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TO: The Manitoba Eco-Network
FROM: Mike Bagamery
SUBJECT: Climate Safe, Green City
DATE: February 2025

Cooling Under Pressure

Personal Thermal Regulation in Public Spaces

Research Memorandum

Introduction

> *"If today's cities are one of the major drivers of climate chaos, they are also its principal victims."*[1]

As climate change advances, it poses a threat to public health by the very fact of higher temperatures, which cause higher stress on vital organs. Cooling centres, which are designated artificially cooled places for people to visit when heat is extreme, are becoming increasingly popular. Cooling centres can save lives en masse in a pinch. Despite this expansion in supply, many municipalities have found gaps in getting people to use designated cooling centres. Barriers to uptake include gaps in the accommodation of people who come with animals, disabilities, or are simply socially marginalized. Duplicate construction of formal cooling centres near informal centres should be avoided, recognizing that many people already go elsewhere for cooling. It is important to work with people and not try to engineer their behaviour too much. We can do this by providing necessities and entertainment for people, designing cooling centres to accommodate the most people, and filling gaps in coverage of existing networks of cooling centres rather than duplicating them.

Research Task

This memorandum reviews popular, academic, and governmental literature around cooling centres. Cooling centres are a short-term measure for adaptation to climate change. This memorandum will explore what cooling centres are, how they operate in various countries, examine how they are sited, what they should offer, how they can accommodate people with health concerns or animals, and discuss what else can be done to adapt to or mitigate climate change.

[1]Dawson (2019 [2017]): p. 234.

What Are Heat Emergencies?

Heat emergencies can be said to be personal (when somebody suffers heat-related illness up to and including death due to impaired bodily function) or community-wide (prolonged periods of extreme heat).[2][3] Not surprisingly, communities' heat emergencies can precipitate personal ones. Zhao Qi and coauthors estimate that excess heat caused anywhere from 304,216 to 732,518 excess human deaths between 2000 and 2019; their median estimate is 489,075. Furthermore, "Globally, from 2000–03 to 2016–19, the cold-related excess death ratio changed by –0·51 percentage points and the heat-related excess death ratio increased by 0·21 percentage points, leading to a net decline of –0·30 percentage points."[4] It is unsurprising that governments, charities, and businesses would wish to provide spaces of respite for people. Cooling centres could save up to 66 per cent of deaths and possibly illnesses associated with heat.[5]

What Are Cooling Centres?

Cooling centres are spaces where people can go to reduce their body temperatures if their living spaces are too warm; they do what they say on the proverbial tin, which may be why few articles about them explain what they are, the polity under discussion notwithstanding.[6] Cooling centres can be designed as such or provide cooling as a side benefit because they have active heat transfer (such as an air-conditioned building) or passive cooling (as a location with shade or proximity to a large body of water).[7] The International Energy Agency (IEA) predicted in a 2018 report that worldwide demand for air conditioning would triple by 2050, as it had done between 1990 and 2016.[8] Canadian cooling centres run the gamut from being water-based recreation areas like splash pads and swimming pools, air-conditioned public buildings like libraries, and large, spacious tents, while in Vietnam the last tend to proliferate. Notably, "in existing urban areas, providing shade alone (via a white top tent) will not decrease the air temperature."[9] For maximal effect in cooling

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[2]See, e.g., the map of free cooling centres and cooling spaces embedded in Thyaparan (2023).

[3]According to Dale Beugin and coauthors, the common expressions "heat wave" and "extreme heat" do not have official definitions from governments in Canada (2023: Box 1, p. 4). However, Tabea Junker and coauthors specify that high humidity must combine with high temperatures to produce a heat wave. High humidity "makes it a challenge for our body to sweat off the heat" (2024: p. 5).

[4]Zhao et al. (2021): Table 1, p. e418, and p. e422.

[5]Bedi et al. (2022) cite this estimate from Bouchama et al. (2007). Vancamp (2019) explains how extreme heat causes various organs to fail.

[6]See, e.g., CBC Winnipeg (2021, 2024) on Winnipeg; *Pittsburgh Post-Gazette* (2024) on Pittsburgh; Huret (2024) for French cities; and Cote (2024) for German cities.

[7]Campbell et al. (2021): pp. 152–5. I agree with Jennifer Kingson (2023) and Ryan Ness (quoted in Thyaparan, 2023), who liken cooling centres to Band-Aids that help temporarily but on which society must not rely exclusively.

[8]Dean et al. (2018).

[9]See, e.g., the map of free cooling centres and cooling spaces embedded in Thyaparan (2023); British Columbia (2020); Junker et al. (2024). The quotation is from British Columbia (2020): p. 4.

people and thereby alleviating stress on their hearts, air conditioning is important, though the benefits tend to last only a short time.[10]

Cooling centres must be safe and welcoming for people. Discrimination and means-testing must not happen: a wealthy, White, able-bodied, male, or neurotypical person must have access as must someone who is poor, Black, Indigenous, disabled, female, genderqueer, or neurodivergent. A manual published by the German Red Cross recommends that they offer a place for visitors to store their personal effects; personal spaces with many seating options; salubrious food, beverages, and appliances to help prepare them; options for education (e.g., about the effects of extreme heat on health) and entertainment (such as Wi-Fi access, games, or reading materials). They should also be on well-trafficked routes, near publicly available bathrooms and washing stations, and staffed by friendly volunteers who know first aid and other emergency medical interventions well.[11] Some areas should be set aside for people with high sensory sensitivity.[12] Before deciding where to set up a cooling centre, mapping a community for two factors—which areas have the most heat-threatened microclimates and the poorest people—is crucial, as Susan Dinnissen and her coauthors see happen in Hanoi, the capital of Vietnam.[13]

The Social Mechanics of Cooling Centres

Using water-based recreation areas as cooling centres offers a measure of community and opportunity to be active while cooling down. The other amenities recommended give people opportunities to partake in other individual and community activities; this is especially important for treating mental health concerns. A cooling centre could also become a co-working space, or vice versa. People can bond and bridge at a well-situated, well-attended cooling centre. Human users who have pets or service animals should occupy separate sections to accommodate those with allergies to extra-human animals, who themselves should be provided with water and food. Cooling centre operators should explain to pet keepers whether and why they accept pets or not so the humans can plan as needed.[14] (Petco, the supply chain store, has offered ad hoc cooling centres to which people can bring pets.[15])

In Hanoi, the German and Vietnamese Red Cross societies mapped the city wards most at risk of heat emergencies to target them for easiest access to Red

[10]Meade et al. (2024); Meade et al. (2023).
[11]Junker et al. (2024): pp. 20, 19, 16.
[12]Yoon et al. (2025) put it this way: “Attempts to accommodate all can backfire” (p. 15).
[13]Dinnissen (2020).
[14]Junker et al. (2024); O’Toole (2023). Gorman et al. (2020: p. 11) note that in Hamilton, “Some respondents described how the environment at the library isn’t welcoming towards their young children, or their dogs, and how that is one of the greatest deciding factors in what cooling locations they choose to use.”
[15]Tarrab (2023).

Cross cooling tents.[16] In Jung-gu, the historic centre of Seoul, Korea, as of 2018, there was a considerable population (about 20%) of senior citizens who could not walk to a cooling centre within twenty-five minutes of leaving their residences. While this situation had improved by 2024 for seniors in Seoul, most people did not realize that this was a problem for people in other demographics like those with disabilities.[17] Three major cities in Canada and twenty-five in the United States have major gaps in equitable access to cooling centres.[18]

Los Angeles County, California, and Maricopa County, Arizona, two populous areas in the hot American Sun Belt, found large gaps in cooling centre use even during periods of community heat emergencies. In Los Angeles, people needing to go somewhere cool tended to prefer informal cooling centres like shopping malls over sites designated as specialized cooling centres. (The same phenomenon has obtained in Hamilton, Ontario, whose government has "provide[d] free admission to public pools, as well as advertis[ed] City facilities like libraries, public beaches, shelters, municipal service centres, and Service Ontario locations" and donated "free water bottles, sun hats, and sunscreen" at community centres during heat emergencies.)[19] This may be partly because, as Andrew Fraser and his coauthors find, "significant fractions of the [cooling] networks were located in areas with abundant, publically available, air-conditioned spaces."[20] In Pacoima, California, near Los Angeles, people tended to use shaded and unshaded areas at about the same levels whether there was a heat emergency in the community or not.[21]

In Rio de Janeiro, Black and disabled persons in the favelas (slums) tended not to have access to cooling centres, nor did many people with disabilities in Aotearoa New Zealand.[22] In Aotearoa New Zealand, women and gender-diverse people were considered especially energy-poor—needing to pay larger shares of their money to using energy at home—as do people with disabilities and mental illnesses.[23]

Mobile cooling centres (which may be retrofitted air-conditioned buses) could and should visit people who have limited mobility or chronic illnesses. Information about how cooling centres work must be available, comprehensive, and understandable: medical professionals and volunteers should avoid jargon, use sign language for those with impaired hearing, large print for those with impaired vision, Braille for those with no or low vision, involve a translator for people not fluent in the prevailing language, and make space for service animals. Doors and registration tables should

[16]Dinnissen (2020).
[17]Ahn and Chae (2018); Lee and Han (2024).
[18]On U.S. cities, see Kim et al. (2021). On Canadian cities, see Quick et al. (2023). Note, however, that in Vancouver many people who were not poor or old did not use cooling centres because they believed those facilities catered specifically to people in those demographics: see Yoon (2025).
[19]Los Angeles: See Derakhshan et al. (2023). Maricopa County: See Berisha et al. (2017). Hamilton: See Gorman et al. (2020). The quotations are from Gorman et al. (2020): p. 5.
[20]Fraser et al. (2018): abstract, p. 109.
[21]Derakhshan et al. (2025): pp. 3, 4.
[22]Mazzone et al. (2024); Dohig et al. (2025).
[23]Dohig et al. (2025); Kelly-Costello (2022).

be operable by people who use wheelchairs; surfaces within and outside the cooling centre should be smooth, lacking in obstructions, and there should be at least one door that does not require stairs to reach.[24]

What Else Can We Do?

Cooling centres are an important short-term adaptation to climate change and can help people in the short term. One comparative study of the strategies of Paris and Seoul for preventing heat-related deaths, taking them respectively as proxies for France and Korea,[25] finds that Paris favours measures for mitigation while Seoul favours adaptation. The death toll in France from the 2003 heat wave there exceeded that in Korea from the 2018 heat wave there by a factor of 309, partly because France implemented adaptive measures after its heat wave whereas Korea did so previously.[26] A review of German cities found that only one had mentioned public cooling spaces as a measure for dealing with acute heat.[27] Both Germany and France have also been noted to have expanded cooling centres.[28] For those who need or prefer to stay at home, and who live in social or multi-unit housing, expanding residential cooling is also important.[29] Both residential and public cooling should be supplemented with ecological restorations like green roofs, renewable energy, and, where possible, should incorporate local design tactics. Repurposing buildings whose previous occupants have stopped using them is also a good way to use less material.[30]

Conclusion

Cooling centres are increasingly part of urban life in the age of climate change. People who face social and economic discrimination, as well as those with physiological differences from the norm, are at greater risk of illness as well as death due to heat. Many municipalities have work to do in attracting people to cooling centres. They can base their attraction on an appeal either to priority, by appealing to those most vulnerable to adverse outcomes from heat exposure, or population, that is, trying to cover the most possible people. Some segments of the population have more immediate need for cooling than others, though attempting to provide for all may have the effect of providing for the neediest.

At present, many people go to unofficial cooling centres, often to accomplish multiple things at once. Sometimes it is worth trying to break people's habits, but other times not; the most existential threats in a heat emergency are illness and

[24]California (n.d.).
[25]Over which countries they have power in politics (as national capitals), economics, and culture.
[26]Hong et al. (2022): pp. 1464–6.
[27]Hannemann et al. (2024).
[28]Cote (2024); Huret (2024).
[29]See Thyaparan (2023); British Columbia (2020); O'Toole (2023).
[30]See Hannemann et al. (2023); Mazzone et al. (2024); Dohig et al. (2025); Limaye et al. (2024); Campbell et al. (2021): p. 156–8.

death. At the same time, we can alter cooling centres to have lower impacts while providing material and social necessities.

Annotated Bibliography

Ahn, Y. and Chae, Y., "Analyzing spatial equality of cooling service shelters, Central district of Seoul metropolitan city, South Korea." *Spatial Information Research*, 26(6) (December 2018): pp. 619–627. DOI: 10.1007/s41324-018-0206-y.

This study finds that in Jung-gu, a district of Seoul, about 20 per cent of seniors live beyond what they consider easy access to a cooling centre: a fifteen-minute-long walk. Indeed, they are clustered in precisely the wards of Jung-gu that do not host cooling centres. The authors recommend establishing new cooling centres near the underserved elderly and list ten locations they consider suitable for such based on their proximity to the most seniors. Most of these are community centres catering to seniors, possibly also chosen based on their name recognition and social acceptance as a 'place to go.'

Bedi, N.S., Adams, Q.H., Hess, J.J., and Wellenius, G.A., "The Role of Cooling Centres in Protecting Vulnerable Individuals from Extreme Heat." *Epidemiology*, 33(1) (September 2022): pp. 611–615. DOI: 10.1097/EDE.0000000000001503.

Assuming the 66 per cent reduction in risk of heat-related death if one visits a cooling centre estimated by Bouchama et al. (2007) below, Bedi et al. focus their attention on why many cooling centres had operated at a fraction of their capacity. They find that people are often unaware of cooling centres, unmotivated to visit one, denied the opportunity to visit one due to immovable commitments like work, or lacking in means to visit one. They assume that cooling centre visitation could also result in 66 per cent reductions in person-visits to emergency departments in hospitals, though this is simply made for the sake of argument in calculating the hypothetical number of people who would need to be treated for cooling centres to be budget-neutral.

Berisha, V., et al., "Assessing Adaptation Strategies for Extreme Heat: A Public Health Evaluation of Cooling Centres in Maricopa County, Arizona." *Weather, Climate and Society*, 9(1) (January 2017): pp. 71–80. DOI: 10.1175/WCAS-D-16-0033.1.

Analyzing cooling centres in Maricopa County systematically—defined to include those housed in non-profit buildings like places of worship as well as government-owned buildings—the authors find that they serve an economically disadvantaged, racially diverse, and often medically vulnerable clientele, 95 per cent of whom were adults. About 78 per cent of visitors used at least one other service offered by the cooling centre in question, such as water, food, a bathroom, Wi-Fi, games, reading material, or some form of social service. Most centres were considered accessible to people with disabilities, either certified compliant with the Americans with Disabilities Act or able to accommodate people with disabilities. This

paper also lists competencies for how to run a successful cooling centre (Table 2, p. 74) and gives a logic behind what is expected of cooling centres if they are funded more (Fig. 1, p. 73).

Beugin, D., Clark, D., Miller, S., Ness, R., Pelai, R., and Wale, J., *The Case for Adapting to Extreme Heat: Costs of the 2021 B.C. Heat Wave*. Ottawa: Canadian Climate Institute, June 2023. Retrieved from https://climateinstitute.ca/wp-content/uploads/2023/06/The-case-for-adapting-to-extreme-heat-costs-of-the-BC-heat-wave.pdf, February 9, 2025.

This broad report is mostly about the importance of longer-term adaptations and an exploration of how the 2021 heat dome affected British Columbia's economy and society for the worse. Cooling centres are mentioned three times as a means for people to get their body temperatures under control. One mention is in the context of the observation that many cooling centres did not open in summer 2021 because operators and would-be users alike were nervous about opening spaces for large numbers of people to congregate during the COVID-19 pandemic (p. 40). The authors also note that the province delegated responsibility for operating cooling centres to municipalities, but "not all municipalities had cooling shelter plans as of 2017" (p. 44).

Bouchama, A., Dehbi, M., Mohamed, G., Matthies, F., Shoukri, M., and Menne, B., "Prognostic Factors in Heat Wave–Related Deaths: A Meta-analysis." *American Medical Association Archives of Internal Medicine*, 167(20) (November 12, 2007): pp. 2170–2176. DOI: 10.1001/archinte.167.20.ira70009.

This review article estimates (based on data about heat-related illnesses and deaths from 1966 to 2006) that visiting locations with ambient cooling (e.g., a cooling centre) is one of the most effective ways to reduce one's risk of death during a heat emergency—in this case by about 66 per cent.

British Columbia (Government of) (author unknown), *Outdoor Cooling Space during Covid-19 Guide*. BC Housing (May 2020): 16 pp. Retrieved from https://www.bchousing.org/publications/Covid-19-Outdoor-Cooling-Spaces-Guide.pdf, February 10, 2025.

This is a set of provincial guidelines for how to set up cooling centres that allow users to maintain their physical distance from each other. As it is published during the early days of the COVID-19 pandemic, its recommendations would lead to an expansive cooling centre being set up. During an event like COVID, an outdoor cooling area is said to be the second-best option for people living in what is sometimes euphemistically called affordable housing, after in-unit cooling and before an enclosed indoor cooling centre.

California (Government of) (author unknown), *Accessible Cooling Centres Guide*. California Office of Emergency Services (n.d.): 3 pp. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/AFN/Documents/AFN-Library/Accessible-Cooling-Centres-Guidance.pdf, February 9, 2025.

This is a set of state guidelines for how to set up cooling centres that accommodate people with a wide range of abilities as well as with animals and without fluency in the prevailing language. Behavioural guidance for staff and volunteers includes trusting a person when they claim to have a health condition, avoiding jargon, and communicating directly with all people in need of the centre on their own behalf, that is, not through their interpreters or support personnel unless absolutely necessary.

Campbell, I., Sachar, S., Meisel, J., and Nanavatty, R., *Beating the Heat: A Sustainable Cooling Handbook for Cities*. Nairobi: United Nations Environment Programme, November 3, 2021. Retrieved from https://wedocs.unep.org/bitstream/handle/20.500.11822/37313/BTH.pdf, February 5, 2025.

Pages 152–153 of this document discuss what "community cooling centres" (defined expansively to include those owned or operated by governments, profit-seeking businesses, and independent non-profit organizations) should provide to their users. The authors recommend that authorities do the following with cooling centres: place them in areas that as many heat-vulnerable people can reach as easily as possible; seek to serve the least well off as a priority but endeavour to admit everybody who visits; charge as little up front as possible; advertise them to people early and often, through multiple media, in all languages, before extreme heat begins; and provide amenities like water and, if possible, food, entertainment, and backup power. Page 154 discusses how public water features can be incorporated into public cooling infrastructure, as does page 155 with public transit networks. Pages 156–158 discuss community greening programs, nature-based solutions, and other surface-cooling work that relevant major actors ought to undertake to help mitigate climate change.

CBC News Winnipeg (author unknown), "Winnipeg mayor calls on province to open cooling centre in response to extreme heat." June 30, 2021. Retrieved from https://www.cbc.ca/news/canada/manitoba/brian-bowman-cooling-centre-extreme-heat-winnipeg-1.6086400, February 13, 2025.

In this story, Brian Bowman, then mayor of Winnipeg, announced that part of City Hall would be open as a public cooling centre until July 4 in response to the heat dome that prevailed over much of Western Canada at the time.

CBC News Winnipeg (author unknown), "Winnipeggers can beat the heat at hydration stations, cooling centres as heat warnings continue." August 24, 2024. Retrieved from https://www.cbc.ca/news/canada/manitoba/winnipeg-hydration-cooling-centres-

heat-1.7304279, February 13, 2025.
This is a report on a heat warning in southern Manitoba in 2024. The city of Winnipeg designated eight places—mainly in the less affluent downtown and north-central parts of the city—as hydration stations, announced that people could "also cool off in leisure centres and libraries during regular operating hours," and could visit public pools and spray pads to cool themselves.

Cote, K., "Germany's Public Health Programs That Address Extreme Heat Need to Be Strengthened." *Climate Scorecard*, August 13, 2024. Retrieved from https://www.climatescorecard.org/2024/08/germanys-public-health-programs-that-address-extreme-heat-need-to-be-strengthened/, February 14, 2025.
An article reviewing the uptick in numbers of heat emergencies, deaths, cases of dehydration, heat stroke, and cardiovascular complications, negative consequences on agriculture and forest integrity, goes on to discuss measures the German government has taken to address them, "but [they] seem insufficient and incipient." Cooling centres are an example of immediate measures that cities are taking; "Berlin has implemented measures to ensure that elderly care facilities have air conditioning and sufficient hydration resources."
Dawson, A. *Extreme Cities: The Peril and Promise of Urban Life in the Age of Climate Change*. London/ New York City: Verso, 2019 [2017].
This book deals with the technical, economic, and social forces enabling or inhibiting mitigation of and adaptation to climate change. Sea walls, energy generation, the spread of diseases, the concept of resilience, and more come in for critical examination. Transformed microclimates set the foundation of what Dawson calls extreme cities. Socioeconomic inequality, which enables the wealthiest people to consume and pollute while the poorest people bear the worst of the burdens, only makes this worse.

Dean, B., Dulac, J., Morgan, T., and Remme, U., *The Future of Cooling: Opportunities for Energy-Efficient Air Conditioning*. Paris: Organization for Economic Cooperation and Development and International Energy Agency, May 2018 (88 pp.). Retrieved from https://iea.blob.core.windows.net/assets/0bb45525-277f-4c9c-8d0c-9c0cb5e7d525/The_Future_of_Cooling.pdf, February 5, 2025.
This report projects the expected need for personal cooling to 2050.

Derakhshan, S., Bautista, T.N., Bouwman, M., Huang, L., Lee, L., Tarczynski, J., Wahagheghe, I., Zeng, X., and Longcore, T., "Smartphone locations reveal patterns of cooling center use as a heat mitigation strategy." *Applied Geography*, 150 (January 2023): article number 102821, 9 pp. DOI: 10.1016/j.apgeog.2022.102821.
Tracking the movements of various people in Los Angeles County, California, through their cell phones, the authors find that informal cooling centres—those not

designated as such by the government of the county or any of its eighty-eight municipalities—made up some 90 per cent of visits to cooling spaces on twelve paired heat days over July and August 2017, with shopping malls being by far the most visited in this category. Formal cooling centres, which included libraries and parks, were used 10 to 70 per cent longer per person per visit, however, and the cutoff for an easy walk was set at 402 metres or about a quarter of a mile, about half that in other studies. Members of disadvantaged communities, including poor, elderly, and racialized people, tended to visit cooling centres in less affluent, more vulnerable neighbourhoods when they visited formal facilities. Being in a nearby, walkable location was not an automatic benefit for formal centres based in vulnerable communities in terms of visitations on very hot days, however.

Derakhshan, S., Dialesandro, J., Turner, V.K., and Longcore, T., "Space-time dynamics in hazard exposure analysis: smartphone locations show pedestrian routes are inflexible to extreme heat events." *NPJ Natural Hazards* 2(2) (January 2025): 7 pp. DOI: 10.1038/s44304-024-00053-4.

Tracking the movements of various people in Pacoima, California, through their cell phones, the authors find that they tended to visit the same locations irrespective of whether there was a heat emergency or not when they went out over July and August 2017. This suggests that they went out with goals to fulfil each time, in turn implying that cooling centres would be most occupied and thus most useful if they were set up along trafficked routes. Even the estimated 10.5 per cent of people without homes did not consciously walk in the shade or otherwise visit cooling facilities (pp. 3, 4).

Dinnissen, S., Faucet, J., Van, T., Vu, T., Dinh, T., and Quang, T., "Fostering anticipatory humanitarian actions for heatwaves in Hanoi through forecast-based financing." *Climate Services*, 18 (April 2020): article number 100171 (4 pp.). DOI: 10.1016/j.cliser.2020.100171.

Workers with the Vietnamese Red Cross and the German Red Cross mapped the fifteen wards of Hanoi most vulnerable to heat emergencies (defined here as meaning a heat index at the 99th percentile and a temperature at or above 37°C for two consecutive days). They then surveyed over 1,200 Hanoians and learned that 66 per cent of those from "vulnerable groups" such as the elderly, underclass, and manual workers had suffered from at least four symptoms of heat exhaustion. At the time of writing, there was a plan to set up cooling centres in the fifteen most at-risk wards.

Dohig, R.K., O'Sullivan, K.C., Desmarais, A.M., and Bierre, S., "Staying cool at home: Cooling practices, barriers, and possibilities for disabled people's experiences of managing summer heat in Aotearoa New Zealand." *Energy Research & Social Science*, 120 (January 2025): article number 103895 (10 pp.). DOI: 10.1016/j.erss.2024.103895.

A survey of people with disabilities (all of whom identified as female or gender-diverse) in Aotearoa New Zealand revealed that they were often either barely surviving summer heat, because it was often too strong for them to do anything else or aggravated their previous health concerns. They also tended to lack control over their home spaces to regulate their temperatures as they needed and felt socially or physically unwelcomed in cooler public areas like swimming pools. One participant mentioned that they were accommodating the wishes of their housemates with respect to thermal regulation (p. 6). Others argued for financial assistance to get personal renewable energy devices or insulation (p. 7).

Fraser, A.M., Chester, M.V., and Eisenman, D., "Strategic locating of refuges for extreme heat events (or heat waves)." *Urban Climate*, 25 (September 2018): pp. 109–119. DOI: 10.1016/j.uclim.2018.04.009.

Having mapped the network of public cooling centres in Los Angeles County, California, and Maricopa County, Arizona, two populated locations in the United States' Sun Belt, the authors find that many of the local government-provided facilities were often near facilities that people already used. As a result, people often did not go to the governmental facilities. They recommend alternative sites for cooling centres from the perspective of optimizing land use and comment on the utility of places of worship as sites for cooling centres.

Gorman, A., Greenhaw, M., and Zaslavsky, D., "Perceptions of Extreme Heat and Cooling Centres in Downtown Hamilton, Ontario." Hamilton, ON: McMaster University Department of Arts and Sciences research paper, March 17, 2020. Retrieved from https://asp.mcmaster.ca/app/uploads/2021/12/4S06-Heat-Research-Report-April-17-2020.pdf, February 10, 2025.

This community-based study interviewed and mapped residents of Hamilton's Beasley neighbourhood, where poverty and the urban heat island effect are especially pronounced, to find out how they coped with extreme heat. Participants in the research study said that they preferred to go to actively air-conditioned spaces and were willing to pay for snacks to avoid the perceived social stigma of 'freeloading' at public buildings. The ability to socialize, see other biota, maintain good health, get in water for fun, perform regular daily tasks, and the knowledge of where cooling centres were also affected participants' visits to them. A major gap in the utility of official cooling centres like the local library and municipal parks is that they only function as such "during City business hours—9 am to 5 pm, Monday to Friday" (p. 11), time which adds up to less than a quarter of one week and which is not the only time during which people need cooling.

Hannemann, L., Janson, D., Grewe, H.A., Blättner, B., and Mücke, H-G., "Heat in German cities: a study on existing and planned measures to protect human health." *Journal of Public Health*, 32 (2024): pp. 1733–1742: DOI:

10.1007/s10389-023-01932-2.
A review of seventy German cities finds that fifty-one had implemented at least one measure for addressing acute heat and forty-one had tried to integrate measures into their everyday policy, but only two, Offenbach am Main and Mannheim, had introduced a specific heat health action plan (HHAP; a third, Wuppertal, was actively developing one, while eight others had such in progress at the time). Forty-four cities published advice on personal behaviour; this was the second most common measure implemented to any degree in the collectivity of cities studied, but it was also the only one in the top eleven that was classified as "short-term" (pp. 1737, 1738).

Hong, Y-J., Min, Y-K., Lee, S., and Choi, S., "Expanded Orientation of Urban Public Health Policy in the Climate Change Era: Response to and Prevention of Heat Wave in Paris and Seoul: A Brief Review." *Iranian Journal of Public Health*, 51(7) (July 2022): pp. 1461–1468. DOI: 10.18502/ijph.v51i7.10080.
Comparing how the municipal governments in Paris and Seoul prepared public cooling shelters, the authors find Paris to have been more reactive and Seoul more proactive in dealing with acute heat. Paris' actions emphasized a desire for long-term prevention at the community level more than short-term relief at the individual scale.
Huret, C., "The French Government Takes Steps to Protect Its Citizens from Extreme Heat." *Climate Scorecard*, August 13, 2024. Retrieved from https://www.climatescorecard.org/2024/08/the-french-government-takes-steps-to-protect-its-citizens-from-extreme-heat/, February 14, 2025.
Cooling centres are mentioned in this news article as part of the second step of France's national plan for dealing with extreme summer heat, jointly with "building heat-resilient infrastructure with green roofs and reflective materials" in large cities like Paris and Lyon. These cost about €200 million per year. "Cooling centres have a 70% occupancy rate, and urban areas with heat-resilient infrastructure have reduced temperatures by up to 2°C," though it is not specified how either was achieved.

Junker, T., Paz Martín, Á., Peter, C., and Smarczyk, T., *Installation and Management of Community Cooling Centres*. Berlin: German Red Cross e.V., March 2024. Retrieved from https://preparecentre.org/wp-content/uploads/2024/04/Community_Cooling_Centre_Manual.pdf, February 9, 2025.
This is a manual for best practices of operating a cooling centre. It provides details on the material amenities that are recommended and a behavioural guide for the medical volunteers and professionals who staff the cooling centres.

Kelly-Costello, Á., "Disability in the Heat." *Disability Debrief*, July 25, 2022. Retrieved from https://www.disabilitydebrief.org/debrief/disability-in-the-heat/, February 9,

2025.
This article cites first-person testimony from named people with disabilities on the Indian subcontinent who live without energy, as well as news articles and academic studies to explain that people with disabilities and long-term illnesses are among those most at risk of dying or contracting a heat-related illness in a heat emergency.

Kim, K., Jung, J., Schollaert, C., and Spector, J.T., "A Comparative Assessment of Cooling Center Preparedness across Twenty-Five U.S. Cities." *International Journal of Environmental Research and Public Health*, 18 (2021): 16 pp. DOI: 10.3390/ijerph18094801.
This study examines the raw and demographically weighted population coverages of public cooling centres in the urban centres of Albuquerque, Baltimore, Chicago, Columbus, Ohio, Dallas, Detroit, Fresno, Kansas City, Long Beach, Louisville, Memphis, Tennessee, Mesa, Arizona, Milwaukee, Minneapolis, Nashville, Oakland, Philadelphia, Phoenix, Portland, Oregon, Riverside, St. Louis, San Antonio, San Jose, Stockton, and Washington, D.C., which were chosen for the study due to their high populations of more than 300,000 people and accessibility of official cooling centre locations through online portals they used. Easy access to a cooling centre was defined as being an 800-metre-long walk, implying that people 'should' be able to displace themselves anywhere from 32 to 56 metres per minute on average. The authors found significant negative correlation between a city's heat index and what they call standardized population coverage (SPC), insignificant positive correlation between its latitude and SPC, and great variations in coverage across vulnerable populations in those cities (those at least 65 years old, Black, Hispanic, without health insurance, and simply below the poverty line; seniors in general were the least well-served). Based on their research, the authors recommend "establishing heat wave adaptation plans and strategies, which consider current locations of cooling centres and spatial distributions of vulnerable subpopulation groups" and better "healthcare resource allocation planning for high-risk subpopulations, not only for cooling centres, but also other facilities such as emergency departments or hospitals" (p. 13).

Kingson, J.A., "Almost all solutions for heat waves in cities are short-term Band-Aids." *Axios*, July 28, 2023. Retrieved from https://www.axios.com/2023/07/28/heat-wave-stay-cool-extreme-cities, February 5, 2025.
This commentary article discusses the progress of climate change and cites the proliferation of cooling centres as among the measures many cities are taking to try to reduce deaths and illnesses from climate change in the short term but contends that these will not matter much in the long term. (Kingson discusses urban reforestation and painting pavements in light colours to increase their reflectivity of heat in the same section.)
Lee, J.S. and Han, A.T., "Heat vulnerability and spatial equity of cooling center:

Planning implications from the Korean case." *Urban Climate*, 55 (May 2024): article number 101869. DOI: 10.1016/j.uclim.2024.101869.

In this study, the authors map the distribution of affordable cooling centres in Seoul and find that it corresponds well with the distribution of facilities for seniors, and that this is attributable to local heat response policies. However, other factors influencing vulnerability to heat are not widely known in Seoul. They construct a Heat Vulnerability Index based on ten variables and suggest ways to make cooling centres more known to all who are vulnerable.

Limaye, V., Kapoor, R., Tiwari, A., Hirani, S., and Gadhvi, R., "Jodhpur, India Unveils a Net-Zero Public Cooling Station." Natural Resources Defense Council India. Retrieved from https://www.nrdc.org/bio/vijay-limaye/jodhpur-india-unveils-its-first-net-zero-cooling-station, February 8, 2025.

The authors contributed to the heat action plan published by the district government of Jodhpur in the Indian state of Rajasthan, published in 2023. This is a promotional article about a public cooling station in Jodhpur that includes the eco-friendly features of solar power and passive ventilation. It is net-zero-emitting.

Mallen, E., Roach, M., Fox, L., et al., "Extreme Heat Exposure: Access and Barriers to Cooling Centers—Maricopa and Yuma Counties, Arizona, 2010–2020." *MMWR Morbidity and Mortality Weekly Report*, 71(24) (June 17, 2022): pp. 781–785. DOI: 10.15585/mmwr.mm7124a1.

A regular report from the U.S. Centres for Disease Control and Prevention, this study reports that senior citizens (adults sixty-five years old and above) suffer from hospitalization due to heat-related illnesses (HRIs) at higher rates than all younger adults (eighteen to sixty-four) in the Arizona locations. The implication is obvious that the best marginal action to reduce rates of heat-related illness is to prevent HRIs in seniors; the authors assume cooling centres are the best way to do so quickly. They cite survey data showing that many seniors in Arizona do not know where cooling centres are, how to reach them from their homes, and that relatively few feel burdened by the cost of cooling their own homes or feel ill because of heat.

Mazzone, A., De Cian, E., de Paula, E., Ferreira, A., and Khosla, R., "Understanding thermal justice and systemic cooling poverty from the margins: intersectional perspectives from Rio de Janeiro." *Local Environment: The International Journal of Justice and Sustainability*, 29(8) (August 2024): pp. 1026–1043. DOI: 10.1080/13549839.2024.2345610.

This paper uses qualitative and quantitative research methods to investigate the living conditions of the people of Rio de Janeiro's slums, motivated by "thermal justice": the principle that every person deserves "opportunities that can achieve safe body temperatures and thermal comfort" (p. 1028). Few of the people of the favelas live near water or green space; about half live in unfinished buildings; only five of

thirty-two interviewees report owning an air conditioner; those who are Black-racialized, gender-diverse, and disabled tend to feel heat waves worst (Table 1: p. 1033). Some of the favela dwellers whom the authors interview, such as a man with mobility impairment and a trans woman, report feeling stigmatized in ostensibly publically open spaces (pp. 1035–7). There is also a discussion of building codes being standardized to able-bodied White males (p. 1028).

Meade, R.D., Notley, S.R., Akerman, A.P., McCormick, J.J., King, K.E., Sigal, R.J., and Kenny, G.P., "Efficacy of Cooling Centres for Mitigating Physiological Strain in Older Adults during Daylong Heat Exposure: A Laboratory-Based Heat Wave Simulation." *Environmental Health Perspectives*, 131(6) (June 2023): 12 pp. DOI: 10.1289/EHP11651.

The authors had forty adults between 64 and 79 years of age participate in a simulated nine-hour heat wave (with a heat index equivalent to 37°C). Twenty, or half, were exposed to 23°C air conditioning for two hours during the fifth and sixth hours of the experiment. This lowered their core temperatures and was associated with better heart function for up to an hour after returning to 37°C, but by the end of the study, the participants were functioning at similar levels again.

Meade, R.D., Notley, S.R., Kirby, N.V., and Kenny, G.P., "A critical review of the effectiveness of electric fans as a personal cooling intervention in hot weather and heatwaves." *The Lancet Planetary Health*, 8(4) (April 2024): pp. e256–e269. DOI: 2542-5196(24)00030-5.

The authors evaluate reports that electric fans can cool people as well as air conditioning can when temperatures meet or exceed 35°C. Contra these claims, they argue that in younger (18–40 years) and older adults (at least 65 years) alike, air conditioning is more effective than fans at truly cooling at most levels of the heat index.

O'Toole, C., "Cooling Centres in Designated Locations in HRM." *Halifax Regional Municipality*, April 26, 2023. Retrieved from https://cdn.halifax.ca/sites/default/files/documents/city-hall/regional-council/230620rc141.pdf, February 10, 2025.

This study, prepared by the chief administrative officer of the Halifax Regional Municipality for its council, identifies cooling centres as public goods to be provided to deal with extreme heat and people with chronic illnesses as most vulnerable to heat-related deaths, with reference to those who died in the 2021 British Columbia heat dome. Barriers to use of cooling centres are discussed: lack of knowledge of where to go, lack of means to get there, concern for pets, concern about stigma, lack of awareness of one's own vulnerability to heat, inability to leave home, and a desire to avoid crowds (Table 1: p. 5). Plans for contingencies such as power outages are important.

Pittsburgh Post-Gazette (author unknown), “Cooling centers in Pittsburgh.” June 18, 2024. Archived through the Wayback Machine on August 24, 2024, retrieved from https://web.archive.org/web/20240824031518/https://www.post-gazette.com/news/weather-news/2024/06/18/pittsburgh-cooling-centres/stories/202406180060 , February 13, 2025.

This story lists designated cooling centres in the Pittsburgh metropolitan area at the time of publication. Most of those in Pittsburgh proper are existing community centres, while in surrounding communities in Allegheny County, Pennsylvania, other buildings with this openness include schools, a fire hall, and a church.

Quick, M., Christidis, T., Olaniyan, T., Newstead, N., and Pinault, L., “Exploring the associations between cooling centre accessibility and marginalization in Montreal, Toronto, and Vancouver, Canada.” *Canadian Geographies*, 67(3) (autumn 2023): pp. 352–365. DOI: 10.1111/cag.12805.

In a study of Montréal, Toronto, and Vancouver, which “all have municipal heat relief policies that include the opening and operation of cooling centres during extreme heat events” and “ha[d] recently experienced extreme heat events and corresponding increases in heat-related morbidity and mortality” (p. 354), the authors find that only slightly more than half of residents had access to cooling centres in these cities within 800 metres’ displacement from their homes or a fifteen-minute walk. In all three municipalities, cooling centres tended to be centrally located. Residential instability was the most salient factor correlated with access to at least one cooling centre; in Vancouver three other indicators of marginalization (economic dependency, ethno-cultural composition, and situational vulnerability of the person) were also important.

Tarrab, Y. (media contact), “PSA: Petco Locations Nationwide Double as ‘Cooling Centers’ to Help Pets Beat the Heat This Summer.” Petco Health and Wellness Company, Inc., July 28, 2023. Retrieved from https://corporate.petco.com/2023-07-28-PSA-Petco-Locations-Nationwide-Double-as-Cooling-Centres-to-Help-Pets-Beat-the-Heat-This-Summer, February 10, 2025.

This press release announces Petco’s decision to open its United States locations for the remainder of the northern summer season of 2023 to pets as cooling centres. It also offers a series of behavioural tips for pet (especially dog) keepers to address extreme heat outside cooling centres: give pets water, cut their fur, protect their feet from hot surfaces, give them exercise during cooler phases of the day, and watch for signs of overheating.

Thayaparan, A. “Cooling centres a ‘Band-Aid’ solution to extreme heat, advocates for the vulnerable say.” *CBC News Online British Columbia*, July 20, 2023. Retrieved from https://www.cbc.ca/news/canada/british-columbia/cooling-centres-vancouver-1.6911715, February 5, 2025.

Quoting policy experts, municipal officials, and advocates for the underprivileged in Vancouver, this news article discusses the importance of mitigation as something that must happen at the same time as adaptive measures like cooling centres are expanded. (This is also one source that distinguishes between cooling spaces and cooling centres, the latter being “a subset of the former” that a municipal government can operate.) Seniors’ advocate Beverly Ho is quoted saying: “It’s tough for our seniors to access cooling centres because a lot of them don’t seem to know where they are or when they’re open … Sometimes the centres are too far away, or the seniors have low mobility or have trouble getting to the centres on hot days, so they prefer to stay home.”

Vancamp, P., “Which body organs are most at risk during a heat wave?” *The Conversation*, July 14, 2019. Retrieved from https://theconversation.com/which-body-organs-are-most-at-risk-during-a-heat-wave-119521, February 18, 2025.

This explanatory scientific article explains how various vital organs suffer by exposure to extreme heat. For example, a higher heart rate is necessary to maintain blood flow throughout the body when people sweat water out; if sweating and heart rates are too high at the same time, they can lead to low blood pressure, fainting, and in the worst cases, heart failure. Dehydration and heat impair brain function, while more frequent breathing helps make blood more basic due to higher levels of bicarbonates and carbon dioxide, which can jeopardize cell functioning. Lower blood flow impairs the function of the intestines and the production of antidiuretic hormone does likewise in kidneys.

Yoon, L., et al. “To cool or not to cool: Understanding and improving cooling centre use in Metro Vancouver through community-based participatory action research.” *Environmental Research: Health*, 3(1) (2025): article number 015011, 22 pp. DOI: 10.1088/2752-5309/ada6f4.

Among the sixty-three participants surveyed for this paper, forty-seven said they had never visited a cooling centre. Participants cited the following barriers to their non-use of cooling centres: concern for personal security as well as hygiene, wish not to bother the government (perhaps having internalized this element of neoliberalism); operational shortcomings like lack of knowledge of cooling centres’ presence (with one participant comparing British Columbia unfavourably to Japan for public communication), lack of amenities, and restricted hours of operation; and difficulty in reaching a cooling centre.

Zhao, Q., et al., “Global, regional, and national burden of mortality associated with non-optimal ambient temperatures from 2000 to 2019: a three-stage modelling study.” *The Lancet Planetary Health*, 5(7) (July 2021): pp. e415–e425. DOI: 10.1016/S2542-5196(21)00081-4.

Attempting to estimate the number of people who die because of exposure to extreme temperatures each year, the authors come up with a figure of more than five million. While the number of people who die due to extreme heat is a small minority, it is growing each year. They found that Eastern Europe was the global region with the highest heat-related death rate between 2000 and 2019.