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HUMAN CASUALTY DUE TO THE 1995 GREAT HANSHIN-AWAJI EARTHQUAKE DISASTER IN JAPAN

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ABSTRACT

Over 5,500 people were killed directly by the 1995 Great Hanshin-Awaji Earthquake Disaster in Japan. About 90% of the victims were crushed to death in collapsed houses or buildings. More than half of them were people, over 60 years old. We studied to clarify the cause of death in relation to age, sex, building damage and building type in Higashinada Ward of Kobe City where we had surveyed the damaged houses. As the result of this investigation, in the target area, the death ratio for the first floor of a wooden dwelling was higher than that of the second floor.

KEYWORDS

Earthquake; casualty; death ratio; building damage; elderly

INTRODUCTION

The Great Hanshin-Awaji earthquake disaster occurred at 5:46 a.m. on January 17, 1995 at the south part of Hyogo prefecture, Japan (Fig. 1). It recorded a magnitude of 7.2 on the Richter scale (14 km deep). The total number of human casualties due to this earthquake reached 5,502 killed, 2 missing and 41,521 wounded. About half of the victims in this earthquake were the elderly over 65 years old. 89% of the total dead were crushed under collapsed houses. After the earthquake, many elderly people weakened and died while living as refugees in shelters or temporary houses. The total number of quake-related deaths came up to 6,348 at 1 year after the earthquake.

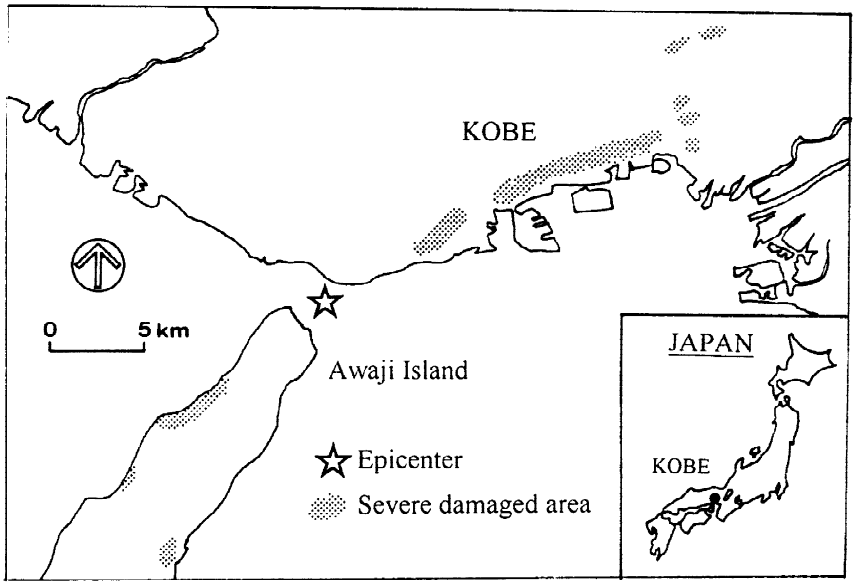

Fig. 1 Location of severe damaged area

RELATIONSHIP BETWEEN THE NUMBER OF BUILDING DAMAGE AND HUMAN LOSS

Fig. 2 shows a relationship between the number of completely destroyed buildings and dead persons which occurred after the Meiji era (1868). Points in this figure stand for earthquakes in which damage was over 20 dead. These points are divided between black dots and white dots by the year 1950 when the building code was enforced. Also, a triangle point corresponds to the Great Hanshin-Awaji earthquake. According to Fig. 2, most of former earthquakes as black dots brought out over 100 dead. However, the Great Hanshin-Awaji earthquake is similar to these pre-1950 earthquakes. It is significant that this earthquake occurred in early morning and also that the focus of the earthquake was very near Kobe and other cities. Most of completely destroyed houses were old and timeworn wooden houses which had heavy tile roofing using mud as mortar. The number of directly killed people per 100 total collapsed dwellings is 5.5.

Fig. 3 shows the relationship between the number of total collapsed buildings and dead persons at each city and town in severely damaged areas. We can find out a clear mutual relation between there two above mentioned, especially in Kobe, Nishinomiya, Ashiya, Takarazuka and Osaka.

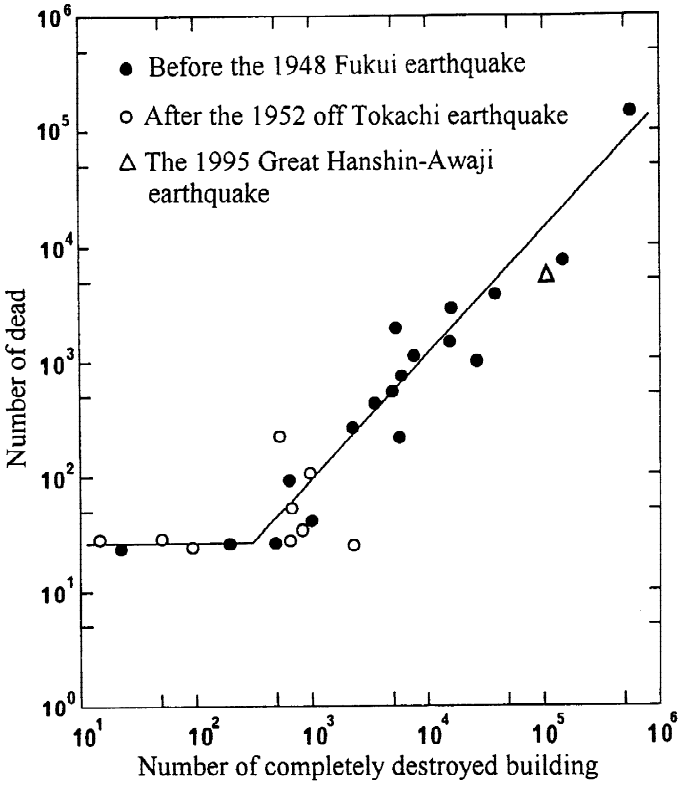

Fig. 2 Relationship between the number of building damage and persons

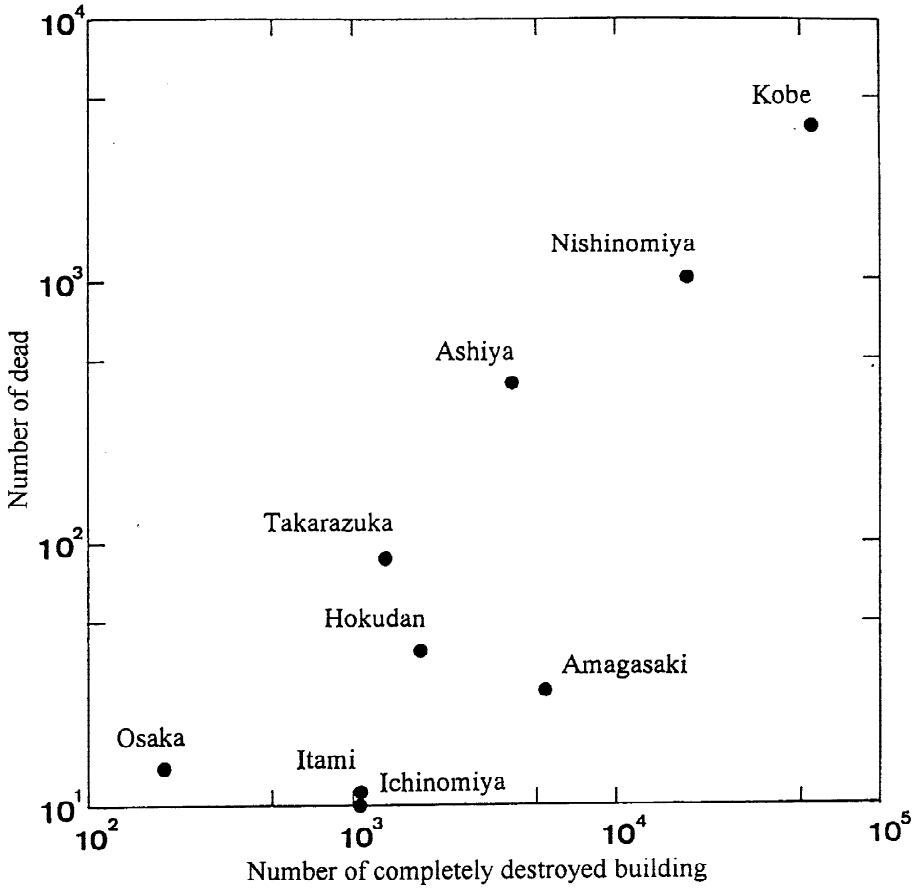

Fig. 3 Relationship between the amount of building damage and dead persons due to the 1995 Great Hanshin-Awaji earthquake

CAUSES OF DEATH

The causes of death for 3,651 dead persons was investigated as in Fig. 4. According to this figure, about 54% of victims suffocated to death. And 12.4% of victims were crushed to death. 12.2% of dead persons were burnt to death by the fire due to the earthquake. It seems that in all cases people were trapped in the debris of their collapsed houses and apartments. Because the time when the earthquake occurred was very early in the morning, almost all residents were still asleep. Therefore, they could not escape from their houses before they collapsed.

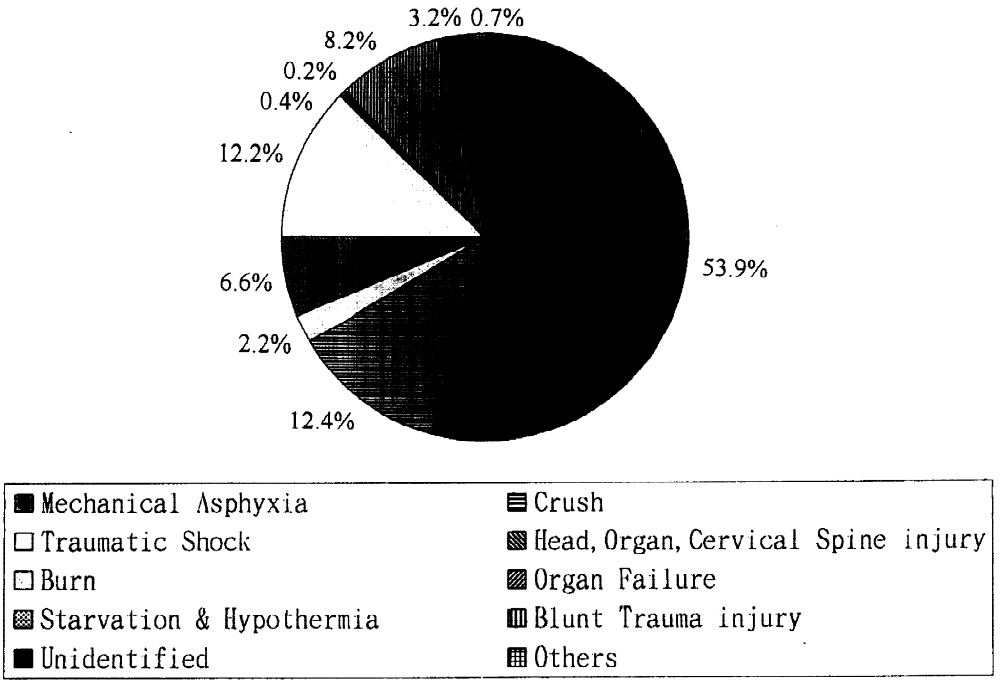

Fig. 4 Causes of death

Fig. 5 shows the variation of death rate with age. Obviously, the death rate of the elderly is higher than that of younger generation. Also, females suffered higher casualty rates than males. This is not an isolated case as we pointed out the same tendency during former earthquakes in Japan (Miyano *et al.*,1993, Miyano *et al.*,1995).

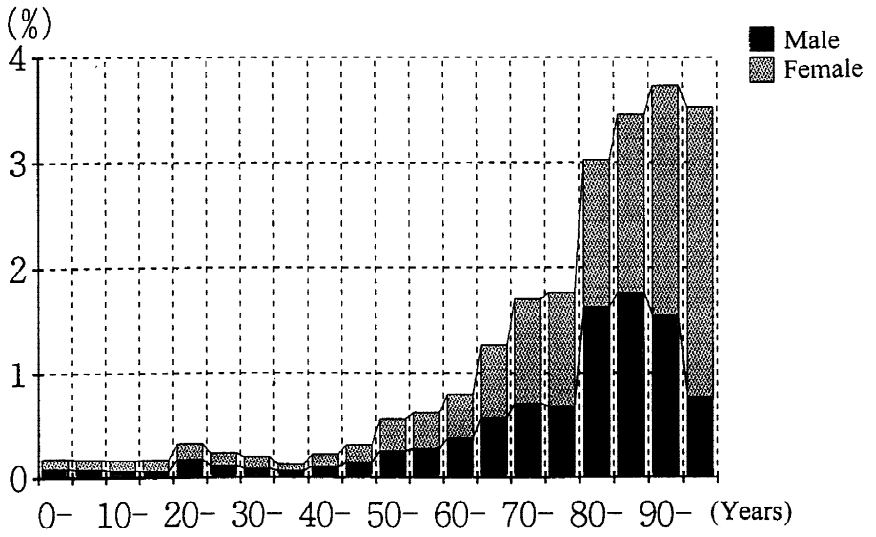

Fig. 5 Variation of death rate with age

UNCRD Research Report (1995) mentioned as follows: one of the reasons why the death rate of old people was higher than other groups was that many of them were living in old wooden houses. Another reason was that they often stayed or slept on the ground floor of two-story houses because of physical weakness which caused their death, when upper floors collapsed on top of them. Lastly, most of them had little strength to escape from under the rubble of their crushed homes. We clarified the risk of being crushed to death on the first and second floors of two-storied wooden houses as in Fig. 6. It is obvious that the danger on the first floor is much higher than that on the second floor.

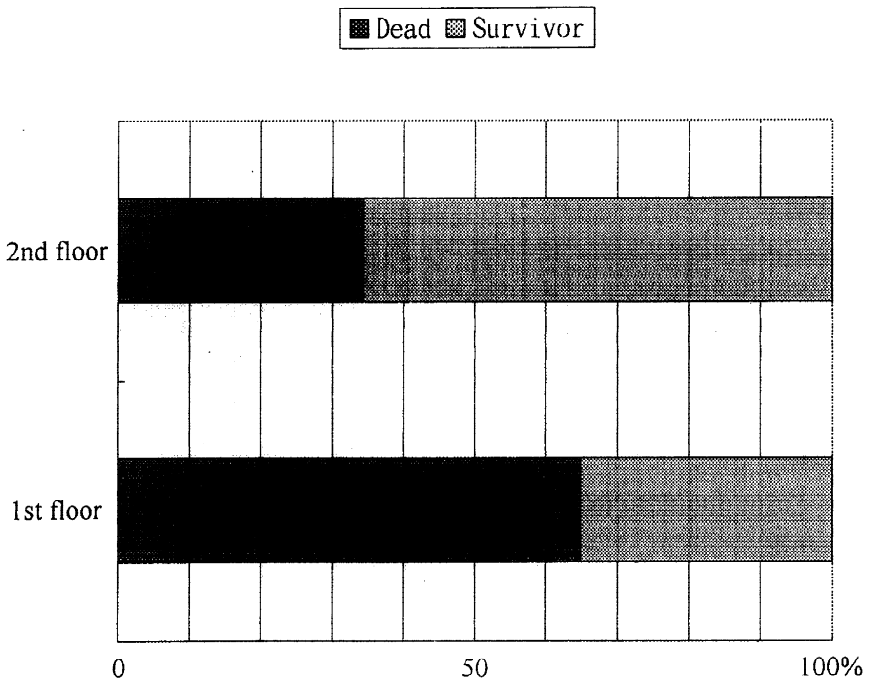

Fig. 6 Risk of being crushed to death on each floor of two-storied wooden houses

CONCLUSION

Human casualty due to the Great Hanshin-Awaji earthquake, was similar to pre-1950 earthquakes in relation between the number of completely destroyed buildings and dead persons.

Beacause many people were trapped in the debris or crushed by collapsed houses, over 50% of victims suffocated to death. Also, 12.2% of dead persons were burnt to death by the fire due to the earthquake.

The death rate of the elderly is higher than that of younger generation. Females suffered higher casualty rates than males.

The risk of being crushed to death on the first floor was about 65%. On the other hand, the risk of that on the second floor was about 35% in two-storied wooden houses.

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