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# Japanese perceptions of societal vulnerability to disasters during population ageing: Constitution of a new scale and initial findings

Michael J. Annear [a,b,*], Junko Otani [b], Xin Gao [b], Sally Keeling [c]

[a] Wicking Dementia Research and Education Centre, University of Tasmania, Rozelle Campus, Corner of Church and Glover Streets, Lilyfield, Sydney 2040, Australia
[b] Graduate School of Human Sciences, Osaka University, 1-2 Yamadaoka, Suita, Osaka 565-0871, Japan
[c] Department of Medicine, University of Otago, Princess Margaret Hospital, P.O. Box 800, Christchurch, New Zealand

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ABSTRACT

This research describes the development and initial results from the *Perceptions of Ageing and Disaster Vulnerability Scale* (PADVS) that was designed to explore perceptions of vulnerability to disasters in the context of population ageing. Few Japanese studies have explored perceptions of disaster-related vulnerability in Japan, although this issue is growing in importance due to the acceleration of population ageing and the recurrence of large-scale disasters.

Following pre-testing, the PADVS was administered with 172 health students and professionals from three Japanese regions in 2016. The reliability and validity of the PADVS were assessed using commonly employed psychometric evaluation techniques, including assessment of face and content validity, internal consistency, item-total correlations, inter-item correlations, and factorial validity. Descriptive statistics were used to ascertain total, subscale, and item scores.

With one item removed due to poor fit, a 13-item version of PADVS exhibited acceptable reliability ($\alpha$=.87) and validity. The scale fit a four-component solution following principal components analysis, with four indicative subscales. Results of PADVS completion showed clear respondent concerns about social isolation and lack of support networks, and poor functional capacity among older adult populations.

The PADVS provides a reliable and valid measure for researchers to assess perceptions of societal vulnerability related to disasters in the context of population ageing. Preparations for recurring disasters should focus on improving supportive social network connections among older adults and providing intervention measures to improve physical, cognitive, and emotional health for older adults, particularly those who live alone in the community.



## 1. Introduction

The 21st century will herald unprecedented global population changes that may increase societal vulnerability to disasters. Vulnerability is typically defined as the potential for losses in human life, economy, community, and the built environment [1]. The pressure of population ageing, in particular, may heighten vulnerability to disasters in countries such as Japan, which are at constant risk from earthquakes, tsunamis, typhoons, and other natural hazards. In Japan, the effects of disasters on ageing populations were brought into sharp focus following the 2011 Great East Japan earthquake and tsunami (also referred to as the 2011 Tōhoku earthquake). Extreme and periodically repeating disasters, such as this, serve as a warning that societies need to continually assess their level of vulnerability and respond appropriately to protect their populations from harm. Japan, in particular, has the most rapidly ageing population in the world and can be described as a *super-ageing society* [2]. According to the World Health Organization, countries with 7% of their population aged 65 years and over are *ageing societies*, 14% constitutes so-called *aged societies*, and 21% or higher defines *super-ageing societies* [3]. Japan reached the status of a super-ageing society in 2007 with 21.5% of the population aged 65 or older. Japanese government reports indicate that the country faces the twin pressures of absolute population decreases and continued super-ageing in the coming decades [4].

Added to these extreme demographic changes, Japan also faces the economic and social recovery following the crisis of the Great East Japan Earthquake and the subsequent tsunami and Fukushima-Daiichi nuclear accident. It is possible that the expansion of population ageing with a reduced base of younger adults to provide economic and social support may increase societal vulnerability, particularly when the risks associated with disasters are considered. The 2011 Great East Japan earthquake and tsunami were devastating and disproportionately

* Corresponding author at: Wicking Dementia Research and Education Centre, University of Tasmania, Rozelle Campus, Corner of Church and Glover Streets, Lilyfield, Sydney 2040, Australia.
*E-mail address:* Michael.Annear@gmail.com (M.J. Annear).

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affected older adults. A high proportion of causalities were older adults, and 65 per cent of those who died were aged over 65 (most deaths were due to drowning) [5,6]. The disaster also had the greatest impact in rural areas, which tend to be heavily populated by older adults due to the outmigration of working-age adults. In the badly affected Iwate Prefecture, a rural region in northern Japan, over 30% of the population was aged 65 years or older [5], which is a common demographic profile from Japan's rural areas. At the time of 1995 Great Hanshin Earthquake that affected Kobe and Osaka (also referred to as the Kobe earthquake), the isolation of older people was identified as a major issue in the provision of post-disaster care and living arrangements, with many health problems (including dementia) worsening for older people who lacked support networks [5,6]. Sudden disruptions of daily routines, the breakdown of multi-generational households, and difficulty adapting changed environments following the disaster traumatized many older adults and contributed to a rise in cognitive and psychological problems. Of particular note, the increased prevalence of *Kodokushi* (dying alone) became a major issue following both the Kobe and Tōhoku disasters [5–7].

A systematic literature search was conducted of research undertaken in Japan that has explored concepts of societal vulnerability in the context of population ageing and disasters. Systematic searches were conducted using the following academic databases: *Ichushi, JDreamIII* (including JMEDPlus and MEDLINE) and *CiNii*. These databases were chosen in order to balance medical, public health, and sources of knowledge from other disciplines. Structured searches were undertaken using combinations the following keywords and Boolean operands: vulnerability (脆弱性), disaster (災害), population ageing (人口高齢化), and older adult (高齢者). Japanese-language searches (with subsequent translation of results into English) were performed and manuscripts were restricted to those published after the year 2000. Most of the studies identified were published after 2011, indicating that the Great East Japan earthquake may have spurred significant research activity. Commonly employed research methods included surveys, face-to-face interviews, and desktop analyses using secondary database or spatial (mapped) information. Participants included older adults, health administrators, and cohorts from general adult populations. Subject areas addressed by researchers included demographic risk factors in disaster recovery [8,9], public health issues following disasters [10–13], awareness and capacity of social support networks [14,15], problems associated with living alone [16,17], difficulties with post-disaster evacuation from urban environments [18,19], and the utilization of temporary housing after a disaster [20,21].

Although 14 studies were identified from systematic keyword searches of three Japanese databases, few focused directly on the societal vulnerability of ageing populations. Many were focused instead on environmental vulnerabilities, such as infrastructure and building design [8,18,19] or post-disaster recovery and activities of daily life [13,21]. While physical environmental factors can certainly increase the risk of human loss and injury, individual and social factors are also important in determining vulnerability. In our review, we located four studies that examined the individual and social vulnerabilities relative to older people in disasters. As part of a post-disaster demographic analysis, Mugikura [9] examined the patterns of vulnerability following the Great East Japan earthquake in the badly affected area of Otsuchi-cho. He found that older residents were disproportionately affected in terms of loss of life, displacement, and injuries, particularly when they were from a low socio-economic status background. Furthermore, Mugikura reported that over 50% of older adults who participated in the study reported poor quality of life and serious mental health problems in the aftermath of the earthquake and tsunami. In a survey of 285 adults in Okayama, Suzue et al. [10] reported that respondents perceived that post-disaster support was largely associated with self-help and mutual community help, but that greater government support was required to improve recovery in rural areas. A similar, though larger-scale, survey of 1477 older people was undertaken in Yokohama by Sawaoka et al. [14], which showed that mutual networks of support are important for post-disaster recovery, but that some older adults struggle to engage with their local networks for several reasons. In particular, older women, people with lower socio-economic status, and those who had not participated in a residents' association were shown to be the least socially integrated in a supportive network that may help to reduce disaster vulnerability. Finally, Yamaguti and Kojo [16] conducted in-depth interviews with eight older-adult disaster survivors aged from 65 to 90 and found a high level of anxiety about ability to cope in a disaster. Those most acutely anxious appeared to be older adults who were living alone without access to a supportive social network or government assistance. These studies suggest that older adults are vulnerable to the effects of disasters and that social support and isolation are important factors in their ability to cope and prepare. Residence in a rural location and low socioeconomic status also appear to be implicated in perceived vulnerability.

Disasters highlight the needs of the poorest and most vulnerable groups in society, including orphans, migrants, the disabled, the impoverished, and older adults [6,7]. The vulnerability of disaster victims and survivors is very often socially constructed [22] and, therefore, also amenable to human intervention as our understanding of the issues around vulnerability changes. As shown in the literature above, there is currently limited evidence that considers perceptions of the impacts of population ageing on societal vulnerability in the face of inevitable disasters. Perceptions of vulnerability can provide a useful initial assessment in the absence of direct measures that may only be permissible following disaster occurrence. To address the paucity of research in this area, the aims of this study are as follows: (a) to test the reliability and validity of the Perceptions of Ageing and Disaster Vulnerability Scale (PADVS) with a Japanese population of health students and academics, and (b) to ascertain current perspectives on how demographic change may affect Japan's vulnerability to disasters.

## 2. Methods

### 2.1. Initial scale development

The first draft of the PADVS was developed based on a review of the literature in the topic areas of *societal vulnerability, ageing, and disasters* and feedback from a team of five academic experts from Australia, Japan, and New Zealand, including a clinical psychologist, environmental gerontologist, cultural anthropologist, public health researcher with disaster research expertise, and a health services researcher. The expert team checked the measure for face and content validity to ensure that the initial scale items reflected a breadth of appropriate and literature-informed content. A total of 14 items were included in the PADVS, which reflected content relating to an increase in the proportion of older adults within society and the potential consequences of this demographic transition. Example item 1 was worded as follows: *Societal vulnerability to disasters is increased by the growing number of older adults in the community* (「自然災害に対する社会的脆弱性が増す要因」として、「コミュニティにおける高齢者数の増加」). A six-point, zero-rated scale was used as the response format with possible answers ranging from 0 (no increase in vulnerability) to 5 (very high increase in vulnerability).

### 2.2. Pre-testing

Following preliminary development, the 14-item PADVS was pretested with a group of 13 health services researchers and clinicians