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Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review

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ABSTRACT

Objectives: The objective of this study was to describe the mental health effects of high ambient temperatures and heat waves, determine whether heat-related morbidity and mortality are increased among people with known mental disorders and identify knowledge gaps to inform targeting of future research.

Study design: Systematic literature review and narrative synthesis.

Methods: A systematic review of published literature using MEDLINE, Embase and PsycINFO without geographical or temporal limits was conducted. We included studies that explicitly linked high ambient temperatures and/or heat waves to mental health outcomes. Evidence was graded using a National Institute of Health framework.

Results: A total of 35 studies were included in the review, among which 34 were observational studies and one was a case–control study. Six broad mental health outcome categories were identified: suicide and heat; bipolar disorder, mania and depression and heat; schizophrenia and heat; organic mental health outcomes and heat including dementia; alcohol and substance misuse and heat; and multiple mental health outcomes/mental health service usage and heat. The studies included were heterogeneous in terms of study design, population, setting, exposure measures, outcomes and location making meta-analysis unfeasible. Fifteen studies showed an increased suicide risk with heat (relative risk [RR] 1.014–1.37 per 1 °C, $P < 0.05$; $r = 0.10–0.64$, $P < 0.05$). Increased risks of mental health-related admissions and emergency department visits at higher temperatures were also found. No evidence of change in community care use was found. Evidence for the impact of heat on other mental health outcomes was mixed.

Conclusions: High ambient temperatures have a range of mental health effects. The strongest evidence was found for increased suicide risk. Limited evidence was found for an increase in heat-related morbidity and mortality among people with known mental health problems. Knowledge gaps exist on the impact of high temperatures on many common mental health disorders. Mental health impacts should be incorporated into plans for the public health response to high temperatures, and as evidence evolves, psychological

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morbidity and mortality temperature thresholds should be incorporated into hot weather –warning systems.

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Introduction

Global average temperatures are increasing due to climate change. 2016 was the warmest year on record; the 10 warmest years on record occurred in the past 15 years¹ with consensus that this warming is anthropogenic.²

Environmental hazards and disasters are associated with a range of adverse mental health impacts.³ Understanding this risk has been highlighted as a priority in a landmark UN agreement, the Sendai Framework for Disaster Risk Reduction.⁴ A number of direct impacts have been reported, including suicide epidemics in agriculture workers linked to prolonged drought,⁵ posttraumatic stress disorder (PTSD), depression after flooding in the UK⁶ and increased violent suicides at high ambient temperatures.⁷ Indirect impacts include mental health consequences of migration and displacement after disasters and conflict and reduced health infrastructure spending.⁷

Common mental disorders such as anxiety and depression are among the greatest health burdens globally.⁸ Severe mental health problems such as schizophrenia and bipolar disorder are less prevalent⁸ but still significant in terms of their impact on health. Treatment options for mental ill-health range from primary care interventions to admission and treatment in specialist facilities. The importance of environmental factors on mental health outcomes is beginning to receive attention.⁹

The fifth assessment report of the Intergovernmental Panel on Climate Change predicted rising temperatures and an increase in the frequency and intensity of heat waves by the mid-21st century.¹⁰ This suggests that extreme weather events may happen with greater frequency, such as the 2003 European heat wave that resulted in an estimated 35,000 excess deaths.¹¹ The association between high ambient temperatures and physical illness is well documented,^{3,12–16} mental health has received less attention although the global evidence base is growing.^{7,15}

The UK Climate Change Risk Assessment 2017¹⁷ highlights risks to health, well-being and productivity from high temperatures as priority areas for action. It is apparent that a summary of the impacts of heat on mental health would be useful to guide planners and healthcare providers and also highlight evidence gaps. We therefore undertook a systematic review of such impacts to inform guidance on, plans for and response to extreme heat.

The primary objectives of the review were to

1. determine the mental health effects of high ambient temperatures and heat waves on populations;

2. identify the geographic, sociodemographic and other contextual factors that contribute to mental disorder during hot weather;
3. determine whether heat-related mortality is increased among people with known mental health disorders; and
4. identify gaps in knowledge to support targeting of future research.

Methods

A protocol following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance was registered with PROSPERO (2017 CRD42017076839).

The search was limited to human studies without date limit. All English language studies were considered from all countries, languages and contexts.

Data sources

Following advice from subject matter experts, MEDLINE, Embase and PsycINFO were searched on August 1, 2017. The search strategy is available as [Supplementary Material \(SM1\)](#). Additional articles were sought from reference lists of included studies and by consulting with topic experts to identify all relevant studies, regardless of publication status and hand searching for additional references.

Study selection

Retrieved studies were loaded into the Endnote X7 reference management system,¹⁸ and duplicates were removed before title and abstract screening was undertaken in duplicate (R.T. and R.H.). Full-text screening was performed in duplicate by three reviewers of the review team (R.T., R.H. and T.W.).

We included studies that explicitly linked high ambient temperatures and/or heat waves to mental health outcomes as follows:

- *Population:* All age groups, with or without pre-existing physical and mental health conditions, and psychiatric inpatients;
- *Interventions:* Exposure to high ambient temperature indoors or outdoors and heat waves/hot weather;
- *Comparators:* Moderate temperatures, between population groups at high temperatures;
- *Outcomes:*
 - *Morbidity:* Alcohol dependence, Alzheimer's disease, anxiety, behaviour disorder, bipolar disorder, dementia, depression, eating disorders, mania, learning disability/

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