ORIGINAL RESEARCH

Health Care Student Perceptions of Societal Vulnerability to Disasters in the Context of Population Aging

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ABSTRACT

Objective: This paper reports on undergraduate health care students' perception of societal vulnerability to disasters in the context of population aging. Forecast increases in extreme weather events are likely to have a particularly devastating effect on older members of the community.

Methods: Undergraduate paramedicine and nursing students were surveyed using the Perceptions of Ageing and Disaster Vulnerability Scale (PADVS) to determine their views on the risks posed to older members of the community by disasters. Data analysis included a comparison of subscales relating to isolation, health system readiness, declining function, and community inclusiveness.

Results: Students reported a moderate level of concern about disaster vulnerability. Students who had previously completed another university degree reported significantly higher levels of concern than those without a prior degree. Australian students reported lower concern about societal vulnerability compared to a previously reported cohort of Japanese students.

Conclusion: Our study suggests current education of future health care students does not promote adequate levels of awareness of the health-related challenges posed by disasters, particularly among older members of the community. Without addressing this gap in education, the risk of negative outcomes for both unprepared first responders and older members of the community is significant. (*Disaster Med Public Health Preparedness*. 2019;13:449-455)

Key Words: disasters, extreme weather events, health care students, population aging, vulnerability

Population aging is a defining demographic trend of the 21st century. Forecasts indicate that, by 2050, the global population of individuals aged 65 and over will reach 1.5 billion, more than double the 2015 figure.[1] In Australia, in 2016, 3.7 million people were aged 65 and over, and this forecast will increase to 8.7 million by 2056.[2] Of this aging population, the oldest-old cohort, those 85 years and older, is increasing most rapidly.[1,3] By 2046, it is projected that there will be 1.4 million people aged 85 and over,[2] and, by 2061, those 85 years and older will account for 5% of Australia's population.[4] The rapid growth in the 85 years and older cohort has significant consequences for health practitioners across diverse disciplines because advancing age is associated with chronic multimorbidities and geriatric syndromes,[5] including frailty, sarcopenia, functional decline, and cognitive impairment such as dementia.[6-8]

Paramedic service providers are increasingly challenged by the effects of an aging population through increased demand for community callouts, more complicated emergency department attendance processes, and transfers between long-term care facilities and hospitals.[9,10] In Australia, increasing demand for paramedic services by persons aged over 85 has been identified as a significant health care workforce issue.[8] This increased demand is associated with a range of factors, including reduced access to primary health care services, particularly among rural and regional older adults, and lack of family and community support for aging in place.[8]

While an aging population is inevitable in developed countries such as Australia, it need not be the so-called *burden* on the health sector and taxpayer as is often portrayed in the media.[11,12] In many instances, older adults contribute significantly to family and community. For example, recent research showed that older adults were central to community recovery efforts in the aftermath of disasters.[13,14] Older adults have been found to mobilize and generate social capital to aid recovery efforts, and their wisdom, resilience, and resources have proven effective in assisting vulnerable community members.[15-17] At the same time, however, vulnerable older persons are also recognized as being at greater risk of harm during and after disasters and suffer greater morbidity and mortality than younger persons.[13,18] Typically, this is due to the prevalence of one or more geriatric syndromes and lack

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of immediate disaster relief and caregiver assistance.[19] The World Health Organization asserts that the occurrence of more disasters in an aging world means more older persons are vulnerable.[13]

Although the relationship between increasing extreme weather events and climate change remains politically contested,[20] such events are forecasted to become more frequent, more intense, and longer lasting in the coming years.[21,22] These events are likely to have a particularly devastating effect on older members of the community.[23] In Australia, the 2009 Black Saturday fires in the state of Victoria resulted in 173 deaths[15] and the relocation of 7,000 people.[24] During the concomitant southeastern Australian heat wave event, in the state of Victoria, there was a 46% increase in ambulance callouts, whereas emergency department admissions of people over 75 years of age due to heat-related illness increased by 37%. Mortality increased by 62% during that event with the greatest increase among those ages 65 years and over.[25] Mortality rates due to extreme heat are thought to be underreported, however, because deaths are often recorded as exacerbations of pre-existing medical conditions.[25,26] New Zealand research reported prevalent psychological problems among older adults in the aftermath of major earthquakes in that country.[27] Elsewhere, international research has identified that Alzheimer's disease symptoms were exacerbated in the wake of a catastrophic natural disaster in Japan.[28] Approximately 71% of people who died as a result of Hurricane Katrina in the United States were aged 60 and over, and 47% were over 75; additionally, a significant number of older people were abandoned by carer staff in the aftermath of that disaster.[29] From a paramedic perspective, ambulance callouts, hospital transfers, and community mortality typically increase during disasters, and events such as the 2009 heat wave were considered to have exceeded the capacity of emergency services to cope.[25,30] Paramedic and other emergency services are typically at the forefront of a community's disaster response.[31,32] Paramedic services have multiple roles in disaster management, including the coordination of resources, triage, acute clinical care, and transport and evacuation of survivors.[33-35] Because a significant proportion of disaster victims are frail older people living in diverse settings, paramedic services typically address the immediate health care needs of this demographic.[29] During the aftermath of a disaster, paramedics must be prepared for the challenges of managing people with a range of geriatric syndromes, including frailty and functional and cognitive decline.[36] Additionally, acute care needs of frail, older adults do not subside in the aftermath of disasters and may even be exacerbated given the added stressors of the situation.[37]

Older community members should be considered a distinct population with respect to vulnerability and disaster planning. There are multiple factors that contribute to older adults being more at risk of injury, illness, or death during and after a disaster.[38,39] Older adults often inhabit structures that were constructed with obsolete materials, and residing in these older structures has been associated with a higher risk of death for occupants during extreme weather events.[38,40] Reliance on community health and allied care services, such as meals on wheels or domestic support by older people prior to a disaster, has also been associated with a higher risk of death.[38,41] Issues of reduced mobility, which limits capacity for escape and evacuation, and the presence of comorbidities have also been shown to negatively influence health outcomes among older adults.[38,42] Further, the reduced thermoregulatory and heat adaptation capacity of older adults poses additional risks in light of forecasts of more frequent and intense heat waves.[43]

Given the increasing regularity and severity of extreme weather events and the growing threat of natural disasters in the aging and urbanizing Asia-Pacific region, the Council of Australian Governments (COAG) has developed a National Strategy for Disaster Resilience,[44] and the Tasmanian Government developed the 2016 Tasmanian State Natural Disaster Risk Assessment.[45] These documents identify the importance of developing community resilience to better withstand the effects of natural disasters and highlight that a coordinated multi-agency and community-based approach are fundamental. The need for multi-agency responses in times of disaster is also recognized by the Council of Ambulance Authorities. Current Paramedic Professional Competency Standards require paramedics to demonstrate the requisite knowledge and skills to participate in mass casualty incidents, including a working knowledge of the application of emergency medicine in disaster situations.[46]

In response to the National Strategy for Disaster Resilience calling for the inclusion of disaster risk reduction content in relevant higher education courses, this research seeks to establish a baseline measure of students' current understanding of disaster vulnerability. Considering that paramedics play an essential community health care role involving regular interaction with an aging demographic,[8] students preparing for a career in paramedicine are ideally situated to offer perspectives about disaster preparedness and vulnerability of older adults in respect to disaster preparedness and community resilience. Student paramedics can also provide an objective perspective that sits outside of professional politics or potential biases. Although a component of paramedic education and training focuses on decision-making in the complex and dynamic environments that disasters generate,[47,48] it is unclear what proportion focuses on the care needs of older people during such times. This research surveyed undergraduate students undertaking a Bachelor of Paramedicine degree and a cohort of practicing paramedics undertaking a "conversion" degree to upgrade their qualifications to the bachelor's level. A cohort of undergraduate nursing students was also surveyed to determine whether differences were evident across health care disciplines. The research used a validated instrument, the *Perceptions of*

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Ageing and Disaster Vulnerability Scale (PADVS), which had previously been administered to a cohort of Japanese health care students and educators.[49] This study provides an opportunity to compare perspectives on disaster vulnerability across different cultures.

METHODS

Survey Tool Development

The PADVS was developed following a review of the extant literature in the topic areas of *societal vulnerability*, *disasters*, and *aging*. As part of an iterative process, feedback from academic experts in Australia, Japan, and New Zealand informed development and pretesting procedures.[49] The PADVS was initially developed for use with a Japanese population, where the confluence of population aging and natural disasters is pronounced, although both English and Japanese versions have been pretested with health student populations. Prior to the present research, language translation (and back translation) of the instrument between English and Japanese was tested with no loss or alteration of meaning occurring.[50] The resulting instrument was validated with 172 health students, professionals, and academics. The PADVS showed a high level of internal consistency (Cronbach's $\alpha - 0.87$) and was found to provide a reliable and valid measure to assess perceptions of societal vulnerability to disasters in the context of population aging among those who work or train in health settings.[49] As discussed by Annear et al,[49] the PADVS may have limitations relating to subscale reliability between differing cultural and demographic groups. Those researchers recommended that international researchers administer the scale to assess its utility across different populations of health trainees and professionals as part of ongoing development and refinement. Given the potential application of this scale to health science students, our study administered the scale to better understand its utility in the Australasian context as well as to elicit potentially useful baseline data.

The PADVS comprises 13 items, which are each scored from 0 to 5, based on respondents' perceptions of age-related societal vulnerability. An exemplar statement from the measure (item 1) reads as follows: "Societal vulnerability to natural disasters is increased by the growing number of older adults in the community." Respondents scored each of the 13 statements from "0" (no increase in vulnerability) to "5" (very high increase in vulnerability). Within the 13-item measure are four validated subscales, which reflect different issues associated with age-related and societal vulnerability to disasters: (1) isolation and access (4 items scored out of 20), (2) declining function (3 items scored out of 15), (3) community inclusiveness (3 items scored out of 15), and (4) health system and health worker readiness (3 items scored out of 15). Higher scores on the PADVS and each of the subscales indicate greater concerns among respondents regarding societal vulnerability.

Survey Administration

The 13-item English-language PADVS was administered electronically to 146 participants via e-mail invitation. The invitation included a link to an electronic version of the survey instrument between November 2016 and March 2017. Aligning with the aims of the research, the study sought participants who were studying community health education (paramedicine and nursing), where there was a strong focus on community care and the health needs of older adults. All students within undergraduate paramedic and nursing courses at a large public university were invited to complete the survey. Participation was voluntary, and consent for the use of aggregated data in reporting was inferred by submission of the online survey. Ethics approval for this research was obtained from an institutional Human Research Ethics Committee, No. H161669.

Data Analysis

All data analyses were conducted using IBM SPSS for Windows (version 23). Continuous data were initially screened for normality and the potential effects of outlier values, indicating the suitability of parametric tests of significance. An examination of the Kolmogorov-Smirnov statistic returned a nonsignificant result ($P = 0.221$), indicating that the data have a normal distribution. Further, the mean PADVS score (45.39) was very similar to the 5% trimmed mean (45.54), demonstrating negligible influence from extreme values. Descriptive statistics (percentages, frequencies, means, and standard deviations) were reported for the demographic characteristics and PADVS total scores. Analysis also included a comparison of the four validated subscales within the PADVS: (1) health system and health worker readiness, (2) declining function, (3) community inclusiveness, and (4) isolation and access. Tests of significance included the Pearson correlation and analysis of variance (ANOVA). Correlations were examined between the main outcome measure (total PADVS score) and the variables of age, gender, and prior education. An ANOVA was undertaken to assess potential differences in perceptions of disaster vulnerability among respondents from different student and occupational cohorts.

RESULTS

Research Participants

Three student cohorts comprising 87 Bachelor of Paramedicine, 42 Bachelor of Nursing, and 17 practicing paramedics undertaking a "conversion" degree to upgrade their existing qualifications to bachelor's level accepted the invitation to participate in the study. Students were all studying in either year 2 or 3 of their degree with 38.6% having previously completed another degree. Gender across the entire cohort was evenly distributed (50.3% female, 47.6% male, and 2.1% other/preferred not to say). The mean age of participants was 31.9 years ($SD = 9.3$). The country of birth was Australia for 84.9% of respondents, and 90.4% indicated that English was their first language.

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Perceptions of Disaster Vulnerability

The total mean score on the PADVS for the response cohort was 45.39 (SD = 9.06) out of 65, indicating a moderate level of concern about disaster vulnerability related to population aging. Among the 3 cohorts, nursing students scored higher than paramedic students, but the difference was not statistically significant. Additionally, there was no correlation between age or gender and total PADVS score. This suggests a degree of homogeneity in health students' assessments of older adults' disaster vulnerability in Australia. Across the 4 subscales, declining function and isolation and access were the areas of greatest concern for respondents. Subscale results are summarized in Table 1 below.

Respondents who indicated that they had completed a prior university degree showed significantly higher PADVS scores than those with no prior degree ($r = 0.22$, $P < 0.001$). According to Cohen's criteria,[51] this relationship was of medium strength. An independent samples T-test was conducted to compare the PADVS scores for respondents who had previously completed a tertiary degree and those who had not. There was a significant difference in scores for those who reported having a prior degree, M = 47.93 (SD = 7.73), and those without, M = 43.80 (SD = 9.55; t [144] = 2.71, $P = 0.008$ [two-tailed]). The magnitude of the differences in means was in the range of small to moderate (eta squared = 0.03). It appears, therefore, those students who have a prior university qualification perceive older adults to be more vulnerable to disasters than respondents without a prior qualification.

DISCUSSION

This research reports on a cohort of Australian health care students' perceptions of societal vulnerabilities to disaster in relation to older members of the community. The increased likelihood of natural disasters, particularly relating to the effects of climate change as we enter the so-called Anthropocene epoch,[52] means communities must prepare their health care workforces to meet the challenges that such disasters pose. The need to continually assess societal vulnerability is considered an important factor in formulating appropriate disaster responses and protecting communities from harm.[49]

This study has identified that, among a cohort of Australian health care students, there is a moderate, though not high, level of concern about societal vulnerability to disasters in relation to an aging population. This perception is lower than that expressed by a previously reported Japanese cohort where respondents considered population aging to be associated with a higher increase in societal vulnerability when disasters occur.[49] This finding may relate to a greater awareness of disasters and their effects in Japan where earthquakes, tsunami, and typhoons occur regularly. It also suggests that there may be a level of complacency among Australian health trainees concerning their assessments of the potential for disasters in Australia and the resultant impacts on older adults. This suggests a need for increased focus on this topic in Australian health care education programs as community resilience to disasters relies on active participation and awareness[53-55] and our research illuminates a relative lack of awareness about vulnerability to disasters in the context of an aging population.

Many of our research participants had previous qualifications, predominantly in the health sciences, and having such qualifications was positively correlated with a higher PADVS score. That is, prior education is related to a perception of higher levels of disaster vulnerability among older adults. This is potentially due to an increased understanding of the health and social needs of older adults. It was not possible to determine whether this additional learning was accompanied by a period consolidating practice before re-entering the tertiary learning environment. As such, we cannot affirm whether it is extended and scaffolded learning that makes a difference or time spent "on the job" and contextualizing theory with regards to a perceived vulnerability associated with aging. However, our findings suggest that, for those with more training, particularly in health care, there is a better understanding of the frailty or complexity of aging bodies with reference to disaster vulnerability. This group may have also had more workplace exposure to older adults after completing their first qualification in health, although this remains to be explored in planned future research with a nationally representative sample.

As first responders, paramedics are well placed to address health problems faced by older adults during and after a

TABLE 1

Absolute and Comparative Scores on 4 PADVS Subscales Addressing Issues Associated with Age-Related and Societal Vulnerability to Disasters ($N = 146$)

PADVS Subscales	Mean	SD	Min	Max	Normalized Mean*
Isolation and access (scored out of 20)	14.28	3.70	3.00	20.00	0.71
Declining function (scored out of 15)	12.58	2.48	4.00	15.00	0.84
Community inclusiveness (scored out of 15)	9.37	2.71	1.00	15.00	0.63
Health system and worker readiness (scored out of 15)	9.22	3.31	0.00	15.00	0.62

*Higher subscale scores indicate greater respondent concern for issues relating to older adult disaster vulnerability in Australian society.

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natural disaster. In the often chaotic circumstances that follow a major disaster, health and social care workforces must have a capacity to operate effectively during times of social and environmental disruption,[53] such as during the aftermath of a disaster, and prepare for challenges such as managing people with dementia.[56,57] Age-related conditions are likely to be exacerbated in a natural disaster, and the acceleration of climate change and rapid urbanization is likely to increase the vulnerability of older adults to hazardous conditions that jeopardize their health.[28,41,54], In Australia, where a significant number of older people live in rural and regional areas and the risk of bushfires is exacerbated as a result of extreme weather events, the vulnerability of older adults is also likely to increase. Similarly, as the population of urban dwelling older adults grows as part of a broader trend of increasing urbanization across the Asia-Pacific region,[58] the risks for heat-related mortality also rise.[59] Future interventions to prepare paramedics for increasing age-related vulnerability should focus on pathology and care practices for age-related physical, cognitive, and sensory issues, including frailty, dementia, and pain,[60] which will be faced by practitioners with increasing frequency.[54,61]

Limitations

The findings of this research need to be considered in the context of the following limitations. First, the research involved students from two campuses of a large public university in two Australian States, as well as a cohort of students engaged in online distance education. Consequently, results may not be more broadly generalizable at this stage. The distribution in the data and a diversity of perspectives among the sample, however, suggest that the findings may be replicated with larger random samples. The results also compare favorably with pilot results obtained from health care students and educators in Japan, suggesting the reliability of our findings.[49] Second, there are inherent limitations in baseline awareness among a cohort of volunteer participants. Compared to Japan, Australia has a relatively low exposure to disasters resulting in significant mortality among older adults. In 2016, the United Nations World Risk Index ranked Japan at 17 of 171 countries in terms of risk of vulnerability to disasters, whereas Australia was ranked 121.[62] This variation in vulnerability might affect baseline awareness and participation rates because Australian students may not yet appreciate the relevance of research of this nature (even as national and regional health agencies try to raise awareness and formulate disaster management strategies).

Developing Community Resilience

Both the COAG National Strategy for Disaster Resilience[44] and the Tasmanian State Natural Disaster Risk Assessment[45] identify the importance of developing community resilience to better withstand the effects of disasters. Consequently, future health care workers, including paramedics, must be conversant with societal factors that increase mortality and morbidity risk during disasters. The aforementioned documents identify the need for community-level risk assessments to inform emergency services response to natural disasters. These documents also highlight vulnerable populations, including older adults, and identify how emergency management services must adapt their responses to mitigate harm in these vulnerable groups. Additionally, the COAG National Strategy for Disaster Resilience identifies the inclusion of disaster risk reduction knowledge in relevant higher education institutions as a priority.[44] We believe that our study directly aligns with state and national strategies by identifying perceptions of disaster vulnerability that may have negative impacts on disaster resilience. In addition, this research highlights knowledge deficits that should be prioritized in designing future disaster response systems until that knowledge gap can be addressed.

CONCLUSION

This study examined health care students' perception of societal vulnerability to disasters, with a focus on older members of the community, to inform emergency services disaster response planning processes and educational intervention. Our results indicate that Australian health care students perceive older adults as moderately vulnerable to disasters with no significant differences between nursing and paramedic student cohorts. Our research also found that students with previous degree level qualifications viewed older adults as more vulnerable to disasters than students without this prior education. Finally, our research found that Australian health care students consider their communities less vulnerable to disasters when compared to a Japanese cohort surveyed about their own aging population.[49] We consider our findings indicate current education of future health care professionals does not promote an adequate level of awareness of the health-related challenges posed by disasters, which are forecast to become more frequent and more intense as we move into the Anthropocene epoch. Low levels of awareness and preparedness were evident during the Australian southeastern heat wave of 2009 in which the capacity of the community to cope with the conditions was considered to have been exceeded.[30] Without addressing this gap in education, the risk of significant negative outcomes to both the underprepared responder[63] and older members of the community[39] is likely. The New Zealand earthquakes of 2010-2011 and subsequent community response showed that health care students can be a ready and willing source of volunteers to assist their communities in the aftermath of a disaster[64]; however, if students are unprepared, exposure to traumatic events may have long-term negative consequences.[63] Based on the findings of this research and the recommendations of the National Strategy for Disaster Resilience, we call for disaster vulnerability to be made a core component of geriatric education for undergraduate paramedics. We propose that outcomes of any such educational interventions be rigorously evaluated to inform

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future initiatives aimed at raising awareness of societal vulnerability to disaster in the context of an aging population.

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Conflict of Interest Statement

The authors report no conflict of interests.

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