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Unpacking Heatwave Vulnerability in Older Adults: A Scoping Review Protocol

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Hannah Mason: This scoping review forms part of Hannah Mason's PhD project at James Cook University



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Abstract

Background: Heatwaves are recognised as a silent killer, with disproportionate impacts on vulnerable populations. In Australia, the intersection of increasing extreme heat events and a rapidly aging population presents a public health challenge. While older adults are often identified as vulnerable during extreme heat, the underlying factors that drive this vulnerability are inconsistently defined across the literature.

Objectives: To identify and synthesize risk factors and protective factors that contribute to heatwave-related morbidity and mortality among older adults in Australia.

Methods: This review will be conducted in accordance with the PRISMA-ScR guidelines. Five online bibliographic databases will be searched using a structured strategy: Medline (Ovid), CINAHL, Scopus, Web of Science and PubMed). Key terms will include extreme heat, heatwaves, older adults, and Australia. The screening process will be conducted via the online tool Rayyan. Included studies will be quality appraised, and then data will be extracted, tabulated, and synthesized.

Results: It is expected that the findings will highlight patterns in health outcomes and the contextual factors that shape vulnerability among older Australians. Results will inform future research and public health strategies to mitigate extreme heat health risks in ageing populations.

Background

- 1 Heatwaves are lethal natural hazards, often overlooked in the context of more violent and visible disasters [1]. Because of this, they are considered a 'silent killer' [1]. The frequency, severity, and duration of extreme heatwaves are projected to rise due to anthropogenic climate change [1, 2]. Heatwaves threaten the environment, the economy, society, and public health [1, 3]. Heatwaves directly impact human health by triggering acute conditions such as dehydration, heatstroke and cardiovascular strain, and also by exacerbating existing medical conditions by interfering with thermoregulation [4, 5]. These events also indirectly affect human health through social determinants, for example, by affecting agriculture and food supply or causing power disruptions [3]. However, this impact is not spread equally across all population groups [6, 7]. Over recent years, heatwaves research has pointed to population groups who are deemed at higher risk for negative health consequences during heatwaves, and this includes older adults [6, 8, 9].

Australia's combination of extreme climate variability and a rapidly aging population makes it a critical setting for studying heatwave vulnerability in older adults. The substantial variability in Australia's climate contributes to its classification as a global hot spot for heatwave activity, where heatwaves can occur in any season [10]. The country is also experiencing rapid population ageing [11], and this demographic shift will result in more older adults exposed to heat stress and growing demand for health services. Historically, older adults have been considered vulnerable to extreme heat [3, 8]. This vulnerability is shaped by physiological factors such as cardiovascular and respiratory problems, but also socioeconomic and demographic factors [8]. However, epidemiological studies have contradictory results regarding the effect of heatwaves on older populations. Some studies report elevated morbidity and mortality in comparison to other age groups [6, 12, 13], while others show more nuanced or inconclusive outcomes [14, 15]. Moreover, there is a notable gap in research exploring the underlying factors that contribute to older adults' vulnerability [16], which may include housing quality, social isolation, access to cooling, pre-existing health conditions, and many unknowns [17, 18]. Understanding these dimensions is essential for developing public health strategies that protect older Australians in a warming climate.

Objective & Research Questions

- 2 **Objective:** The purpose of this review is to identify and determine the driving factors that influence heatwave vulnerability for older adults in Australia.
- 3 **Research Questions:**

- a) What are the risk factors that increase heatwave morbidity and mortality for older adults in Australia?
- b) What are the protective factors that reduce heatwave-related health risks for older adults in Australia?

Methods

4 This scoping review will be conducted in accordance with the PRISMA-ScR guidelines [19].

5 PECO Framework-

To refine the eligibility criteria and ensure a systematic approach to study selection, the PECO framework (Population, Exposure, Comparator, Outcome) has been adopted to guide study inclusion (Table 1)[20].

Table 1. Application of the PECO Framework to the Research Question

Concept	Parameters
Population	Older adults, with age definitions as reported in the included studies. We will document how age is operationalised across the literature to identify how 'older adults' are defined in the context of heatwave research.
Exposure	Extreme heat or heatwave events, with definitions as reported in the included studies. We will document how heatwaves are operationalised across the literature to identify patterns in how extreme heat and heatwave events are characterised (e.g. temperature thresholds and relative vs absolute definitions).
Comparison	Non-extreme heat and non-heatwave periods, where appropriate.
Outcome	Health outcomes during heatwave periods, including morbidity (GP visits, ambulance presentations, emergency department presentations, hospital admissions) and mortality, as well as identified modifiable and non-modifiable risk and protective factors for these health outcomes.

6 **Search strategy-**

A librarian at James Cook University was consulted to inform the search strategy. Five databases that are commonly accessed in Public Health research will be searched: Medline (Ovid), CINAHL, Scopus, Web of Science and PubMed. The search string will follow the organisation presented below in

Table 2. Searches will be slightly modified to suit the functionality of each database, with Boolean operators and truncation applied as appropriate.

Table 2. General search strategy

General Concept	Search Terms
Extreme Heat	"extreme heat" OR "heat wave" OR "hot spell" OR "heat spell" OR heatwave OR "hot temperature" OR "effects of heat" OR "heat stress" OR "extreme hot weather"
Older Adult	elder* OR older adult OR geriatric OR aged OR aging OR senior OR mature adult OR late life OR age group OR age
Australia	Australia OR Queensland OR New South Wales OR Victoria OR Tasmania OR Australian Capital Territory OR Northern Territory OR QLD OR NSW OR Vic OR Tas OR ACT OR NT OR WA OR SA

7 Study selection-

The inclusion and exclusion criteria are described in Table 3.

Table 3. Inclusion and exclusion criteria

Domain	Inclusion	Exclusion
Design	Studies that provide relevant data to the research questions and meet the inclusion criteria as defined by the PECO statement	Grey literature, editorials, commentaries, and reviews. Studies that do not report primary data
Reporting of Results	Studies that report primary data relevant to the research question	Studies where relevant data for older adults cannot be extracted
Type of Exposure	Real-world extreme heat and heatwave events	Experimental studies using artificially induced heat exposure in controlled settings
Language	Studies published in English	Studies published in languages other than English
Publication Date	No publication date restriction	N/A

Results from each of the five databases will be imported into the Systematic Review Accelerator tool for deduplication. Deduplicated results will then be imported into Rayyan, a web-based tool for facilitating blinded systematic review workflows [21]. Authors will blindly screen all titles and abstracts against the inclusion criteria, with each

paper having a minimum of two reviews. Any conflicts or studies marked as “maybe” will be resolved during a team meeting. Once decisions are finalised, full-text articles will be retrieved via the James Cook University Library. Full-text screening will then be undertaken via the same blinded process to confirm eligibility. The references of all included studies following this process will be exported into Endnote for citation management.

8 **Quality appraisal-**

The Quality Assessment for Diverse Studies (QuADS) tool will be used to assess the quality of the included study [22]. This tool is designed to accommodate a range of methodological approaches, which is suitable for this review. Quality appraisal will be conducted by a single author, with 20% checking from a second researcher. The results of the appraisal will be used to describe the overall quality of the evidence, but will not be used to exclude studies from the review.

9 **Data extraction and analysis-**

A data extraction tool will be developed in Microsoft Excel. The research team will determine the variables of interest for data extraction based on the research question [23]. Data extraction variables will include: author(s), year of publication, study design, study period, data sources, study population, exposure (heatwave or extreme heat), definition for exposure, morbidity outcomes, mortality outcomes, risk factors, and protective factors. One author will extract the data with 20% checking from a second research team member.

Extracted data will be synthesised using descriptive and thematic analysis [19]. Quantitative data will be summarised using frequency, counts, and tabulations to identify patterns across the included literature. Qualitative data will be analysed thematically to capture conceptual patterns. Where appropriate, results will be stratified by outcomes, geographic region, study design, or population characteristics.

10 **Funding and conflict of interest-**

The authors declare no funding nor conflicts of interest.

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