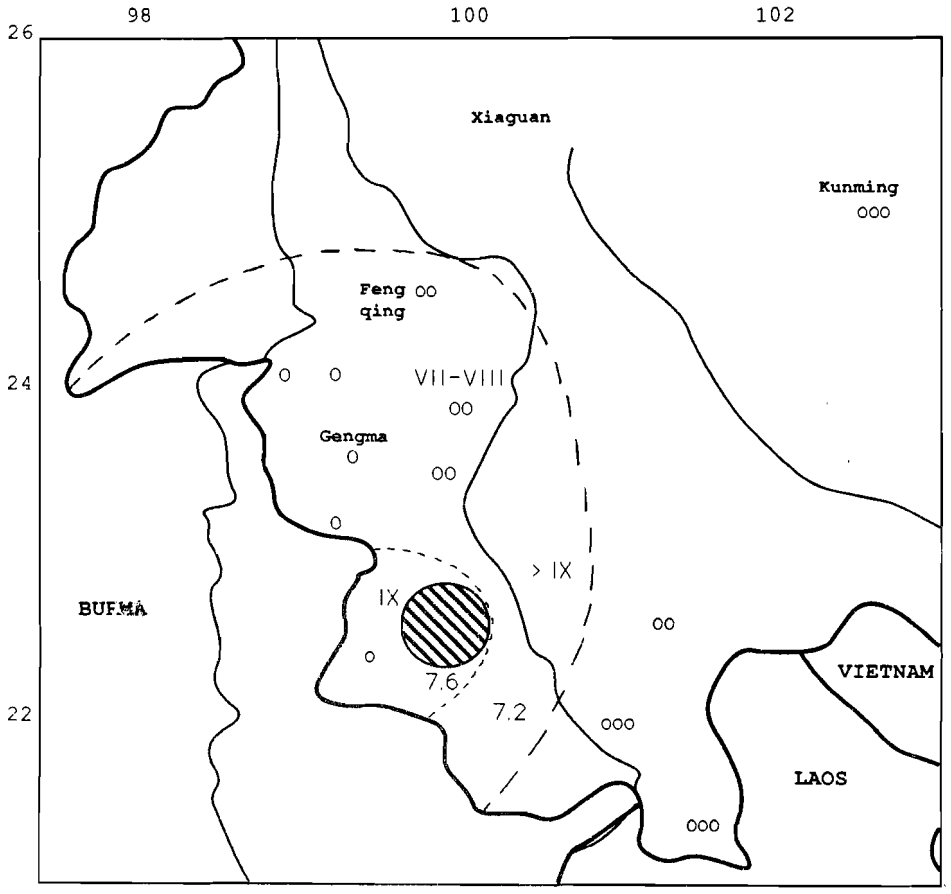
The first relief groups to arrive were the local security police and the army. The medical teams from Kunming arrived 36 hours later. Epidemiological data on patterns of injury, cause of death and survival and mortality trends of persons extricated alive are not easily available. Limited data from the Kunming Preventive Hospital have provided valuable insights.

Care was provided in Kunming for 128 patients who were transported from the earthquake site. These patients were subsequently released from the hospital. Information on the number of patients who died on the way to hospital and following hospital admission was difficult to obtain. To obtain clearer figures, it might be possible to trace individual records.

Of the 128 patients treated in Kunming, 18 per cent had multiple injuries, which can be classified into three main groups: open wounds, crush syndrome and disjointed limbs. There were, in addition, six cases of spinal injuries.

Secondary injuries appeared to be a serious problem in this sample. There were 21 burn cases from fires following the earthquake. Every burn case suffered subsequent infection. There were ten major trauma cases caused by accidents. Six of these were car accidents and four were related to exposed construction metal in collapsed buildings. Seven cases of 'normal' crisis occurred, including one ruptured uterus and two severe haemorrhages resulting from childbirth.

The 19 earthquakes in Yunnan have killed 18,897 persons with a single earthquake average of 1,000 persons killed and 50,000 injured (These figures should be treated with caution since the definition of 'injured' is not stated.). The destruction of all of the health facilities in the affected areas



Note: Adapted from maps provided by the Bureau of Medical Administration and the Red Cross of Yunnan Province. Roman numerals indicate range on Mercalli Scale; Arabic numerals represent the Richter Scale reading.

Key
o: telephone disrupted
oo: buildings partially collapsed
ooo: strongly felt

FIGURE 2 *Impact of the 1988 Yunnan earthquake by structural intensity, measured on the Mercalli Scale, I–XII*

during the 1988 earthquake necessitated assistance from neighbouring regions. The absence of immediate impact epidemiological profiles of death and injury reduced the effectiveness of preparedness and preventive planning for Yunnan. The long term impacts remain unknown. This report emphasizes the types of measures which need to be taken by the health sector in preparation for future earthquakes.

EARTHQUAKE PREPAREDNESS

There are four main lessons to be learned from the Yunnan earthquake. Firstly, accurate records should be made in advance.

efficient needs assessment and response management. Accurate and reliable estimates of expected numbers of injured, homeless, or food and shelter needs will depend on quick access to these population profiles.

Secondly, radio communication, especially in mountainous provinces with weak road networks, is a critical aspect of a disaster preparedness programme. A central base for information and communication is essential for effective response when planning action for the immediate post-impact phase. Standard principles of urban emergency management can be applied with appropriate modification throughout the region. With a radio communications centre, it is possible to transfer patients more efficiently to health centres and hospitals in less-affected areas according to patients' medical needs and specialities of the receiving institutions. A limited number of field hospitals and mobile units with radio communication may also remain necessary for critical cases on-site. The cost effectiveness of the investment in mobile units with radio communications should be considered in view of limited resources and lack of skilled personnel.

Thirdly, proper preparedness can substantially reduce the mortality and morbidity which are indirect consequences of earthquakes. Mortality and morbidity caused by fires, car accidents and construction debris accidents contribute significantly to the total earthquake related damages — all of which can be prevented or minimised. Strategies to address these points can be largely drawn from community education initiatives. As an example, education about post-impact fire risks is critical. Increased awareness of the factors which encourage combustion will help reduce the risks of fires. In earthquake-prone Japan, for example, fire has been recognised as a principal earthquake hazard and important measures have been taken to forewarn and educate households in risk reducing behaviour.

Community education about the dangers of earthquake damaged sites (exposed wires, holes, construction materials, unstable debris) would further reduce post-earthquake accidents. Training in the proper and safe methods for rescue and extraction from rubble or collapsed structures would improve the efficiency of post disaster assistance. It has been shown (De Bruycker *et al.*, 1980, Noji *et al.*, 1985) that immediate rescue and extraction is undertaken by the community members themselves (family, friends or neighbours) using simple tools, such as picks, shovels or hands. Professional teams (Red Cross, firemen or army) could educate the local community in proper and safe methods for extraction. This should result in the reduction of the number of dead during the immediate and post-impact period.

The number of car accidents in the Yunnan case study indicates panic and inadequate logistical management on the disaster site. Red Cross and specially trained medical personnel can help reduce this problem by organising and directing on-site medical care traffic to eliminate the hazardous or incorrect operation of rescue vehicles.

Fourthly, adequate monitoring and knowledge of survival and injury patterns are essential for effective planning and training of health personnel. The types of injuries sustained and their expected frequencies can determine the training programme requirements for paramedical health personnel. The importance of this point is illustrated by the evaluation report of the Tang Shan earthquake (Zhang Qinnan, 1988), which indicated low recorded frequencies of head and chest injuries to those persons who were rescued alive. This was because most individuals with head and chest injuries died on impact or immediately afterwards. Thus, the profile of the recorded injury patterns was very misleading. Recording of every cause of

death, however rudimentary, is fundamental to preparedness and preventive activities. Standard epidemiological questions such as who died, where, when and how provide important information for health preparedness and response.

Finally, while it is unrealistic to expect that no mortality will result from earthquakes, there are many actions which could be undertaken to reduce their impact. The external and delayed relief which characterizes health response to disasters today will always be marginally effective and costly. The main approach to disaster management and preparedness should become local community preparedness. By using the same methods that are applied to other health issues, local community education and preparation for disasters should become an integral yet distinct part of routine programmes.

Note

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