

Heatstroke in Older Adults

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Abstract

Older adults are both physiologically and environmentally more susceptible to heatstroke, and according to Japanese data, approximately 30% of male and 50% of female taken to hospital by ambulance due to heatstroke are aged 65 years or older. It has also been reported that heatstroke becomes severe more easily in older adults. In terms of environment, heatstroke amongst older adults is characterized by many patients developing the condition in their homes rather than outdoors, in contrast to young people. Compared to young people, as older adults fundamentally have a reduced body fluid volume, reduced skin temperature-sensitivity, reduced amounts of sweating, and reduced thirst sensitivity, they are susceptible to heatstroke. Furthermore, in many cases older adults are taking multiple drugs, and it has been indicated that the use of drugs such as diuretics, anticholinergic agonists, β -blockers, and antipsychotics affects thermoregulation and so may increase the risk of heatstroke amongst older adults.

Key words Older adults, Heatstroke, Risk factors, Prevention

Introduction

Recently there has been an increase in the number of patients taken to hospital by ambulance due to heatstroke in the summer months. Of these, approximately 30% of male and 50% of female are aged 65 years or older. Furthermore, a characteristic of older adults is that a high percentage of older patients develop heatstroke while going about their daily life, and the factors behind this are also unique to older adults.

Epidemiology of Heatstroke in Older Adults

With the cooperation of fire departments in 20 locations nationwide, the National Institute for Environmental Studies conducts an annual survey in which the number of patients transported to hospital by ambulance due to heatstroke is calculated and published. However, this tally does not include cases in which the heatstroke

patient was not taken to hospital by ambulance. **Figure 1** shows the percentage of overall heatstroke patients for each gender and age group based on data for 2010.¹ The percentage of heatstroke patients aged 65 year or older was 33.7% of male patients and 57.6% of female patients in the 2010 report; 24.2% of male patients and 46.1% of female patients in the 2009 report; and 26.9% of male patients and 49.7% of female patients in the 2008 report.^{1–3}

Furthermore, as age increases, there is a confirmed tendency for the percentage of moderate and severe heatstroke cases to increase (**Fig. 2**). In a 2010 report by the Ministry of Health, Labour and Welfare (MHLW) of Japan on the actual age groups with deaths due to heatstroke, 79.3% of total heatstroke deaths were older adults aged 65 years or older.⁴ Moreover, the peak age group for deaths due to heatstroke is 75–89 years (**Fig. 3**). Both older male and female developed heatstroke in their homes with notably greater frequency compared to patients in

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other age groups (Fig. 4).

A heat wave that occurred in Europe in 2003 was reported to have caused more than 50,000 deaths, many of whom were older adults in particular. Epidemiological research conducted in France and Italy has identified risks of death for

older adults at the time of a heat wave as living alone, poverty, living in long-term care facilities for the elderly, having chronic disease, physical

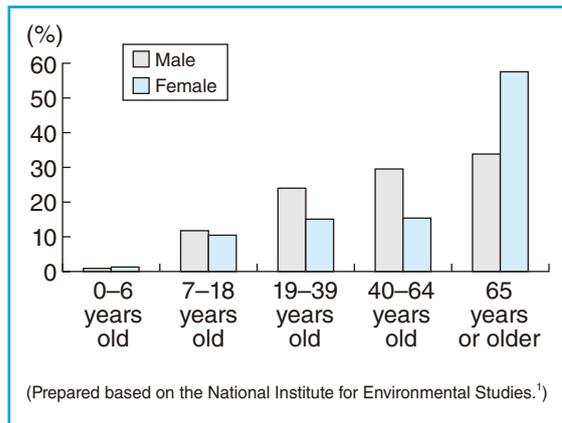


Fig. 1 Occurrence of heatstroke by gender and age group

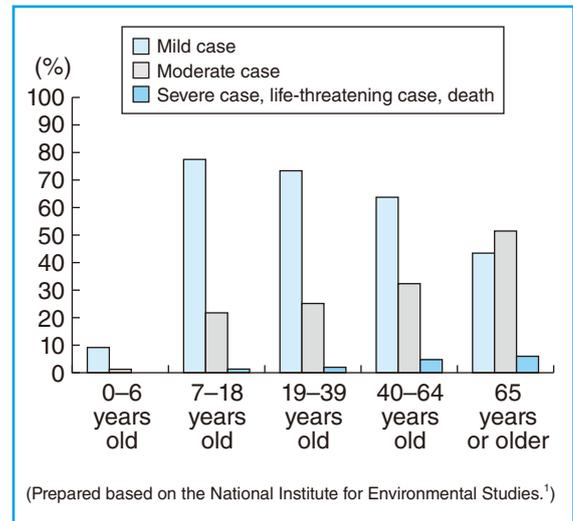


Fig. 2 Percentage of heatstroke patients by age group and severity of condition

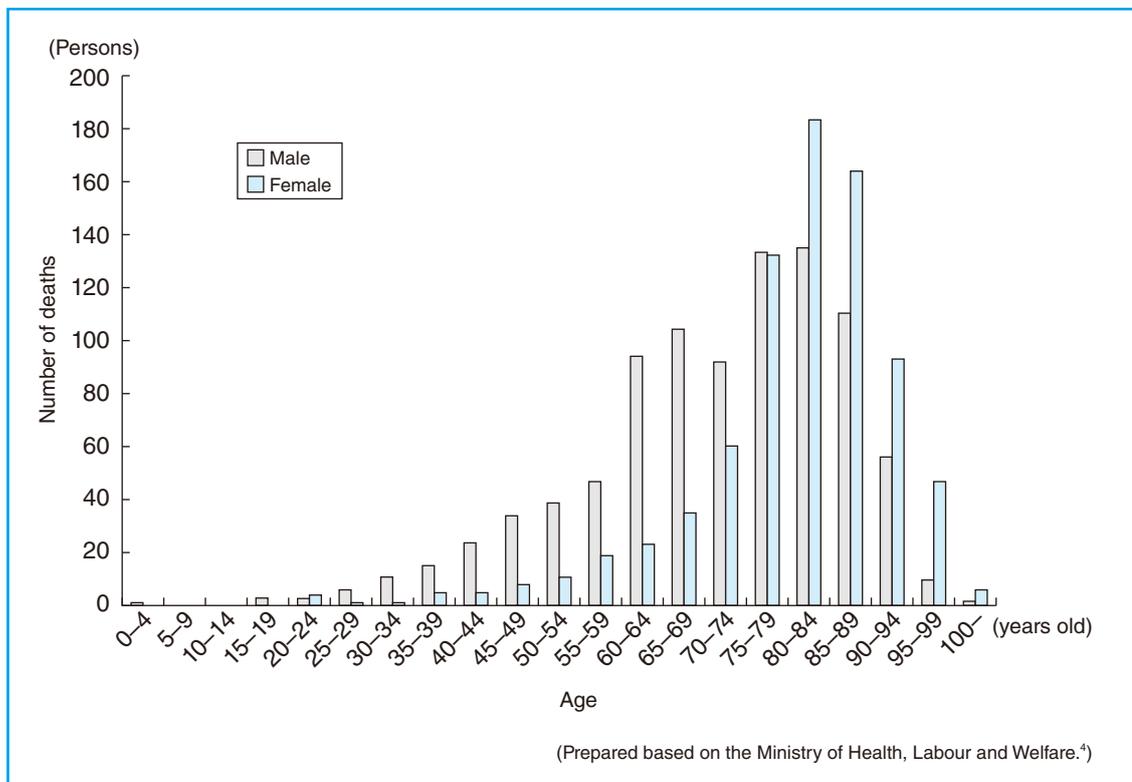


Fig. 3 Number of deaths in 2010 due to heatstroke by age group

dysfunction, and taking drugs such as diuretics, antipsychotics, benzodiazepines, and NSAID.^{5,6}

Characteristics

From the above-mentioned epidemiological research, several characteristics of heatstroke in older adults become apparent. First of all, mild cases of heatstroke are rare; many cases of heatstroke in older adults are moderate to severe. Secondly, in many cases the patient develops heatstroke in their home. Furthermore, Iwata et al. have reported the results of their investigation of older adult patients aged 65 years or older who visited their emergency medical center for heatstroke. They found that the rate of hospitalization for older adults was significantly higher than for younger people (80% for patients aged 65 years or older vs. 13.9% for patients aged 64 years or younger) and the average length of hospital stay was also significantly longer (27.5 days vs. 5.3 days).⁷ They also found other characteristics of heatstroke in older adults to be that in many cases the patient develops heatstroke within their home and they live either alone or

with just their spouse; in many cases the patients also did not have air-conditioning.

Physiological Characteristics of Older Adults

Older adults tend to have reduced skin temperature-sensitivity and adaptation of the autonomic nerves to heat and autonomic thermoregulation tend to be slowed. Furthermore, compared to young people older adults generally have lower amounts of sweating and skin blood flow; thus their ability to radiate heat from the skin is low and the core body temperature rises easily. In heatstroke, water and sodium are lost through sweating. It is known that older adults generally have lower amounts of bodily fluids and reduced electrolyte homeostasis, making it easy for water or electrolyte abnormalities to occur. Fluid comprises approximately 60% of an adult's weight, but this percentage decreases with age and in people aged 70 years or older is reported to be approximately 50%. Moreover, renal function also decreases with age, with both glomerular filtration rate and urinary concentrating ability

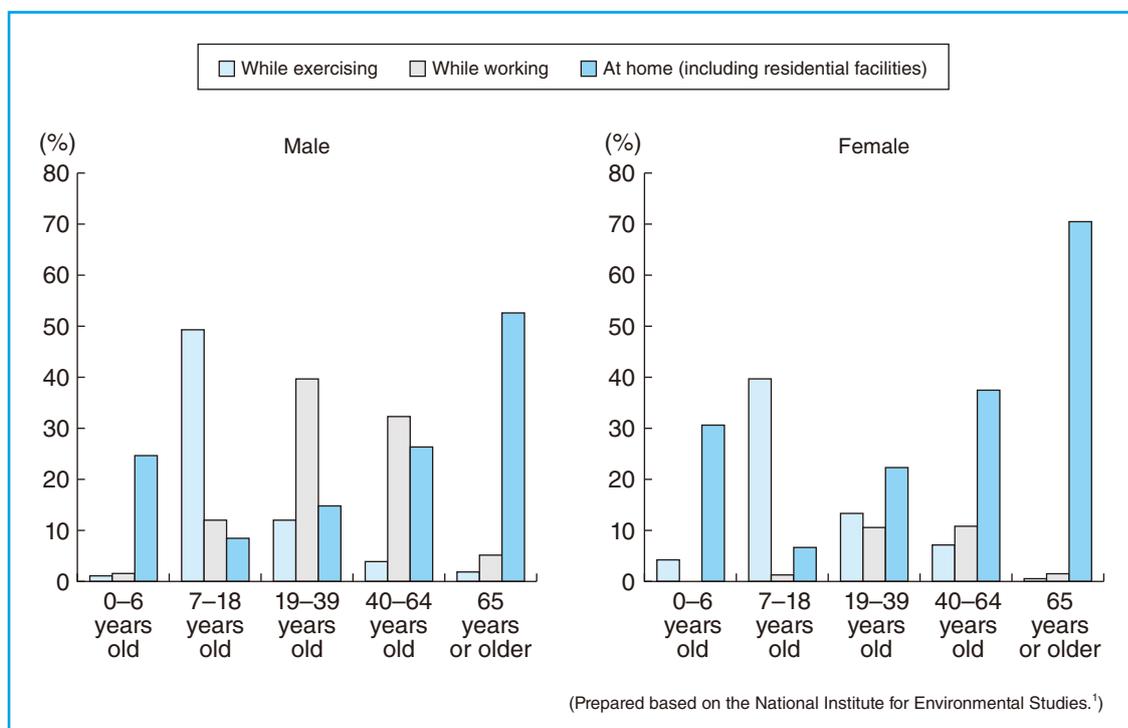


Fig. 4 Percentage of heatstroke patients by gender, age group, and place where heatstroke occurred (cause)

decreasing, making older adults more susceptible to hypotonic polyuria. While nighttime urination is controlled by an antidiuretic hormone (vasopressin) in young people, lower levels of this hormone are observed in older adults, and so their urine volume during the night increases. Furthermore, thirst sensitivity also decreases with age, and so older adults do not become thirsty easily.

Due to these many factors, dehydration and electrolyte abnormalities are easily induced in the older adults. The reduction of circulating blood volume due to dehydration leads to reduced skin blood flow and affects thermoregulatory functions as an exacerbating factor, triggering heatstroke. These physiological characteristics particular to older adults are directly linked to risks for heatstroke.

Physical and Psychological Characteristics and Environmental Factors

The number of older adults requiring long-term care has been increasing year-on-year since the introduction of the long-term care insurance system in Japan in 2000, and currently approximately 4.5 million people require this care. According to *the 2010 National Livelihood Survey*, there are approximately 5.02 million older adults nationwide who live alone and 26.1% of older adults requiring nursing care live alone, of which 20% are classified as care level 3 or higher. Older adults requiring long-term care are somehow managing

to live in their communities using long-term care insurance services, but they are extremely susceptible to sudden environmental changes and have far less acclimation than younger people.

Physical and cognitive dysfunctions seem to be responsible for the low adaptability, and such patients are unable to respond to sudden environmental changes without sufficient long-term care. Furthermore, advanced age can itself be a factor, with older adults lacking acclimation to temperature. In addition, many older adults will refrain from drinking fluids due to concern about going to the bathroom frequently at nighttime and endure high temperatures without using an air-conditioner. Moreover, nowadays the poverty rate amongst elderly households is rising, with an increasing number of older adults receiving welfare benefits. Social welfare funds borrowed by welfare recipients from the Social Welfare Council to purchase an air-conditioner are classified as income and deducted from the recipient's social welfare benefits. It has been pointed out that older adults in households receiving welfare benefits that cannot purchase an air-conditioner for this reason are at high risk for heatstroke. In 2001, the MHLW of Japan finally arrived at a policy whereby the loans mentioned above are not classified as income.

Relationship With Drugs

Thermoregulatory system is operated by autonomic nervous responses due to stimulation of temperature-sensitive neurons linking the peri-

Table 1 Drugs that affect thermoregulation

<p>Heat radiation damage from the skin</p> <ul style="list-style-type: none"> α adrenaline agonists (peripheral vasoconstriction) Amphetamine, cocaine, ephedrine Anticholinergic agonists (antiperspirants) Anticholinergic drugs, antihistamine drugs, tricyclic antidepressants
<p>Drugs that reduce cardiac function</p> <ul style="list-style-type: none"> Drugs that reduce cardiac output Anti-arrhythmic drugs, β-blockers, calcium antagonists Drugs that reduce circulatory blood volume due to diuresis Diuretics, alcohol
<p>Hypothalamic function regulation</p> <ul style="list-style-type: none"> Antipsychotics Phenothiazine drugs (chlorpromazine, levomepromazine, etc.) Butyrophenone drugs (haloperidol) Atypical antipsychotic drugs

pheral and hypothalamic areas, somatic responses, and behavioral responses. Accordingly, there are not only thermoregulatory mechanisms at the nerve level but also regulating mechanisms performed by various neurotransmitters, such as vasomotor functions in peripheral skin and subcutaneous tissue as well as regulatory mechanisms performed by the sweat glands. All drugs acting on any of these levels could potentially affect thermoregulation.

Older adults tend to have many medical problems, and it is imperative to be always mindful of the possibility that they are receiving treatment from multiple medical institutions and taking multiple medications. It is possible that drugs related to vasoconstriction such as sympathomimetic agents and β -blockers, which affect cardiac output, could influence internal body temperature management. In addition, it is demonstrated that drugs such as anticholinergic drugs, antihistamines, diuretics, laxatives, and tricyclic antidepressants are also risk factors for heatstroke. Many studies have demonstrated that antipsychotic drug use is a risk for heatstroke through affecting the hypothalamus and influencing thermoregulation. This is reported to be due to changing the set point of thermoregulation by the antidopaminergic action of antipsychotic drugs.^{8,9} Furthermore, diuretic use without sufficient fluids intake is also a risk of heatstroke due to the reduction of amount of body fluids (Table 1).

Prevention

Older adults have poor sensitivity to heat and in many cases do not recognize early on that their environment is uncomfortably hot and humid. Furthermore, sweating functioning is reduced and thermoregulation is slowed in older adults. If an older adult is living alone, there are no other family members to notice rises in room temperature, and if they collapse from heatstroke, their discovery is delayed because they are inside their homes. Because the amount of water in the bodies of older adults is lower than in the bodies of younger people, their body temperatures can rise easily. It is thought that this overlapping of several adverse conditions makes it easier for older adults to develop severe heatstroke in their daily lives.

In particular, despite the importance of fluid

intake, in many cases dehydration is advanced in older adults when they can realize that they are thirsty due to decreased thirsty sensitivity. Therefore, there is a need to decide in advance the amount of fluids that an older adult should consume daily in addition to meals and to consider measures for ensuring that older adults regularly drink or are given fluids regularly. It should also be noted that in the case of lack of appetite, which is a characteristic of older adults, it is common for an older adult to be unable to even drink water. Even when older adults are normally able to somehow manage to maintain a lifestyle living on their own, family members or health/welfare workers keep track of their health status as older adults are unable to respond to sudden environmental changes. Since air-conditioners, electric fans, and opening windows are all factors that can prevent severe heatstroke, in particular older adults—who tend to refrain from using such appliances—should be encouraged to, for example, placing a humidity and temperature gauge in the living room to enable them to visually gauge room temperatures and managing them by deciding clear temperature settings such as 28°C and 60% humidity.

Conclusion

From the above we can understand that the causes of heatstroke in older adults not only comprise physiological characteristics particular to older adults but are also intertwined with their physical, psychological, and social backgrounds. It is predicted that in the future there will be an increase in the number of older adults in Japan who have no alternative but to live alone, and not only that, older adults with some form of disability who have no choice but to live alone. Heatstroke is a disaster brought about by high temperatures in summer, but its occurrence can be predicted to a certain extent and prevented through the appropriate involvement of health/welfare workers and thorough social maintenance. In this sense, the number of older adults who collapse from heatstroke can be a good indicator of a society's elderly healthcare and welfare measures and aging society policies. Issues related to heatstroke are closely related to social problems facing older adults in Japan—including issues that have been gaining attention recently such as “solitary death,” “death of

elderly people by starvation,” “poverty amongst elderly households,” and “social isolation”—

and are not issues that can be resolved through medical care alone.

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