



UK Health  
Security  
Agency

# **Public health management approaches to extreme hot or cold weather**

A rapid evidence summary

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## Main messages

1. This rapid evidence summary (search up to 8 August 2023) identified and summarised evidence relating to public health approaches under extreme hot or cold weather conditions in the event of a national power outage.
2. Three case reports were identified ([1 to 3](#)). Included studies discussed public health resources and advice issued both before and during power outages that occurred alongside extreme hot weather. No studies were identified discussing public health approaches in extreme cold weather during power outages.
3. Public health interventions discussed in the identified case reports include disposal of perishable foods and medications and approaches to protect and prioritise the elderly.
4. The evidence in this summary comes from case reports ([1 to 3](#)). Case reports are more susceptible to researcher bias and findings may be difficult to apply to other events. All 3 of the identified extreme hot weather events with power outages occurred in the USA, which may limit the generalisability of these findings to UK settings.
5. This rapid summary demonstrates that the available evidence for public health approaches for extreme hot weather conditions in the event of national power outage is very limited in quantity and quality and doesn't enable conclusions to be drawn about effectiveness of approaches. There was no available evidence for extreme cold weather during power outages.

## Purpose

The purpose of this rapid evidence summary was to identify and assess the available evidence that discussed public health approaches for the management of extreme temperatures (hot and cold) in the event of a large-scale power outage.

## Methods

The review question was:

1. What evidence is available for public health approaches under extreme hot or cold weather conditions in the event of national power outage?

A rapid evidence summary was completed in August 2023, which identified evidence to answer the research question specified above. We searched Medline, Embase and Web of Science in August 2023 for relevant evidence published prior to 8 August 2023.

Screening of title and abstracts and full texts was undertaken in duplicate by 2 reviewers for 10% of studies, with the remainder completed by one reviewer. Disagreement was resolved by discussion.

A protocol was produced before the literature search was conducted, including the review question above, the eligibility criteria, and all other methods, see [Annexe A](#). There were no deviations from the protocol.

## Evidence

In total, 1,295 studies were screened on title and abstract, of which 31 studies were screened on full text, and 3 were included in this rapid evidence summary ([1 to 3](#)). All were case reports, and all focused on the management of public health in a power outage during extreme hot weather or heatwaves. There was no evidence of studies that discussed public health approaches in extreme cold weather during power outages.

## Case reports

Three case reports that recounted public health approaches to power outages during extreme hot weather in the United States were identified.

A report from the United States Centres for Disease Control and Prevention (2013) ([1](#)) compared a multi-state power outage in 2012 that had occurred during extreme hot weather (temperatures ranged from 28.3 degrees Celsius (°C) to 40.0°C) to previous periods of extreme hot weather without power outages that had occurred in the United States from 1982 to 2012. The authors shared public health interventions that might have reduced loss of life during the 2012 event. Interventions were mostly targeted at the elderly. Areas with high concentrations of elderly individuals experiencing power outages were identified and prioritised for power restoration, and the National Guard was sent to identify individuals in these areas who were showing symptoms of heat exhaustion. 'Check your neighbour' and 'Knock and Talk' initiatives were promoted, to try and identify and assist individuals who were at risk. Multiple formats (such as press releases and reverse emergency [911] calls) were used to efficiently communicate with the public and promote advice and available resources. One state had been communicating educational messages regarding extreme heat events from the beginning of summer, and so public awareness was likely heightened. Another had pre-scripted public health messages on the dangers of excessive heat exposure, which the author suggested allowed for a quicker response to the event.

Imperato (2016) ([2](#)) reported on their experience as Commissioner of Health of New York City in 1977, when there was a large-scale power outage during a 10-day heatwave (average temperatures reached 36°C). Priority concerns for the Department of Health's blackout

contingency plan were outlined, and public health approaches to several themes were discussed. These included to avoid swimming at beaches. There were concerns that failures in the sewage system may cause contamination of local bodies of water, and so a 24-hour order stating water as unsafe for bathers was issued. This was contested by others, including the fire department, as individuals may have found other ways to cool down that could negatively affect water pressure. To ensure proper disposal of spoiled medical products. Advisories were issued to medical facilities and the public to ensure proper disposal of medications and other medical products. This guidance was supported with the implementation of a designated hotline. To support guidance about perishable food supplies, guidance was issued to advise the public about which food products to discard, and a food spoilage hotline was set up to provide advice to the public about the disposal of spoiled foods. Deaths on the day of the power outage were higher than the previous 13 days, however daily deaths rose again the week after the power outage (when temperatures reached around 40°C). The author suggested that this was indicative of deaths being temperature-related, rather than related to the power outage (2).

Neitch and others (2013) (3) report on 2 cases where elderly, bed-ridden patients receiving home-based care experienced worsening of pressure sores following a power outage of several days in temperatures around 36°C. Both patients developed stage II and III ulcers and died within 6 months of the power outage. Two public health resources were available during this event; a call centre to provide community assistance, and a vulnerable patient registry to provide local authorities with a list of vulnerable patients so they could be monitored in a disaster situation. However, the study states that these resources were under-utilised, and only 2 out of 13 physicians at the hospital were aware of their existence. The authors note that healthcare providers should be instrumental in sharing this information, and that more efficient use should be made of these pre-existing resources for vulnerable individuals by utilising health professionals who could distribute flyers to patients or those who provide home care or liaise with local media outlets.

## Health inequalities

There was very limited evidence available on public health management approaches during extreme hot or cold weather in a power outage among vulnerable groups, with the evidence limited to the elderly. Two of the case reports highlighted public health approaches specifically targeted towards the elderly that occurred when there were power outages during extreme hot weather (1, 3). There was no available evidence on differences of extreme heat and cold management strategies on other populations that may be considered vulnerable in this situation, such as those experiencing homelessness or different ethnic or social groups.

## Limitations

This rapid evidence summary used streamlined systematic methods to accelerate the review process. Most article screening was completed without duplication, and therefore it is possible

relevant studies may have been missed. Due to time constraints, critical appraisal was not undertaken which limits our ability to interpret the findings in the context of risk of bias.

The evidence comes from 3 case reports on 3 different power outages during extreme hot weather ([1 to 3](#)). Findings outlined in these case reports may be difficult to apply to other events and may be more subjective and susceptible to researcher bias. All the available evidence was from power outages during extreme hot weather in the United States, and so this may limit generalisability to UK settings.

## Evidence gaps

No studies were identified on public health management approaches in extreme cold weather during a large-scale power outage.

The effect of described public health interventions on relevant outcomes (for example, hospitalisations or deaths) in this context has not been examined in the identified studies.

## Conclusion

This rapid evidence summary included 3 case reports that discussed the public health approaches to the management of extreme heat during a large-scale power outage, and so only very limited evidence was available. Public health interventions that were discussed included disposal of perishable foods and medications as well as approaches to protect and prioritise the elderly medications, multi-media approaches to public health messaging and approaches to protect and prioritise the vulnerable. Due to time constraints, critical appraisal of the included studies was not undertaken. However, the evidence in this summary was from case reports which are by nature at high risk of bias. All evidence focused on extreme hot weather and power outage in the USA and so may be less applicable to UK settings.

## Acknowledgments

We would like to thank colleagues within the All Hazards Public Health Response division who either reviewed or input into aspects of the review.

## Disclaimer

UKHSA's rapid reviews and evidence summaries aim to provide the best available evidence to decision makers in a timely and accessible way, based on published peer-reviewed scientific papers, unpublished reports and papers on preprint servers. Please note that the reviews:

- use accelerated methods and may not be representative of the whole body of evidence publicly available
- have undergone an internal, but not independent, peer review
- are only valid as of the date stated on the review

In the event that this rapid evidence summary is shared externally, please note additionally, to the greatest extent possible under any applicable law, that UKHSA accepts no liability for any claim, loss or damage arising out of, or connected with the use of, this review by the recipient and/or any third party including that arising or resulting from any reliance placed on, or any conclusions drawn from, the review.

## References

1. Centre for Diseases Control and Prevention (CDC). '[Heat-related deaths after an extreme heat event: 4 states, 2012, and United States, 1999-2009](#)' Morbidity and Mortality Weekly Report 2013: volume 62, issue 22, pages 433 to 436
2. Imperato PJ. '[Public health concerns associated with the New York City blackout of 1977](#)' Journal of Community Health 2016: volume 41, issue 4, pages 707 to 716
3. Neitch SM and others. '[Pressure sores in bedridden elders after prolonged power outages from severe weather: examining 2 underutilized disaster resources](#)'. Clinical Geriatrics 2013: volume 21, issue 11

## Annexe A. Protocol

### Review question

The review question is:

1. What evidence is available for public health approaches under extreme hot or cold weather conditions in the event of national power outage?

This rapid evidence summary will identify and synthesise primary studies and reviews investigating public health approaches under extreme hot or cold weather conditions in the context of a power cut/outage

### Eligibility criteria

	Included	Excluded
Population	Humans	Studies not in humans
Settings	Community	Laboratory-based studies
Context	National power outage or large-scale power cut AND extreme hot or cold weather conditions	Other weather events not related to temperature (such as floods) Non-power outage scenarios
Intervention	Any public health-related approaches, guidance or advice to individuals, households, or communities for the management of exposure to extreme hot or cold weather in a power cut / power outage (For example, how can individuals maintain body temperature, how can food be preserved)	
Language	English language	Non-English language studies
Date of publication	Any	
Study design	<ul style="list-style-type: none"><li>• observational studies</li><li>• randomised controlled trials</li><li>• case reports</li></ul>	Editorials Letters Opinion pieces



	Included	Excluded
	<ul style="list-style-type: none"> <li>guidelines</li> <li>reviews (systematic, umbrella, rapid reviews)</li> </ul>	
Publication type	Published, peer-reviewed primary research studies or reviews, pre-prints	

## Identification of evidence

We will search Medline, Embase and Web of Science to identify any existing evidence related to the review question, published prior to 8 August 2023.

Screening on title and abstracts will be undertaken in duplicate by 2 reviewers for 10% of the potentially relevant studies, with the remainder completed by one reviewer. Full text screening will follow the same process. Disagreement will be resolved by discussion or with a third reviewer. Due to time constraints formal critical appraisal of included studies will not be undertaken.

## Synthesis of evidence

Details of findings relevant to the research question will be extracted and described in text. Variations across populations and subgroups, for example cultural variations or differences between ethnic or social groups will be considered, where evidence is available.

## Search strategy

### Database: Ovid MEDLINE(R) ALL <1946 to 7 August 2023>

1. Electric Power Supplies/ (8,943)
2. Electricity/ (19,815)
3. 1 or 2 (28,116)
4. (failure\* or supply or supplies or cut or cuts or outage\* or insecurity or instability or unstable or limited).tw,kf. (2,453,358)
5. 3 and 4 (2,691)
6. (blackout\* or ((electric\* or power) adj3 (cut\* or outage\* or failure\* or suppl\* or insecurity or loss))).tw,kf. (11,386)
7. 5 or 6 (13,233)
8. exp Climate Change/ (30,214)
9. exp Extreme Weather/ (303)
10. Extreme Heat/ (566)
11. Hot Temperature/ (125,085)
12. exp Cold Temperature/ (79,471)

13. Weather/ (11,831)
14. ((extreme\* or severe) adj3 weather).tw,kf. (2,960)
15. ((extreme\* or severe) adj3 (heat or hot or cold or temperature\*)).tw,kf. (11,672)
16. ((extreme\* or severe) adj3 humid\*).tw,kf. (247)
17. ((extreme or adverse or serious or bad or hot or high or severe) adj (weather or heat or hot or cold)).tw,kf. (9,334)
18. ((high\* or record or severe) adj3 temperature\*).tw,kf. (111,115)
19. ((low\* or cold\* or freezing or sub-zero) adj3 temperature\*).tw,kf. (118,034)
20. (heat wave\* or heatwave\*).tw,kf. (3,521)
21. (cold adj (spell\* or snap\*)).tw,kf. (310)
22. anomalous heat.tw,kf. (73)
23. exp Heat Stress Disorders/ (6,961)
24. hyperthermi\*.tw,kf. (35,536)
25. hypothermi\*.tw,kf. (47,340)
26. Hypothermia/ (15,005)
27. exp Cold Injury/ (2,548)
28. ((heat or cold) adj (injury or stress or exhaustion or stroke\*)).tw,kf. (26,640)
29. frostbit\*.tw,kf. (1,771)
30. (record adj2 (weather\* or cold or heat\* or hot\* or temperature\*)).tw,kf. (603)
31. or/8-30 (504,595)
32. 7 and 31 (675)

## Database: Embase <1974 to 7 August 2023>

1. power supply/ (10,578)
2. electricity/ (36,377)
3. 1 or 2 (46,029)
4. (failure\* or supply or supplies or cut or cuts or outage\* or insecurity or instability or unstable or limited).tw,kf. (3,395,742)
5. 3 and 4 (6,208)
6. (blackout\* or ((electric\* or power) adj3 (cut\* or outage\* or failure\* or suppl\* or insecurity or loss))).tw,kf. (13,072)
7. 5 or 6 (16,585)
8. exp climate change/ (58,789)
9. exp extreme weather/ (1,117)
10. high temperature/ (37,962)
11. cold/ (25,870)
12. weather/ or exp severe weather/ (26,372)
13. ((extreme\* or severe) adj3 weather).tw,kf. (3,002)
14. ((extreme\* or severe) adj3 (heat or hot or cold or temperature\*)).tw,kf. (12,309)
15. ((extreme\* or severe) adj3 humid\*).tw,kf. (266)
16. ((extreme or adverse or serious or bad or hot or high or severe) adj (weather or heat or hot or cold)).tw,kf. (10,105)
17. ((high\* or record or severe) adj3 temperature\*).tw,kf. (102,517)

18. ((low\* or cold\* or freezing or sub-zero) adj3 temperature\*).tw,kf. (107,210)
19. (heat wave\* or heatwave\*).tw,kf. (3,702)
20. (cold adj (spell\* or snap\*)).tw,kf. (323)
21. anomalous heat.tw,kf. (43)
22. exp temperature stress/ (48,320)
23. hyperthermi\*.tw,kf. (44,784)
24. hypothermi\*.tw,kf. (56,005)
25. exp cold injury/ (43,447)
26. exp heat injury/ (9,053)
27. ((heat or cold) adj (injury or stress or exhaustion or stroke\*)).tw,kf. (28,409)
28. frostbit\*.tw,kf. (1,582)
29. (record adj2 (weather\* or cold or heat\* or hot\* or temperature\*)).tw,kf. (707)
30. or/8-29 (458,807)
31. 7 and 30 (983)

## Web of Science Core Collection (Science Citation Index Expanded, Social Sciences Citation Index)

Date of search: 8 August 2023

TS=((blackout\* or ((electric\* or power) NEAR/2 (cut\* or outage\* or failure\* or suppl\* or insecurity or loss or instability or unstable or limited))))

AND

TS=((extreme\* or severe) NEAR/2 weather) OR TS=((extreme\* or severe) NEAR/2 (heat or hot or cold or temperature\*)) OR TS=((extreme\* or severe) NEAR/2 humid\*) OR TS=((extreme or adverse or serious or bad or hot or high or severe) NEAR/0 (weather or heat or hot or cold)) OR TS=((high\* or record or severe) NEAR/2 temperature\*) OR TS=((low\* or cold\* or freezing or sub-zero) NEAR/2 temperature\*) OR TS=("heat wave\*" or heatwave\*) OR TS=(cold NEAR/0 (spell\* or snap\*)) OR TS=("anomalous heat") OR TS=(hyperthermi\*) OR TS=(hypothermi\*) OR TS=((heat or cold) NEAR/0 (injury or stress or exhaustion or stroke\*)) OR TS=(frostbit\*) OR TS=(record NEAR/1 (weather\* or cold or heat\* or hot\* or temperature\*))

Filtered to categories: Health Policy Services or Health Care Sciences Services or Medicine General Internal or Public Environmental Occupational Health or Public Administration (Web of Science Categories)

48 results

## About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

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