

Analysis of deadly residential fire scenarios in Japan

Hiroshi Aoyama (K110601)

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In Japan, about 1,000 residential fire deaths occur every year, and it has not been improved very much. Elderly people aged 65 and over, account for more than one half of the residential fire deaths. The deaths toll may increase further in the coming super-aging society. To counter such a situation, Japan's Fire Service Act was revised to mandate installation of home smoke alarms. In the United States, installation of the home smoke alarm is already compulsory, and the effect was that the residential fire deaths had been halved. In Japan, its effect is not yet apparent. The effect of home smoke alarms may be estimated, if actual deadly scenarios of residential fires were analyzed. The purpose of this study is to present statistical analysis results of deadly residential fires on "how people die," in "what kind of fire scenarios," and "who are most vulnerable."

The data used for this study are Fire Data (2004 - 2008) and Fire Deaths Data (1999 - 2008) extracted from "Fire Reports" annually gathered by Fire and Disaster Management Agency. Special attention is paid on (1) the causes of fire, (2) casualty's characteristics, and (3) spatial relationship between the fire origin and the victims. By analyzing these data, typical scenarios of deadly residential fires were sought and classified. Only the fires of "residential buildings" were used for the analysis, arson and suicidal fires were excluded.

About one half of victims were found to die at the place of fire origin without escaping. Among these victims, cigarette is a most common ignition source, which ignites such as futon/cushion (bedding materials), paper/trash/garbage, (tatami) floor, and textiles. A large portion (35 % if unknown causes are excluded) of people die by cigarette caused fires, which starts only in smoldering mode. Through analysis of various aspects such as causes of deaths, time of day and damaged floor area, it was found that a most probable scenario may be, a person sleeping after smoking, inhales carbon monoxide released from the smoldering object without recognizing, and become unable to move by the toxicity and eventually dies by asphyxiation or burns.

Another common scenario found by the analysis is an elderly person, handling a naked flame during cooking or trying to ignite a candle on an altar, or using a heater to warm up themselves, whose clothing is accidentally ignited and die by direct burns. This scenario generally occurs during the daytime and the damaged floor area is very small.

One fourth of residential fire deaths occur on persons who were in the remote place from the fire origin at the time of ignition. Those fires generally end up with large damaged floor area. Nearly 60 % of those are found to be killed by "Carbon monoxide poisoning/Asphyxiation", generally regardless of the ignition source and ignited material, but rather general among the elderly and disabled persons.

Installation of smoke alarms may be effective for reducing the number of deaths in initially smoldering fires such as caused by cigarette, since much time is saved by early detection because the growth rate is very small. However, it may not be effective for the clothing fires, because the developing time is very short and early detection may not be good enough. The typical deadly fire scenarios found by this study may be used as tools for evaluating the effects of measures in reducing the number of deaths in residential fires.