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Death Rate of Survivors in Nagasaki at Early Time of A-Bomb Explosion

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SUMMARY : The death rate of survivors at early time after A-bomb explosion was analyzed with the A-bomb disaster survey in Nagasaki city. Survivors who were alive September 1st, 1945 was 20,746 persons, in which 17,869 persons (86.1%) had information for the analysis. The death rate in 1945 of survivors exposed in their houses at less than 1,199 m from the hypocenter was higher than those exposed not in their houses. The death rate of survivors in 1946 decreased rapidly, although that of survivors exposed at less than 1,199 m from the hypocenter was still high.

INTRODUCTON

There are some reports on the mortality of A-bomb survivors after 5 years of A-bomb explosion in 1945[1, 4]. Shirabe performed questionnaire survey for A-bomb survivors in Nagasaki in 1945[8, 9]. Hiroshima city performed survey for A-bomb survivors in 1946, and performed household reconstruction survey[3, 5, 6, 10]. However, there are not enough analyses of A-bomb survivors at early time after the explosion.

The Nagasaki City had began an investigation of A-bomb victims in 1970[7]. In January, 1971, the Council for A-bomb Disaster started a survey in Nagasaki for A-bomb victims exposed at the distance within 2 km from the hypocenter for 10 years[7]. It surveyed 91.8 % of original households, and obtained information for the mortality analysis of A-bomb survivors at early time after the A-bomb explosion.

We analized the death rate of A-bomb survivors by using the survey data of Nagasaki City Hall.

MATERIALS AND METHODS

We used the survey of A-bomb victims in Nagasaki performed by the Council for A-bomb Disaster[7] for the analysis of death rate. A number of 11,292 households were known existing before the A-bomb explosion, and 10,371 households (91.8 %) were confirmed where 47,121 persons were known belonged to these households. Of them, 5,237 persons (11.1 %) were unable to identify the following information ; sex, date of birth, date of death if dead, or distance from the hypocenter. A number of 18,258 persons were exposed to the A-bomb in their own house, and 23,626 persons were exposed not in their own house. We excluded the persons who died during August 1945 from the syudy, because parameters are unknown for a large fraction of them and most of death was caused by physical disaster. We examined the death rate of survivors who were alive September 1st, 1945. The subjects of the study are 20,764 persons, in which 8,155 persons were exposed in their

Table 1. Number of subjects

Place at the time of bomb	Number	%
In their house	8,155	39.3
Outside of their house	9,714	46.8
Unknown	2,895	13.9
Total	20,764	100.0

house, 9,714 persons exposed out of their house, and 2,895 persons had not information described above (**Table 1**). The death rate was analyzed in the relationship of the distance from the hypocenter. We used BMDP statistical software and the significant test for the assumptin was carried out with the linear trend test[2].

RESULTS AND DISCUSSION

The death rate in 1945 of survivors who were alive on September 1st in 1945 is shown **Fig. 1** by closed symbols, by grouping survivors exposed in their house and those exposed out of their house. It decreased with the distance from the hypocenter. That of survivors exposed out of their house was lower than those exposed in their house at less than 1,399 m from the hypocenter. However, its death rates at 1,400-1,699 m from the hypocenter were reversed.

The houses where survivors were exposed were generally made of wood at that time in Nagasaki. Survivors were sheltered from irradiation by the wooden structure of the houses when exposed to A-bomb radiation. The estimated radiation dose in wooden house was 3.4. Gy, 1.5 Gy and 0.47 Gy at 1,199 m and 1,399 m and 1,700 m from the hypocenter, respectively. Survivors who were exposed not in their houses would be thought to be working in arms factories where transmitted radiation would be smaller than in the wooden houses, although its value is not known. The death rate for survivors exposed out of their house at 1,400-1,699 m from the hypocenter was higher than that exposed in their houses. The cause of death would be irradiation, wound and other damages by destruction of building. This complexity of causes of death might reversed the death rates.

The death rate in 1946 of survivors who were alive on January 1st in 1946 is also shown in **Fig. 1** by open symbols. That at less than 1,199 m from the hypocenter was still high, but that at 1,200-1,399 m and 1,400-1,699 m became the control level which would be indicated at 1,700 m from the hypocenter.

Almost all victims survived 4 months after the explosion of A-bomb, or were alive on January 1st in 1946, recovered from the damages. The victims exposed at less than 1,199 m from

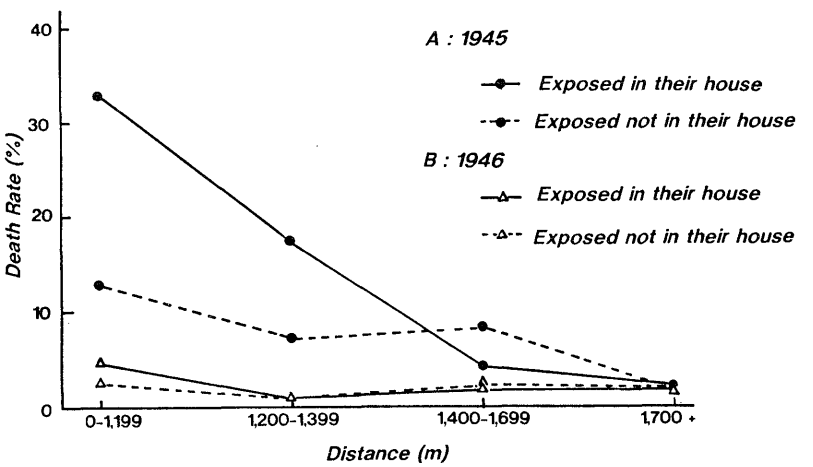

Fig. 1. Death rate of A-bomb survivors who were exposed in their house and of those exposed not in their house.
A: Death rate in 1945 of survivors who were alive on September 1st, 1945.
B: Death rate in 1946 of survivors who were alive on January 1st, 1946

the hypocenter might received damages heavily, and still had high death rate in 1946.

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