

Ageing in the Warming World

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Facts



1.07-degree
rise in temperature in
the past was due to
human activity.^[1]



2-degree
rise in average
temperature this century
is predicted, as well as
more extreme
temperature events,
such as heat waves.^{[2], [3]}



1.5-degree
warming goal set in the
the Paris Agreement, to
avoid the worst
consequences of global
warming.^[1]



1 in every 8
people
in the world live with a
mental disorder.^[4]



55.2 million
people
living with dementia
worldwide.^[5]



Around 2
billion people
will be aged 60 years or
over by 2050 globally.^[6]

Challenges and Responses



Climate change and population ageing are major global health challenges for this century.^{[7], [8]} We are confronting long-lasting warming event and unprecedentedly severe heatwaves, which threaten the wellbeing of individuals.^[9] Is there an association between heat and mental disorders and is heat a risk factor for mental wellness of those who are ageing?

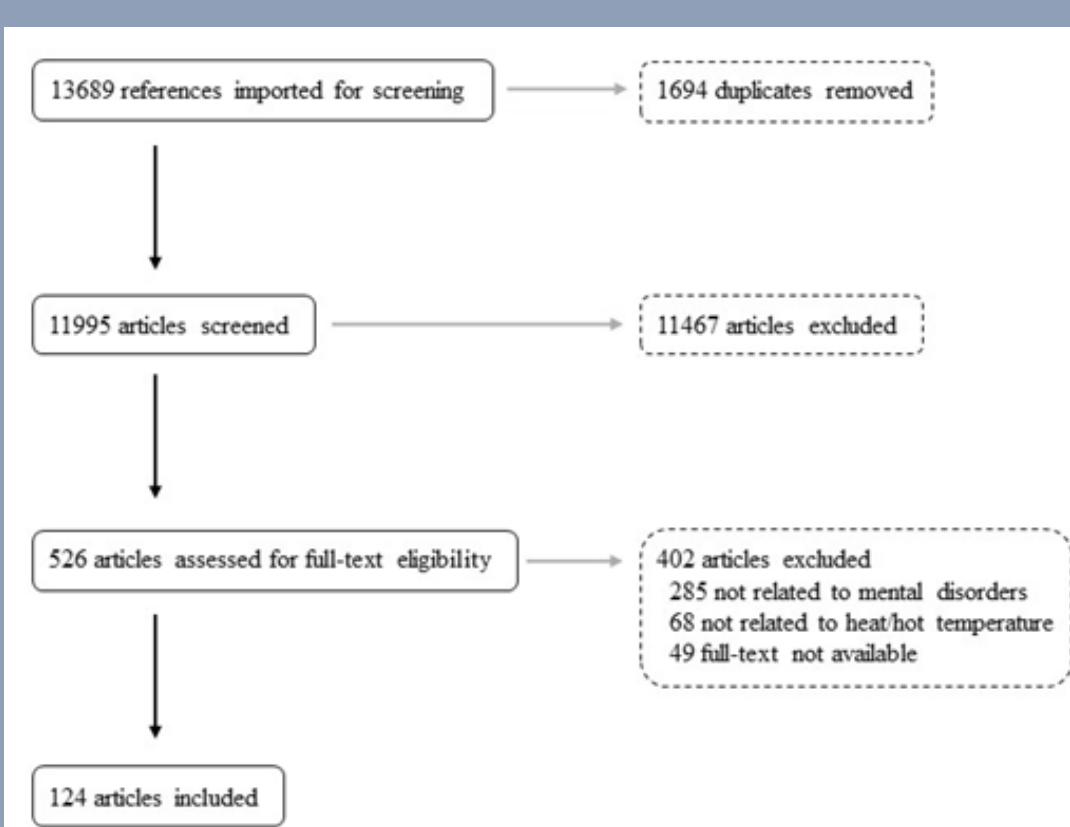


To respond to these challenges, my PhD has the following objectives: (1) a scoping review: to understand the extent and type of existing evidence demonstrating the relationships between heat and mental disorders; (2) a quantitative study: to examine whether heat (short-term) and rising temperature (long-term) are associated with impaired cognitive function and dementia. These studies aim to answer research questions: (1) What do we know about the association between heat and mental disorders according to existing literatures and what are the gaps? (2) What measurements of heat were used to study the relationship between heat and mental disorders? (through a Scoping Review) (1) What is the relationship between heat and cognitive function? (2) What is the long-term effect of rising temperature on cognitive function? (through a Quantitative Study)

Heat and Mental Disorders: a Scoping Review

The protocol for the scoping review was developed in accordance with the guidance and reporting items proposed by the Joanna Briggs Institute Scoping Review Methodology Group.¹⁸ The review is also shaped by Arksey and O'Malley guidance from 2005. The databases Embase, PubMed, Global Health and Web of Science were systematically searched for relevant articles, using the combination of key words related to "heat" and "mental disorders".

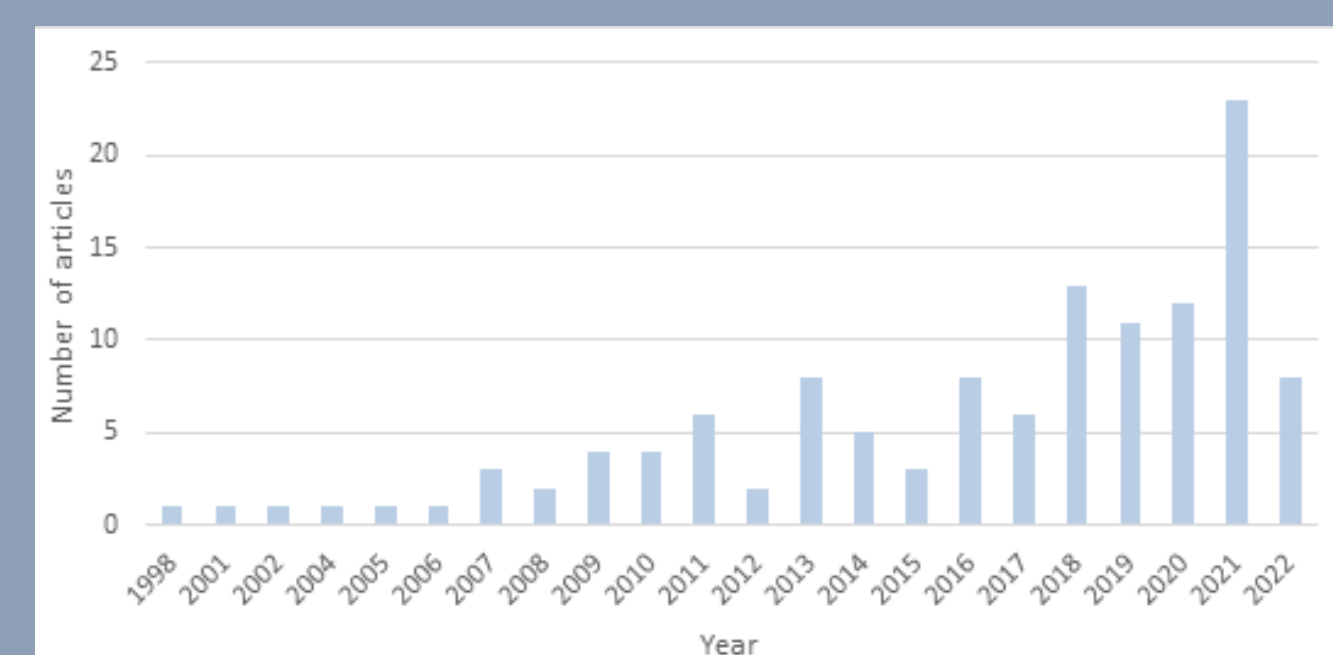
- 124 articles were included in this scoping review. Most studies were conducted in high income settings in Europe, North America, Asia, and Oceania. There was significant growth in the number of articles published from 1998 to 2022.
- Daily minimum, maximum, and mean temperature were the three most common used measurements of heat. Most studies adopted the top percentile (90th, 95th, 97.5th and 99th) of temperature as the threshold of heat.
- Increasing frequency and intensity of heat waves and increasing temperatures pose great stress on the burden of mental disorders. Heat and higher temperature were associated with more mental disorders-related hospitalisations, emergency department visits and mortalities.
- Research gaps were identified of studies in low-income setting, African, Latin American and Caribbean countries, and studies focused on specific mental disorders such as dementia.



PRISMA flow chart

	Percentage (n)
Geographical area (excluding multi-area articles, n=95)	
East Asia and Pacific	42.1% (40)
Europe and Central Asia	28.4% (27)
North America	25.3% (24)
South Asia	2.1% (2)
Latin America & the Caribbean	1.1% (2)
Middle East and North Africa	1.1% (2)
Income status (excluding multi-area articles, n=95)	
High-income economies	81.1% (77)
Upper-middle-income economies	13.7% (13)
Lower-middle-income economies	5.3% (5)
Low-income economies	0% (0)
Study design (all original articles, n=83)	
Quantitative research	89.2% (74)
Qualitative research	9.6% (8)
Mixed-method research	1.2% (1)
Study result disaggregated by sex	
Yes	48.0% (60)
No	22.4% (28)
N/A	29.6% (37)
Study result disaggregated by gender	
Yes	42.4% (53)
No	28.0% (35)
N/A	29.6% (37)

Characteristics of articles included



Number of articles published between 1998-10th of May, 2022

The Association Between Heat and Cognitive Function: a Secondary Data Analysis



Age plays a significant role in determining an individual's ability to cope with heat stress. The exposure to hot temperature can negatively affect cognitive function, especially in older populations, as age-related changes can reduce the ability of regulating internal temperature. However there are few studies looking into the direct effect of heat on cognitive function in an older population. The aim of this quantitative study is to examine whether heat (short-term) and rising temperature (long-term) are associated with impaired cognitive function, mild cognitive impairment and dementia.



True population data, from English Longitudinal Study of Ageing (ELSA) and China Health and Retirement Longitudinal Study (CHARLS), will be used to examine the association between heat and cognitive function in England and China. Meteorologic data, including daily average temperature and humidity, will be collected from local monitoring sites of databases. The characteristics of participants and the temperature distribution during study period will be summarised. Then generalised linear mixed models will be used to explore the relationship between exposure to heat and cognitive function.

[1] IPCC, *Climate Change 2022: Impacts, Adaptation, and Vulnerability*. Cambridge University Press, 2022.

[2] Collins, M., et al., *Long-term climate change: projections, commitments and irreversibility*, in *Climate Change 2013-The Physical Science Basis: Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. 2013, Cambridge University Press, p. 1029-1136.

[3] Helldén, D., et al., *Climate change and child health: a scoping review and an expanded conceptual framework*. *The Lancet Planetary Health*, 2021. 5(3): p. e164-e175.

[4] Institute of Health Metrics and Evaluation. Global Health Data Exchange (GHDx), (<https://vizhub.healthdata.org/gbd-results/>), accessed 14 May 2022).

[5] Global status report on the public health response to dementia. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

[6] <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>

[7] Watts, N., et al., *The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate*. *The Lancet*, 2019. 394(10211): p. 1836-1878.

[8] Livingston, G., et al., *Dementia prevention, intervention, and care: 2020 report of the Lancet Commission*. *The Lancet*, 2020. 396(10248): p. 413-446.

[9] Myers, S. and H. Frumkin, *Planetary Health Protecting Nature to Protect Ourselves*. 2020.