Int J Public Health (2012) 57:297–304
DOI 10.1007/s00038-011-0243-y

ORIGINAL ARTICLE

Minimising harm from heatwaves: a survey of awareness, knowledge, and practices of health professionals and care providers in Victoria, Australia

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Received: 6 September 2010 / Accepted: 17 January 2011 / Published online: 8 March 2011

Abstract
Objectives Heatwaves cause illness and death, and are likely to become more severe and frequent in the future. This study has investigated the awareness, knowledge and practices of health professionals and care providers regarding heatwaves and health of older clients, in order to inform harm minimisation strategies for Victoria, Australia.
Methods An electronic survey of personnel of six health profession and care provider groups that support the health of older people living in the community was conducted in Victoria, Australia, in 2008. Descriptive statistics were derived through quantitative analysis.
Results Survey respondents showed a high level of awareness that heatwaves can be harmful for older people. Gaps in knowledge were identified regarding thermoregulation, risk factors, heat-related illness, and the use of fans. Few organisations had existing heatwave response plans, and responses to heatwaves were mostly reactive and opportunistic.
Conclusions Despite a broad level of understanding of the dangers of heatwaves, an opportunistic, reactive approach by health profession and carer personnel, in conjunction with gaps in knowledge, leaves older people in Victoria at risk of preventable harm from extreme hot weather.

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Keywords Survey · Heatwave · Older people · Community health services · Knowledge

Introduction

Episodes of extreme hot weather, also known as heatwaves, are a major threat to public health, as was illustrated by the disastrous consequences of heatwaves across Europe during the summer of 2003 (Robine et al. 2008), and more recently in south-eastern Australia (Victorian Government Department of Human Services 2009). In Victoria, Australia, 374 excess deaths were associated with a heatwave that occurred in the last week of January 2009 that included three consecutive days of maximum temperatures over 43°C and a peak temperature of 45.1°C (Victorian Government Department of Human Services 2009).

The potential for heatwaves to cause public health disasters in the future is significant, with predications that heatwaves are very likely to be more severe and to occur more frequently in the future (Meehl and Tebald 2004; Intergovernmental Panel on Climate Change 2007). In Melbourne, the capital city of Victoria, the number of days each year with maximum temperatures exceeding 35°C is predicted to rise from a current average of 9 to 26 days by 2070 (CSIRO and Bureau of Meteorology 2007). The number of people at particular risk of harm from heatwaves is also likely to increase as a consequence of demographic trends and increased urbanisation. The elderly, particularly those who are socially isolated (Bouchama et al. 2007), suffering from chronic illness (Stafoggia et al. 2006; Vandentorren et al. 2006; Foroni et al. 2007), and with limited ability to care for themselves (Brucker 2005; Foroni et al. 2007), are at increased risk of heat-related death (Brucker 2005; Pirard et al. 2005). For the population of Melbourne, the average daily mortality of people aged

65 years and over increases sharply when the mean daily temperature exceeds a threshold of 30°C, or the daily minimum temperature exceeds 24°C, for even a single day (Nicholls et al. 2008). In Australia, the proportion of the population aged 65 years and over is projected to double over the next 50 years, reaching 24% by 2056 (Australian Bureau of Statistics 2008), while the proportion of lone-person households is projected to increase to 34% of all households by 2026, with up to one-third of these being occupied by people aged over 75 years (Australian Bureau of Statistics 2006). An increasing proportion of the population living in large capital cities, projected to be 67% by 2056 (Australian Bureau of Statistics 2009), is also significant since highly urbanised areas are known to enhance the health impact of heatwaves by creating urban heat islands characterised by higher overnight minimum temperatures than surrounding areas (Frumkin 2002).

Minimisation of the adverse health effects of heatwaves requires public health strategies targeted towards vulnerable groups, including older people. Health professionals and care providers that support the health of older people living in the community are a valuable resource for the prevention and management of the health impact of heatwaves. The purpose of the following study was to investigate the awareness, knowledge and practices of this group of personnel regarding heatwaves and the health of their older clients, in order to inform the development of effective practices and policies for the minimisation of harm to older people from extreme hot weather in Victoria.

Methods

Approach and setting

A cross-sectional study of health profession and care provider personnel was conducted using an anonymous, structured survey in electronic and hard-copy format, from June to September in 2008, in Victoria. Analysis of collected data was also completed in 2008.

This study was part of a larger project commissioned by the Department of Human Services that was supervised and managed by researchers from the Centre for Research Excellence in Patient Safety, Department of Epidemiology and Preventive Medicine, Monash University, Victoria, Australia. Approval to conduct this study was received from the Monash University Standing Committee on Ethics in Research involving Humans.

Survey instrument

Development of a survey instrument was informed by a review of the literature, by feedback from the Project Reference Group (a panel that included representatives of public health, aged care, environmental science, primary health care, and community care organisations), and by pilot testing for face validity with a sample of Monash University staff. The final instrument was designed using the web application Survey Monkey, an online survey management tool (Survey Monkey 2008).

The survey consisted of 32 questions in eight sections designed to collect information about demographic and professional characteristics of respondents, awareness of the impact of extreme hot weather, knowledge of extreme heat and health, and current and potential professional practices to reduce heat-related illness. No identifying information was collected.

A range of closed-ended question types were used including multiple choice, categorical, numerical, and Likert-type questions with 3 or 5 point rating scales. A final optional question provided the opportunity for additional written comments, and five questions included an 'other, please specify' option. A modified Dillman protocol was used to guide study participation (Dillman 1999): surveys were sent directly by email, or as a hard-copy version in the mail, and reminder emails or letters were sent to prospective respondents at 2 and 4-week intervals after original receipt of the survey.

Study population and sample selection

The study population consisted of personnel of six community-based health profession and care provider organisations that have a key role in supporting the health of Victorians aged 65 years and over, as described in Table 1. Samples of personnel of these organisations were selected using a range of protocols, and invited to complete the survey as illustrated in Fig. 1.

Data analysis

Data obtained from closed-ended questions were imported into Stata/MP 10.1 for quantitative analysis (Stata Corporation 2006). Responses to the final open ended question were analysed qualitatively and will be reported separately.

Descriptive statistics were used to summarise information about survey respondents, their awareness of the impact of extreme hot weather and of risk factors for harm, knowledge of extreme hot weather and health, and professional practices regarding the minimisation of harm to elderly clients during extreme hot weather.

Responses to questions assessing awareness of temperatures constituting hot weather were recorded as continuous variables. The mean and standard deviation of responses were calculated for each respondent, and average values determined for professional groups. The average of

Table 1 Participating health profession and care provider organisations

General practitioners
General practitioners provide primary health care, and are often the first port of call for someone seeking health care services. Approximately, 86% of the Australian population visit a general practitioner at least once a year[a]
Practice nurses
Practice nurses are nurses employed within a general practice setting. Approximately, half of general practice clinics in Victoria employ practice nurses[b]. Practice nurses perform a range of activities including preventive health education and screening, health assessments, chronic disease management and care coordination
District nursing service
Provides general and specialist nursing care to people in their homes across metropolitan Melbourne. District nursing is a major provider of aged care in Victoria, with the aged and frail making up the majority of clients
Public sector residential aged care facilities
Provide care for older people unable to live at home due to frailty, disability, illness, or lack of a carer. The level of care provided by these facilities ranges from support with accommodation and personal care to 24-h nursing care. There are more than 800 aged care facilities in Victoria, with a quarter of these being public sector facilities and operated by the State Government
A non-government care provider organisation
A non-for-profit organisation that provides care and support services to assist elderly clients live in their own homes. Care packages are designed for each client, with services arranged to meet a range of personal, social and housing needs
Local Governments
The 79 Local Governments throughout Victoria provide support services for people living in the community whose capacity for living independently is limited, including frail older people and younger people with disabilities. This study focuses on the home care and delivered meals services which are staffed by paid employees, and in the case of the delivered meals services, predominately volunteers

[a] Australian Government Department of Health and Ageing General practitioners (2007) Rural health workforce strategy. http://www.doctorconnect.gov.au/internet/otd/publishing.nsf/Content/work-Public+health

[b] Australian Practice Nurse Association About Practice Nursing (2008) About General Practice Nursing. http://www.apna.asn.au/scripts/cgiip.exe/WService=APNA/ccms.r?PageId=11012

nominated maximum daytime and minimum overnight temperatures, the proportion of these answers over 30°C, and the proportion of responses for overnight minimum temperature >24°C, were also determined for each respondent and for professional groups.

Responses to dichotomous questions were reported as frequency and percentage. Responses to questions with an ordinal five point Likert-scale were summarised into dichotomous categories and reported as frequency and percentage. Where relevant, responses to questions were reported in quartiles. The responses to questions about a case scenario used to determine knowledge of risk factors were combined and reported as quartiles for factors categorised as protective or harmful.

Results

A total of 1,072 nursing and care provider personnel were invited to complete the survey, from whom a total of 316 valid responses were received, giving an overall response rate of 29.5%, as shown in Table 2. A convenience sample of 11 General Practitioners also answered the survey, giving a total of 327 responses which have all been included in the analysis.

Most respondents were aged 45–54 years (41%), female (86%), had been in their current professional role for <5 years (47%), had daily contact with people aged over 65 years (82%), and had not had the experience of caring for an older person affected by heat (70.5%).

Awareness

Temperature

Overall, the mean maximum daytime temperature nominated by respondents to represent a 'hot day' was 31.2°C, and the mean minimum overnight temperature nominated by respondents to represent a 'hot night' was 21.8°C. Only one-third of all respondents (33.8%) nominated a temperature of >24°C to indicate a hot night. District nurses and General Practitioners nominated overnight minimum temperatures >24°C the least often, while Local Government care providers nominated minimum overnight temperatures >24°C most often. When the average value of daytime maximum and overnight minimum temperature was derived for each respondent, only 13.3% had a derived average daily temperature >30°C.

Impact of hot weather

A high proportion of respondents demonstrated that they were aware that an episode of extreme hot weather is likely to be harmful for older people in Victoria, with more than 90% agreeing that a heatwave 'is likely to cause older people who are already ill to become sicker', and that a heatwave is 'likely to be associated with an increased number of older people dying'. The least well-understood characteristic of heatwaves that increases the risk of illness in older people was 'extreme hot weather occurring early in summer'.

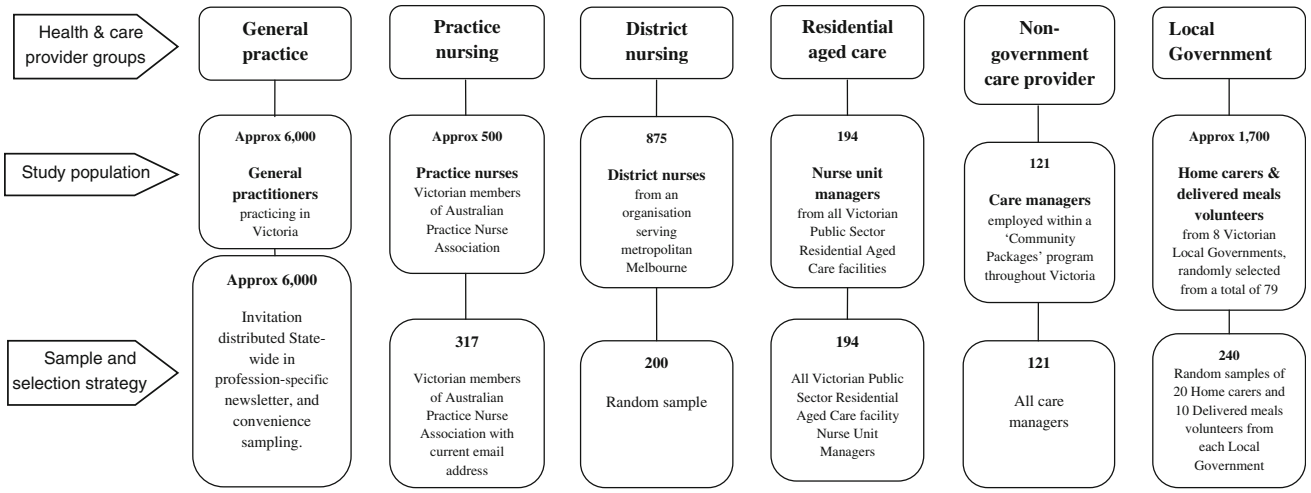

Fig. 1 Study populations and sampling strategies, for participating health profession and care provider groups

Table 2 Response rates, for health and care provider personnel invited to complete survey

	General practitioners	Practice nurses	District nurses	Nurse unit managers	Care managers	Home carers and delivered meals volunteers	Total
Surveys distributed	n/a	317	200	194	121	240	1,072
Valid surveys returned	11	44	36	91	33	112	327
Proportion of total responses (%)	3.4	13.5	11.0	27.8	10.1	34.2	100
Response rate (%)	n/a	13.9	18	46.9	27.3	46.7	29.5[a]

n/a not applicable

[a] This figure does not incorporate responses from General Practitioners in numerator

Table 3 Awareness of risk factors for illness and deaths during heatwaves, by study population

Risk factors identified in case scenario	General practitioners ($n = 11$) (%)	Practice nurses ($n = 44$) (%)	District nurses ($n = 36$) (%)	Nurse unit managers ($n = 91$) (%)	Care managers ($n = 33$) (%)	Home carers and meals volunteers ($n = 112$) (%)	All respondents ($n = 327$) (%)
Harmful factors							
Being elderly, taking a diuretic, limited mobility, living alone, living near top of building, living in city, windows locked shut, not using air conditioner, heatwave in early summer, many people away, public holiday, power failure, daytime temperature in mid-thirties, high humidity, heatwave lasting for several days, hot nights							
Identified 100% of harmful factors	100	87.8	84.9	88.4	83.3	63.4	78.9
Protective factors							
Having a working air-conditioner, having friends, attending a weekly card game, receiving a delivered meal each day, people asked to check on elderly neighbours, family and friends, 3-day warning period							
Identified 100% of protective factors	91.0	95.1	97.0	91.9	100	85.7	91.4
Harmful and protective factors							
Identified 100% of harmful and protective factors	100	95.1	90.9	94.2	93.3	80.4	89.1

Risk factors for illness and death during heatwaves

Overall, when asked to consider a case scenario, respondents demonstrated a high level of awareness of factors that influence risk of heat-related illness, with greater awareness of protective factors than harmful (see Table 3). The protective factor least often correctly identified was a regular social outing, in the scenario a weekly card game

(81%), while the harmful factors least often correctly identified were 'living in an inner city area' (55%), 'keeping the windows locked shut' (77%), 'limited mobility' (78%), and 'heatwave occurring early in summer' (64%). The level of awareness of protective and harmful factors was lowest for Local Government care providers and highest for Care Managers (protective factors) and Nurse Unit Managers (harmful factors).

Knowledge

Thermoregulation

Sixty-two percent of respondents correctly answered 8 or more of the 10 items assessing knowledge of thermoregulation, with changes to cutaneous blood flow being least well understood. Knowledge of thermoregulation was least for Local Government care providers, and greatest for District Nurses and General Practitioners.

Only 9% of respondents correctly answered all parts of the question assessing knowledge of sweating, with this poor result reflecting the few correct responses to the part of the question that assessed knowledge of the effectiveness of sweating as a mechanism for cooling the body on a very humid day. Almost all respondents understood that sweating can be impaired in people taking certain types of medication, and that sweating can be impaired in older people (see Table 4).

Heat-related illness

Only 23% of respondents correctly answered all six statements assessing knowledge of heat related illness. Only half of all respondents knew that 'pre-existing illness is a main cause of deaths of the elderly during heatwaves', and only 63% of respondents understood that heatstroke is not a minor illness.

The overall level of knowledge was highest for General Practitioners and District Nurses, and lowest for Local Government care providers, with differences apparent between professional groups. District Nurses best understood that most people who die in heatwaves are aged 65 years or older, Care Managers showed the highest level of knowledge that people with a psychiatric illness are at increased risk of death during a heatwave, and Nurse Unit Managers most frequently agreed that an older person may not be thirsty even when dehydrated (see Table 4).

Use of fans

Overall, only 5% of respondents correctly answered all four statements assessing knowledge of fans, with the overall level of knowledge being least for Nurse Unit Managers and Local Government care providers, and greatest for Care Managers. Less than half of respondents understood that 'fans do not cool the air' and that 'fans are less effective on a very humid day' (see Table 4).

Practices

Current practices

More than 90% of respondents reported that they do something different in their workplace on excessively hot days. The intervention most often practiced to prevent and manage heat-associated illness is 'provide verbal advice to clients ordinarily seen on that day' (78%). The least often practiced interventions are 'visiting clients more frequently' (25%) and 'transporting clients to a cooler place' (26%).

More than 86% of respondents reported making specific recommendations about managing the heat or heat associated illness last summer. The most common recommendations were 'drink more fluids' (91%) and 'stay indoors' (85%). The least common recommendation was to 'check on frail neighbours, family or friends' (48%). Only 18% of respondents reported that their workplace currently had a documented emergency response plan, with respondents from Local Government and Residential Aged Care Facilities most frequently reporting that these were in place.

Overall 59% of respondents nominated a 'public health announcement through the media (e.g. TV, radio, newspaper)' as the most effective way of contacting them with a heat alert. Telephone/text messages or specific communications from a central coordinating agency were not seen as effective strategies to raise awareness.

Capacity to minimise heat-related illness

More than 90% of respondents agreed that they would be able to assist with the four listed preventive measures to reduce harm from heat associated illnesses. The preventive measure most were able to assist with was 'identify clients at risk of heat associated illness' (96%) and the measure least were able to assist with was 'contact clients at risk of heat associated illness' (91%).

During a heatwave respondents most frequently agreed they would be able to 'provide advice to those seen on that day' (98%), and least frequently agreed they would be able to 'provide treatment to those who are ill because of the heat' (81%). Overall, 91% of respondents agreed that they have sufficient knowledge and skills of heat associated illness to provide 'general education of clients about prevention of heat-associated illness'. Fewer agreed that they have sufficient knowledge and skills to provide 'advice to

Table 4 Knowledge of heatwaves and health, by study population

Survey topic	General practitioners ($n = 11$) (%)	Practice nurses ($n = 44$) (%)	District nurses ($n = 36$) (%)	Nurse unit managers ($n = 91$) (%)	Care managers ($n = 33$) (%)	Home carers and delivered meals volunteers ($n = 112$) (%)	All respondents ($n = 327$) (%)
Thermoregulation (correct response)							
The following help to keep body temperature constant during hot weather							
Shivering (no)	100	84.2	93.8	77.8	80.0	89.4	85.4
Drinking hot fluids (no)	88.9	91.7	87.5	80.3	73.3	70.7	78.9
Increased sweating (yes)	100	97.6	97.1	93.2	93.3	83.2	91.4
Decreased blood flow to the skin (no)	100	74.3	79.4	80.0	77.8	69.8	77.3
Increased blood flow to the skin (yes)	100	77.8	81.8	82.7	75.0	62.1	76.6
Wearing thicker clothes (no)	100	97.6	100	95.2	96.4	98.1	97.4
Sitting still (yes)	54.6	77.8	80.7	75.0	82.8	81.4	78.2
Wearing loose, light clothing (yes)	100	100	100	100	100	100	100
Drinking cold fluids (yes)	90.9	97.6	100	98.8	96.8	97.2	97.8
Splashing cool water on the skin (yes)	100	95.2	100	98.8	96.7	99.1	98.4
100% (8–10 items) correct	81.8	71.4	88.6	67.8	67.7	42.3	62.2
The following statements about sweating are correct							
Sweating is an effective means of cooling the body on a hot and very humid day (no)	54.6	9.5	14.7	21.8	17.9	12.9	17.2
Sweating in hot weather can be impaired in people taking some types of prescription medication (yes)	100	91.2	100	98.8	100	92.3	96.5
Sweating will always occur if a person is too hot (no)	70.0	90.0	100	90.6	88.9	63.4	81.9
Sweating in hot weather can be impaired in older people (yes)	100	89.2	94.1	96.6	96.6	93.2	94.4
100% (4 items) correct	27.3	7.1	11.4	16.7	6.7	1.8	9.2
Heat-related illness (correct response)							
Agree and strongly agree							
The main cause of death of older people during extreme hot weather is their pre-existing illnesses (yes)	88.9	50.0	50.0	48.8	37.5	52.9	50.8
Heatstroke is a minor illness that can be managed with fluid replacement and rest in a cool place (no)	90.0	69.2	78.1	61.3	70.0	50.0	63.3
An older person will always be thirsty if they are dehydrated (no)	90.0	92.7	100	94.2	89.7	63.1	83.4
A person with a high temperature, hot dry skin and confusion can be managed at home if family members are available (no)	90.0	95.2	87.9	87.2	89.7	78.4	85.8
Most of the people who die during heatwaves are aged 65 years or older (yes)	81.8	72.4	88.0	64.1	73.1	59.0	67.6
People with a psychiatric illness have an increased risk of dying during a heatwave (yes)	90.0	66.7	84.2	62.1	87.5	62.8	69.1
100% (5–6 items) correct	63.6	23.8	32.4	23.6	26.7	13.5	22.7
Use of fans (correct response)							
Agree and strongly agree							
Fans are an effective way of cooling the air (no)	63.4	54.1	54.8	32.0	40.0	28.3	37.9
Fans are useful for bringing cooler air into a room from outside (yes)	30.0	35.3	32.3	35.9	29.6	33.0	33.6
Fans are protective against heat-related illness on hot, very humid days (no)	40.0	61.3	54.8	41.4	42.9	28.4	40.8
Blowing hot air on a person can cause heat exhaustion to occur more quickly (yes)	85.7	77.8	89.5	91.5	94.1	85.7	87.4
100% (4 items) correct	9.1	10.0	6.3	2.4	13.3	2.7	5.2

carers about managing groups of clients' (78%), or that they have sufficient knowledge and skills to provide 'a specific assessment of risk of heat associated illness for individual clients' (74%). Only 71% of respondents agreed they would be able to develop 'a prevention strategy with interested community groups'.

Participation in specific strategies

Respondents most frequently agreed their organisations could assist to reduce harm to older people from heatwaves by 'providing information to individuals' (96%), 'providing information to groups' (93%), and 'distributing pamphlets' (91%). Strategies least frequently agreed to from the suggested list were 'organising cooling shelters' (36%), and 'seeking out homeless individuals' (42%).

Discussion

This survey-based study has investigated the awareness, knowledge and practices of personnel of health profession and care provider groups that support the health of older, community dwelling Victorians, regarding the health impact of heatwaves.

The study found that most survey respondents showed a high level of awareness that heatwaves can be harmful for older people, and perceived 'hot weather' as being within temperature parameters known to be associated with increased mortality of older people in Victoria.

Notable gaps in knowledge were identified, including a lack of understanding that older people frequently die during extreme hot weather due to worsening of pre-existing illnesses, and that heat-stroke is a serious condition requiring urgent medical attention. Living in a city, and being exposed to heatwaves occurring early in the summer season were least well-understood risk factors for heat-related illness, while regular social interaction was the least well-understood protective factor. The function of fans was most poorly understood, with less than half of all respondents understanding that fans do not cool the air. Differences were apparent between the health profession and care provider groups, with the overall level of knowledge being least for Local Government care providers.

Few organisations were found to have existing heatwave plans, and responses to heatwaves were found to be mostly reactive and opportunistic, rather than proactive. While most respondents felt they could contribute to identifying and contacting high risk individual prior to and during a heatwave, few actually did this. The most commonly cited reasons for not taking action were that advice had already been provided and that other professional groups or family members would provide the necessary care. Few respondents believed their organisations could participate in proactive activities such as seeking out the homeless.

One peer-reviewed international study has described perceptions of staff of health and care provider organisations regarding the implementation of a heatwave plan (Abrahamson and Raine 2009), and others have investigated knowledge and perceptions of risk of harm from heatwaves of older people themselves (Sheridan 2007; Abrahamson et al. 2008). However, the study reported here is the first to provide empirical evidence about the awareness, knowledge and practices of health profession and carer personnel regarding the health impact of extreme hot weather on older people living in the community in Victoria, or internationally.

This study is limited by a low response rate and by the potential for responder and measurement bias. Potential sources of error were addressed using random sample selection, by promoting participation using an established protocol, by pilot testing the survey tool for face validity, and using the Project Reference Group to triangulate study findings.

Excluding General Practitioners, the overall response rate was 29.5% (316/1072), and varied considerably between the stakeholder groups. The low response rates from nursing staff were particularly surprising, and may be due to a lack of time, or lack of interest in the subject matter. The low participant rate is perhaps reflective of the widespread decline in response rates for all types of surveys (Tourangeau 2004), and limits the ability to draw conclusions about individual professional groups or to generalize to other professions.

Responder bias may have led to an over-estimate of awareness and knowledge if responders were more interested in the health impact of heatwaves than non-responders; the anonymous nature of this study did not allow assessment of non-responders. Measurement error may have arisen through misinterpretation of survey questions. Despite these limitations, this study has identified knowledge and practice gaps common to all participating health profession and carer groups.

This study provides evidence of gaps in knowledge, and of an opportunistic, reactive approach to the minimisation of harm from heatwaves by health profession and care provider staff in Victoria, that leaves vulnerable older people at risk of preventable harm. Based on these findings, there is an imperative to improve knowledge of heat-related illness and the management of the elderly during periods of extreme heat. Very few respondents indicated that their workplace currently has a documented emergency response plan, a significant public health gap that will need to be addressed. Findings from this survey will inform the development of appropriate policies to address key knowledge gaps, and contribute to the development of the heatwave planning for Victoria.

This study was completed prior to severe heatwave in Victoria in 2009; it would be of interest to repeat the survey to investigate changes in awareness, knowledge and practices of health and care providers since that event, particularly in light of the subsequent publication of

heatwave planning resources by the Victorian Government Department of Health, including the 'Heatwave Plan for Victoria 2009–2010'(Victoria Government Department of Human Services 2009; Victorian Government Department of Health 2009, 2010).

Acknowledgments This research project was funded by the State of Victoria through its Department of Health. The views and conclusions are those of the authors and do not necessarily represent those of the Department of Health or Monash University. The authors wish to thank the individuals who participated in the survey and also members of the Project Reference Group who provided feedback regarding project findings.

Conflict of interest The authors declare that they have no competing interests.

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