Title page

Title: Characteristics of elderly people living in non-air conditioned homes

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Abstract

The present study aimed to clarify the characteristics of elderly people living in non-air conditioned homes. A questionnaire survey conducted in Misato city in July 2013 revealed that 96.1% of elderly individuals lived in air-conditioned homes. Elderly individuals living without air conditioners tended to be men, and those who were unmarried, living alone, or living in an apartment. The results suggest that most elderly individuals without air conditioners lived in multi-unit apartments.

Introduction

In recent years, temperatures have been rising worldwide due to anthropogenic climate change [1], with a concomitant rise in the number of deaths caused by high ambient temperatures [2, 3]. In Japan, the number of heat-related deaths has been increasing, with a higher risk of heatstroke found among elderly individuals [4, 5]. Heatstroke tends to have more serious consequences in elderly individuals because of their decreased sensitivity to heat, sweating, ability of the body to thermoregulate, and increased prevalence of underlying diseases such as hypertension and dementia [4]. A previously reported heatstroke survey in Tokyo [6] showed that the prevalence of heatstroke increased with age, and the symptoms of heatstroke in elderly individuals who lived without younger family members tended to be severe. In the aging Japanese population, the percentage of elderly individuals living alone was 16.4% in 2010 and continues to increase every year [7]. Support by community health services is important to protect this aging population from heatstroke. Since most heatstroke events in elderly individuals occur at home, adequate use of air conditioning can effectively prevent indoor heatstroke; the guideline issued by the Japanese government recommends the use of air conditioners to prevent room temperatures from rising. The increased use of air conditioners among elderly people and those at high risk of experiencing heatstroke in

urban areas has been reported by Kondo et al [8]. According to this study, more than half of the elderly individuals surveyed used air conditioners only when they felt hot, and approximately 3% and 15% never used them in the daytime or when sleeping, respectively. It is important to determine the reasons why elderly people do not use air conditioners and to conduct intervention programs to promote their use. Different approaches are required for elderly individuals who do not install air conditioners in their homes and for elderly people who have air conditioning but do not use it. For this reason, we considered an approach to prevent indoor heatstroke in elderly people that focused on installation of air conditioning units. The purpose of the present study was to clarify the characteristics of elderly people living in non-air conditioned homes and to discuss the community support available to them.

Materials and methods

We conducted the survey in Misato City, located in the southeastern end of Saitama prefecture, Japan, and 20 km from the center of Tokyo. The population is approximately 135,000 individuals. In July 2013, self-reporting questionnaires were distributed by mail to 2,124 residents aged ≥65 years who were randomly selected from the basic resident register. The questionnaire covered sociodemographic characteristics such as age, sex,

family structure, and working status; and residential environmental factors such as type of housing (detached or apartment), residential area, and installation of cooling devices. With regard to residential areas, participants were divided into seven groups based on local government districts. To investigate the association between the installation of air conditioners and other factors, we used chi-square tests using SPSS Statistics 20. Ethics approval for our survey was granted by the Institutional Research Ethics Committee of the University of Tsukuba.

Results

We received 1,262 questionnaires from the participants, and the number of valid responses was 1,244 (valid response rate, 58.6%). The participants' ages ranged from 65 to 84 years (mean ± SD, 72.5 ± 5.0 years) and the number of men and women was 549 (44.1%) and 695 (55.9%), respectively. The number of married participants was 772 (62.1%), and 295 (23.7%) participants lived alone. The number of workers and unemployed participants was 325 (26.1%) and 908 (73.0%), respectively. There were 695 (55.9%) participants who reported living in a detached house, 514 (41.3%) participants who reported living in apartment housing, and 20 (1.6%) participants lived elsewhere (e.g. nursing home). Regarding the installation of a cooling device, 1,195

(96.1%) participants had an air conditioner, 1,162 (93.4%) participants had a fan, and 2 (0.2%) participants had none. The mean number of air conditioners installed was 2.5 (±1.4; Fig. 1); and the number of homes with air conditioners installed only in the living room was 1,012 (81.4%), only in the bedroom was 854 (68.6%), and in both rooms was 671 (53.9%; Fig. 2).

Table 1 shows the factors associated with the installation of air conditioners. Age and working status were not associated with the installation of air conditioning. A higher proportion of men (5.3%), unmarried individuals (6.1%), those who lived alone (8.5%), and those in apartment housing (5.7%) had no air conditioning than women (2.5%), married individuals (2.1%), individuals living with family (2.3%), and those living in detached housing (1.9%), respectively. The percentage of homes without air conditioners installed was 7.0% in one area and 0–2.9% in other areas.

Discussion

According to the Japan Meteorological Agency, Japan's annual average temperature and the number of days when the temperature is high has increased since the 1990s. In eastern Japan, where the target city of the present survey is located, deviation from the normal mean temperature was recorded at +1.5°C in 2010, the highest in recorded

history, and +1.1°C in 2013, the third highest [9]. In Japan, heatstroke in elderly people is serious problem; in 2013, the number of emergency room visits due to heatstroke was 58,729, of which 27,828 were by elderly individuals [10]. The majority of elderly people who responded to our survey (96.1%) had air conditioners installed in their homes. A higher proportion of men and/or individuals living alone had no air conditioning. Considering that the prevalence of heatstroke is higher in men [11] and those who do not use air conditioners [12] and that elderly individuals who live alone are less likely to be diagnosed with heatstroke early, elderly individuals have a higher risk of heatstroke, and any initiative for preventing heatstroke needs to be tailored for them. In addition to these sociodemographic characteristics, the percentage of installation of air conditioners was lower in apartment houses and in one area, which has one of the largest multi-unit apartments in Japan. In a survey of elderly people's residential sleep environments in Tokyo, apartment houses had a lower percentage of installed air conditioners in the bedroom than detached houses [13]. According to this 2013 study and the present study, the type of house is associated with the installation of air conditioners. It is, however, unlikely that the type of house itself affects installation, and rather it should be considered as a surrogate measure of other factors such as economic conditions. The relationship between the percentage of air conditioners and

these variables suggests that elderly people who do not install air conditioners are concentrated in this multi-unit apartment. In Japan, the number of deaths among elderly individuals who lived alone in this type of multi-unit apartment has been increasing with the aging population and the number of elderly people living alone. From this background and the findings of this study, community health services specific to and prioritized for elderly people in multi-unit apartments are important. An NPO group has been established to assist elderly individuals living in multi-unit apartments. We plan to conduct a survey to evaluate an effective intervention program to prevent heatstroke, focusing on this area and considering the community service provided by the NPO group. This survey will investigate the actual condition of air conditioners installed in multi-unit apartments and whether the absence of air conditioning can increase the risk of heatstroke. Furthermore, the association between health condition, heatstroke prevention behavior, and objective thermal environment (e.g., use of cooling device, room or outside temperature, or humidity) will be examined.

The present study focused on the installation of air conditioners in summertime to prevent heatstroke. The installation and the use of air conditioners by elderly people may contribute to better health because the installation of air conditioners has been suggested to be associated with sleep in summertime [14] and because cold ambient

temperature in wintertime is related to the incidence of myocardial infarction [15]. We cannot conclude that the findings of this study apply to the situation in wintertime because almost all Japanese people use stoves, electric heaters, and kotatsu (Japanese typical table over an electric heater) more often than air conditioners [16]. However, we can hypothesize that the reason for the lack of air conditioner installation is related to the installation of other heating appliances, and understanding the characteristics of elderly individuals might be useful in planning health service interventions in wintertime as well.

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Conflict of interest

The authors have no conflicts of interest or financial ties to disclose.

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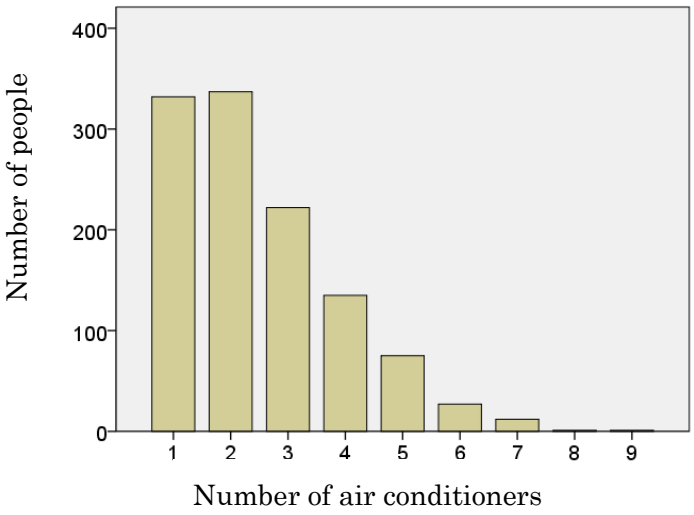

Figure 1. Histogram of installation of air conditioners

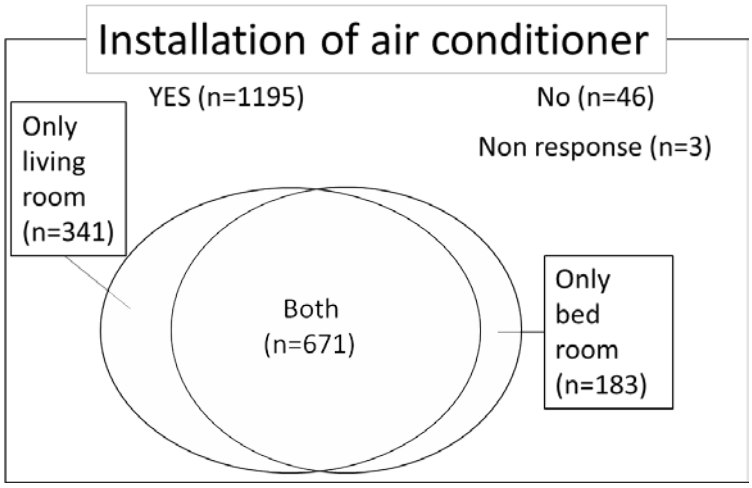

Figure 2. Installation of air conditioners

Table1. Installation of air conditioners and associated factors

	Number	Air conditioners installed				p value
		Yes		No		
		Number	%	Number	%	
Total	989	950	96.1	39	3.9	
Age						
65–74years	660	634	96.1	26	3.9	1.000
75–84years	329	316	96.0	13	4.0	
Sex						
Male	433	410	94.7	23	5.3	0.051
Female	556	540	96.1	16	2.9	
Area						
A	187	182	97.3	5	2.7	
B	138	133	96.4	5	3.6	
C	87	84	96.6	3	3.4	
D	155	151	97.4	4	2.6	0.230
E	134	130	97.0	4	3.0	
F	269	251	93.3	18	6.7	
G	19	19	100.0	0	0.0	
Marital status						
Married	615	599	97.4	16	2.6	0.006*
Not married	361	339	93.9	22	6.1	
Living with family						
Yes	733	714	97.4	19	2.6	0.000*
No	243	223	91.8	20	8.2	
Working status						
Employed	240	232	96.7	8	3.3	0.553
Unemployed	739	708	95.8	31	4.2	
Type of building						
Detached	543	533	98.2	10	1.8	
Apartment housing	415	389	93.7	26	6.3	0.001*
Other	17	15	88.2	2	11.8	

Significant differences are marked as ＊$p<0.05$