ENVIRONMENTAL RESEARCH
HEALTH

PURPOSE-LED PUBLISHING™

PAPER • OPEN ACCESS

To cool or not to cool: understanding and improving cooling centre use in metro vancouver through community-based participatory action research

To cite this article: Liv Yoon *et al* 2025 *Environ. Res.: Health* **3** 015011

ENVIRONMENTAL RESEARCH
HEALTH

OPEN ACCESS

RECEIVED
30 August 2024

REVISED
8 November 2024

ACCEPTED FOR PUBLICATION
7 January 2025

PUBLISHED
17 January 2025

PAPER

To cool or not to cool: understanding and improving cooling centre use in metro vancouver through community-based participatory action research

Liv Yoon[1,*], Giulia Belotti[2], Rachel Stern[3], Katherine White[4], Aida Mohajeri[5], Abby Zhou[1], Eduardo Rosales Miranda[6], Erika Siao[3], Thanh Le[7], Jeff Masuda[8], Eun-young Lee[9] and Chris Buse[10]

[1] School of Kinesiology, Faculty of Education, University of British Columbia, Vancouver, BC, Canada
[2] Institute for Resources Environment and Sustainability, University of British Columbia, Vancouver, BC, Canada
[3] Department of Geography, Faculty of Arts, University of British Columbia, Vancouver, BC, Canada
[4] School of Population and Public Health, University of British Columbia, Vancouver, BC, Canada
[5] Department of Educational Studies, Faculty of Education, University of British Columbia, Vancouver, BC, Canada
[6] Science-Po, Paris, France
[7] International Relations Program, Faculty of Arts, University of British Columbia, Vancouver, BC, Canada
[8] School of Public Health and Social Policy, University of Victoria, Victoria, BC, Canada
[9] School of Kinesiology and Health Studies, Queen's University, Kingston, ON, Canada
[10] Faculty of Health Sciences, Simon Fraser University, Burnaby, BC, Canada
[*] Author to whom any correspondence should be addressed.

E-mail: liv.yoon@ubc.ca

Keywords: cooling centres, heat, housing, resilience, inequity, right to cool

Supplementary material for this article is available online

Abstract

Extreme heat events present significant health risks, particularly for populations facing systemic marginalization. Through interviews and FGs with 63 ($n = 60$ residents; $n = 3$ service providers (SP)) participants, this paper explores the barriers and opportunities related to access and use of cooling centres from both user and provider perspectives, as well as broader implications for addressing vulnerability to extreme heat in the metro Vancouver region of British Columbia, Canada. Initially focused on cooling centres, our research expanded to include the complexities of individual and systemic responses to heat, highlighting the complex interplay between personal preferences and structural barriers. Key barriers to cooling centre usage reported by participants included concerns over safety, hygiene, stigma, lack of information, and infrastructural challenges such as transportation. SPs faced constraints with staffing, limited hours, and underutilization of additional services. Tensions emerged between individual, do-it-yourself (DIY) approaches and collective solutions, with participants seeking agency in their choices while acknowledging the need for improved, community-based interventions. The study also uncovered the unintended effects of inclusivity, as the presence of individuals who use substances or are unhoused in cooling spaces deterred some potential users, underscoring the challenges of designing universally accessible services. Broader systemic issues, such as housing security and the quality of indoor environments, further intersected with vulnerability to extreme heat, exacerbating risks for those opting to stay at home. The paper recommends leveraging existing public spaces, enhancing social networks, improving tenant protections, and fostering 'right to cool' initiatives to balance immediate relief with long-term systemic reform, particularly around the rental housing crisis and tenant insecurity. By addressing both individual and collective needs, this approach can mitigate the health impacts of extreme heat while promoting greater equity and resilience.

1. Introduction

Extreme heat is the leading cause of weather-related illness and death in Canada, causing more than 600 deaths in British Columbia (BC) alone during the 2021 Western Heat Dome [1–3] that covered large parts of the pacific northwest region of North America, with its epicentre over BC. 98% of these deaths occurred indoors, pointing to the importance of indoor environmental quality [1–3]. Bearing the brunt of these dangers are those exposed to extreme heat for prolonged periods of time, such as people experiencing homelessness or living in low-quality housing—many of whom may also be marginalized along other axes, including seniors, those with disabilities or conditions that impact mobility and cognition, those with mental health and substance use challenges, and/or experiencing social and material deprivation [4–6]. With extreme heat becoming more intense and frequent due to climate change, its disproportionate impacts on people with few protective buffers is a crisis that warrants urgent attention.

Recognizing this risk, many municipal governments offer extreme heat-related services and resources, such as cooling centres. In this study's context of metro Vancouver, BC, Canada, cooling centres and resources (such as misting stations) are activated when Environment and Climate Change Canada issues a heat warning for the area at different temperatures specific to the province and region—for our study area, the threshold is two days of maximum daytime temperatures of 29 °C and 16 °C for night time minimum temperatures [7].

These resources are offered in addition to cooling services and spaces that are always available regardless of official heat warnings, such as spray parks, wading pools and weather-protected plazas. However, there are no studies that explore their uptake in the BC context.

In response, our team of researchers, health systems providers, and community partners carried out a community-based participatory research study with the objectives of: (1) improving access to and uptake of existing services and resources, and; (2) seeking creative and transformative alternatives that can protect people at highest risk from extreme heat. Through qualitative interviews and focus groups (FGs) with 63 residents of metro Vancouver area, we explored the experiences and perspectives of: (1) adults over 18 years old (with a particular focus on seniors) who have, or have not, used extreme temperature services (i.e. cooling centres); and (2) service providers (SPs) of cooling centres and spaces. The following inter-related research questions led the study:

(1) What are the experiences of people who access cooling centres?
(2) What are the reasons for why certain populations choose to access or not access these spaces?
(3) How could SPs amend, tailor, iterate, or supplement existing approaches to extreme temperature shelters and services to be responsive to community concerns?
(4) Recognizing the shortcomings of existing traditional approaches (e.g. cooling centres), what alternative supports and outreach measures would align with potential user needs?

In doing so, we aimed to understand access to cooling services as an important part of community coping strategies at the local level. This study acknowledges that the broader issue underlying heat vulnerability is deeply rooted in structural factors like rental housing insecurity for tenants and social inequities. The housing crisis in BC, exacerbated by climate change, has transformed many homes into sites of precarity rather than refuge [8]. Those most at risk to heat-related adverse health outcomes often live in substandard or unaffordable housing with limited control over their environments, further compounding their exposure to extreme temperatures [8–10]. While long-term solutions must address these systemic inequities, it is acutely critical to focus on immediate measures—such as enhancing access to cooling centres—because people are dying *now*. Cooling centres and other temporary solutions, though imperfect, remain vital lifelines for populations disproportionately at risk who have few protective buffers in the face of extreme heat [11]. With this background, we first situate the study in existing literature.

1.1. Health impacts of extreme heat is a justice issue

The impacts of extreme heat on people marginalized along various axes of social inequities have been well documented [1, 3–5, 7–14]. However, studies that focus on seniors and precariously housed populations to date have been mostly epidemiological in nature [15–17], or based in the US [6, 18–25], Australia [17, 26–30] or Europe [15, 31–34]. There is a small number of qualitative studies that explore seniors' perceptions of heat risk and coping strategies in Canada, but they are based in Ontario (i.e. outside our study area), limited in scope, or not peer-reviewed [13, 35–40].

A more nuanced understanding of the perspectives of adults who face systemic marginalization with experience of extreme temperatures in Canada is urgently needed. Many people experience marginalization along other axes of identity as well, including disability, race, gender, and sexual orientation [41]. It is

important to note that both housing security *and* quality play a role in extreme heat protection [30, 34, 42]. For those in low-quality housing, extreme heat risks persist through factors such as poor insulation and ventilation, over-exposure through indoor trapping of heat, and risky coping strategies [42].

Elderly people face high heat-related risk due to physiological changes that affect thermoregulation, increase of chronic health conditions [34, 43], and experiences of social isolation [12, 16, 34]. This is a pressing issue as there has been a 53.7% increase from 2000 to 2018 in global annual average of heat-related mortality in people over 65 years of age [44], and Canada's older adult population is growing rapidly [45, 46]. There are studies that situate seniors' thermal safety in the broader context of household energy insecurity (ability to meet everyday energy needs), which highlight the role of socioeconomic and housing factors in compounding temperature-related health risks [47, 48].

1.2. Cooling centres as a response to extreme heat and the need for experiential evidence on their effectiveness

Many health authorities across Canada have devised response plans to extreme temperatures. In addition to conventional cooling centres, there are efforts to leverage existing facilities and resources such as public libraries, swimming pools, and city parks [49]. Despite efforts to provide a protective response, this project's community partners have consistently relayed that extreme temperature services in BC are underutilized [13, 50], and research suggests that their overall effectiveness is not thoroughly understood [51, 52]. While there are presumed reasons behind their underutilization (e.g. difficult to access for seniors who live alone; limited hours; lack of accommodation for pets, medical equipment; distrust of medical authorities), there is a need for more lived experience-based knowledge from those directly impacted [13, 51, 53]. Spatial analyses show that 54% of Vancouver's populations have access to at least one cooling centre, and that high socio-economic and cultural marginalization and residential instability areas were correlated with more likelihood for cooling centre access [54].

Following the 2021 western North America heat dome, a survey with SPs revealed that perceived barriers to cooling centres include: lack of awareness; inability to bring a pet; stigma; distrust of authority; and lack of staff training [13]. However, qualitative analyses of user or provider experiences of cooling centres in Canada is limited [55]. This study addresses this existing knowledge gap by analysing in-depth interviews with both users and providers of extreme temperature-related services. We consider this approach necessary to obtain a fuller and more nuanced understanding of how to tailor to various axes of equity, and how to better align user needs and provider capacities.

2. Method

2.1. Participants

2.1.1. Residents

We recruited adults over 18 years old in metro Vancouver in BC, Canada who have previously used cooling centres. We also included *potential* users (hereon 'residents' [R])—meaning those who experience heat in their indoor home environments and could benefit from using cooling centres, but either choose not to, or have not been able to do so.

Our resident participants ($n = 63$) were mainly female ($n = 50$), over the age of 55, and included individuals from a variety of housing situations, including some facing challenges with inadequate or precarious housing. Overall, 47 out of 63 residents reported never having visited a cooling centre. However, it is important to note that participants often had an unclear understanding of what constitutes a 'cooling centre'. Many existing facilities, such as community centres, swimming pools, and libraries, are only officially activated as cooling centres during extreme heat events (EHEs), leading to confusion. As a result, it was not uncommon for participants to claim they have never used a cooling centre, while mentioning having visited places like community centres instead. Resident demographics are described in detail in table 1.

Community partners of the project—including seniors' networks, cultural communities, neighbourhood houses, and organizations supporting populations facing injustices—facilitated recruitment using posters developed by researchers and word of mouth. Interested participants contacted the research team to schedule interviews. In total, 63 participants from diverse ethnic backgrounds and neighbourhoods, aged 23–92 years, took part in the study. In operation, this meant conducting interviews and FGs in six different languages: Cantonese, English, Farsi, Mandarin, Spanish, and Vietnamese. Studies [12, 56] show that areas with lower socioeconomic status have higher rates of heat-related morbidity and mortality, and these areas in metro Vancouver—as is the case in many other regions—are often neighbourhoods with higher populations of racialized people and immigrants. Recognizing these barriers, it was important for us to deliberately include these populations. Further, we also knew from the project design stage with our community partners that many of their patrons and neighbours found it difficult to address their concerns around heat due to the

Table 1. Self-reported demographic characteristics of resident participants.

Characteristics	Total ($n = 60$)
Gender	
Woman	50
Man	9
Non-binary	1
Age (years)	
20–29	2
30–39	1
40–49	0
50–59	1
60–69	8
70–79	8
80+	8
Unspecified, but otherwise expressed they were 'seniors'	32
Housing status	
Housed	56
Unhoused	4
Primary (most-spoken) language	
English speaking	16
Non-English speaking	44
Cantonese	17
Farsi	1
Mandarin	19
Spanish	2
Vietnamese	5

language barrier, which made it even more important for us to recruit them for this study. Lastly, recognizing that these populations are often excluded from research studies as English fluency is often a participation eligibility criterion, we wanted to ensure this barrier was removed. Participants had the option to disclose their gender, age, housing status, and primary spoken language, but we did not ask about socioeconomic status.

2.1.2. SPs

The SP ($n = 3$) interviewed in this study worked in various positions at public library branches in the metro Vancouver region, which were activated as cooling centres during EHEs (see description of this process in section 1). All SP participants had experience working at cooling centre locations during times of activation, as well as during periods of regular temperature.

2.1.3. Data collection

Developing questions for semi-structured interviews and FGs was an iterative process, specifically following the five-phase framework outlined by Kallio *et al* [57], which includes formulating a preliminary interview guide, pilot testing it, and revising questions iteratively based on the pilot [57]. Upon consultation with community partners at the outset of the project, the resulting interview guide for residents included 18 primary question prompts, categorized into five groups: participant background (Q1-3), conditions of thermal comfort and whether they have used cooling centres (Q4-8), their experience using the centres, if applicable (Q9, with follow-ups a-h), reasons for not using them and any alternatives used (Q9-13), and suggestions for improvement (Q14-18) (see supplemental file A).

Semi-structured interviews ($n = 12$) and FGs ($n = 11$) were conducted from October 13th, 2023, to February 22nd, 2024, by the research team. All FGs took place in-person, interviews were conducted in person ($n = 6$), over Zoom ($n = 3$), or the phone ($n = 3$). In-person interviews and FGs took place in private spaces within neighbourhood houses, or at a location chosen based on participant preference and availability.

Each participant took part in either an interview or FG, averaging 54.5 mins (range: 28–197 mins). Interviews and FGs were audio-recorded and transcribed using Otter.ai [58], with all transcripts reviewed for accuracy by the research team. Transcripts of interviews conducted in languages other than English were translated by research team members who spoke the language, using Brislin's back-translation method [59]. Anonymization was applied to all identifying information.

We analyzed the data using Braun and Clarke's six-step framework thematic analysis, a method identifying repeated patterns of meaning across datasets [60]. Our semantic approach emphasized the themes that emerged from explicit meanings and experiences shared in the interviews and FGs [61]. For this

process, we used Dedoose qualitative content analysis software [62]. Coders began by familiarizing themselves with the data during transcript verification and engaged in repeated active reading to uncover meanings and patterns. Subsequently, coders generated initial codes that captured fundamental segments of the data relevant to the research questions outlined above [63]. For these steps, following on work on coding with multiple coders in a research team [64, 65], all coders were paired in groups of two (eight coding teams total) and worked together to code assigned SP and resident interviews.

We identified the initial round of themes through 'descriptive coding' [66], which involved close reading of transcripts, coding for key descriptive ideas and responses, and compiling relevant text extracts [60]. Each coded extract could contribute to multiple themes, depending on each excerpt's richness and contents. Themes were then refined by a core team of coders through careful re-reading of collated extracts to ensure coherence and simplified into key themes with specific descriptive sub-codes. We then validated these key themes through 'resonance check' community consultations (online and in-person) with community organizations to ensure they accurately reflected the dataset's meanings for participants, with participants and partner organizations affirming the resonance of the themes we identified [60]. We utilized reflexive memos, written reflections, and positionality statements for each researcher/coder to deepen our understanding of participant experiences and contexts.

3. Findings: barriers and experiences of residents and SPs

Below, we present main findings from the interviews and FGs about what residents felt compromised their access to, and experiences in, cooling centres (figure 1)—organized into three themes: (1) concerns and perceptions (2) operational barriers; and (3) infrastructural barriers. The legend following each quote indicates whether the participant was a SU Resident ('R') or a SP followed by the participant ID number, and whether the quote is from a 1:1 interview or a FG. While this section predominantly focuses on Residents' experiences, SPs' perspectives are included to simulate an exchange between the two parties (figure 2). By examining both user-reported barriers and provider efforts, this section highlights critical gaps and potential improvements in cooling centre access and operations to better support vulnerable populations during heat waves.

3.1. Concerns and perceptions

The concerns and perceptions around cooling centres, their intended audiences, and the ability to feel comfortable in these spaces were key findings in our work. Specifically, we heard that people's usage of cooling centres was impacted by: [1] safety concerns and stigma, as well as cooling centres being perceived as unnecessary; [2] hygiene concerns with cooling centres; and [3] differing views on the responsibilities of government versus individuals during heat events.

3.1.1. Safety concerns and stigma

First, residents stated safety concerns around public spaces and stigma around whom public cooling centres were intended for. Elderly housed participants at times expressed stress over the 'unfamiliarity' of cooling centres, describing:

> '*It's too unfamiliar, right?… I'm afraid that people will be more 'diverse', with some security issues*' (R_FG01).

The theme of unfamiliarity with cooling spaces was common, with many participants opting to go to the air-conditioned mall or other stores instead. One participant described that while they had used both a cooling centre at a community centre and the mall, the mall had ice cream and seating. She added:

> '*I go to Metrotown [a nearby local shopping mall] because I still can bring my phone and I can be connected to, you know, my internet. And that's important for me, you know, me and my phone (laughs)…*' (R31).

However, she described that the mall had become more inhospitable since the COVID-19 pandemic, as they had taken out a lot of the seating then. Another participant shared:

> '*Every summer is filled with anxiety, so I dare not go to other community [centres]. There are many people, strangers, some of whom engage in activities like smoking weed. Therefore, I avoid those community centres. I can only go to places like the Food Court. I can sit there all day because they have air conditioning*' (R_FG05).

In addition, 'feeling comfortable' extended to language barriers and participants not feeling as though the spaces were for them. One participant in a Chinese-speaking FG shared:

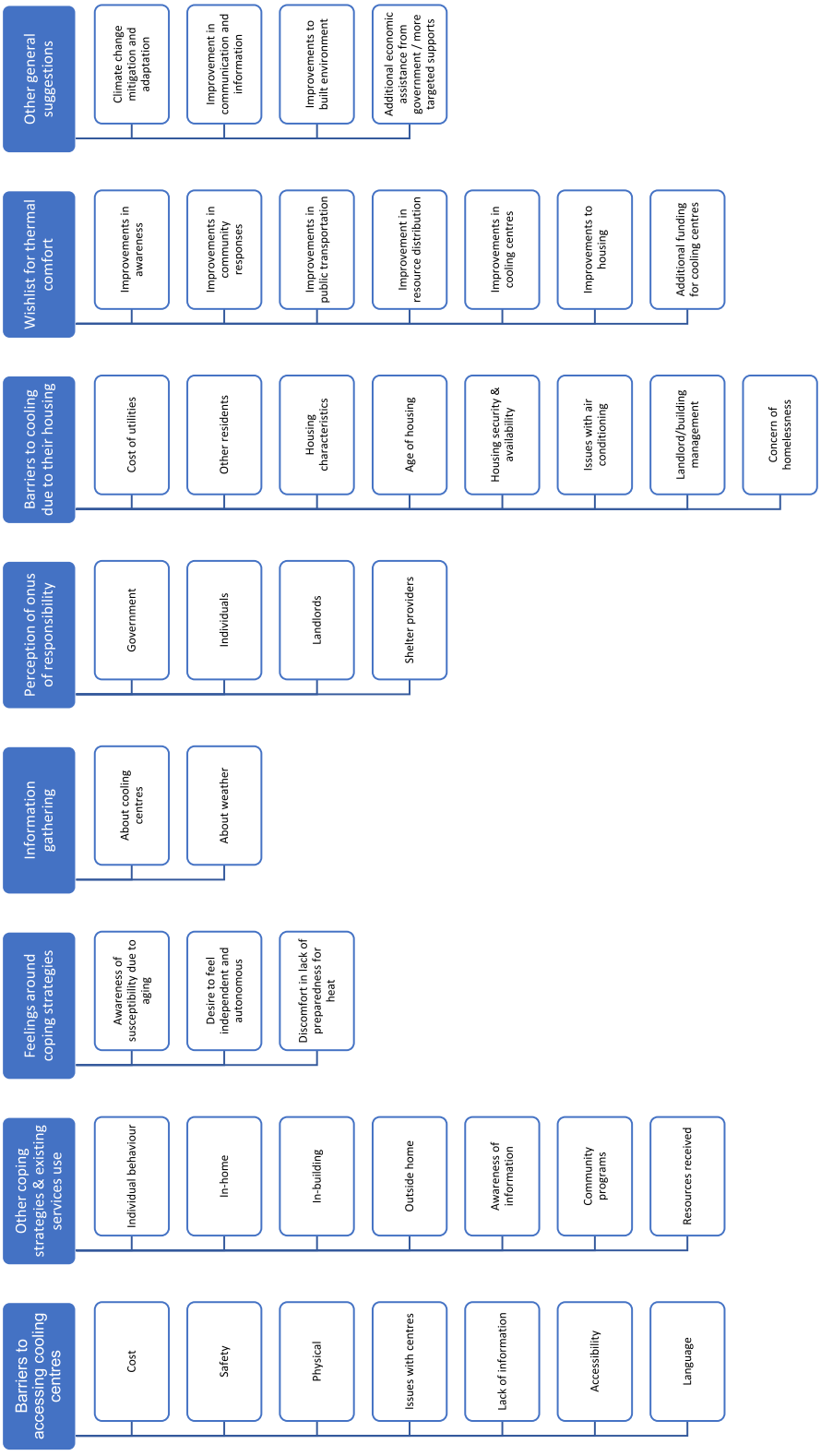

Figure 1. Summary of main categories and sub-categories of findings from residents (service users and potential users).

> *'My personal feeling is that because my English isn't good, I don't know a lot of information. For example, for the AC [referring to both the local utility company's free air conditioner provision program and use of cooling centres more broadly], a lot of people don't know. The info we know is word of mouth. If we don't have English foundation, we don't get the info*' (FG09).

Language barriers emerged specifically in Chinese-speaking FGs where there was a sense that English fluency was necessary for understanding a lot of the information and policies around heat. In one exchange

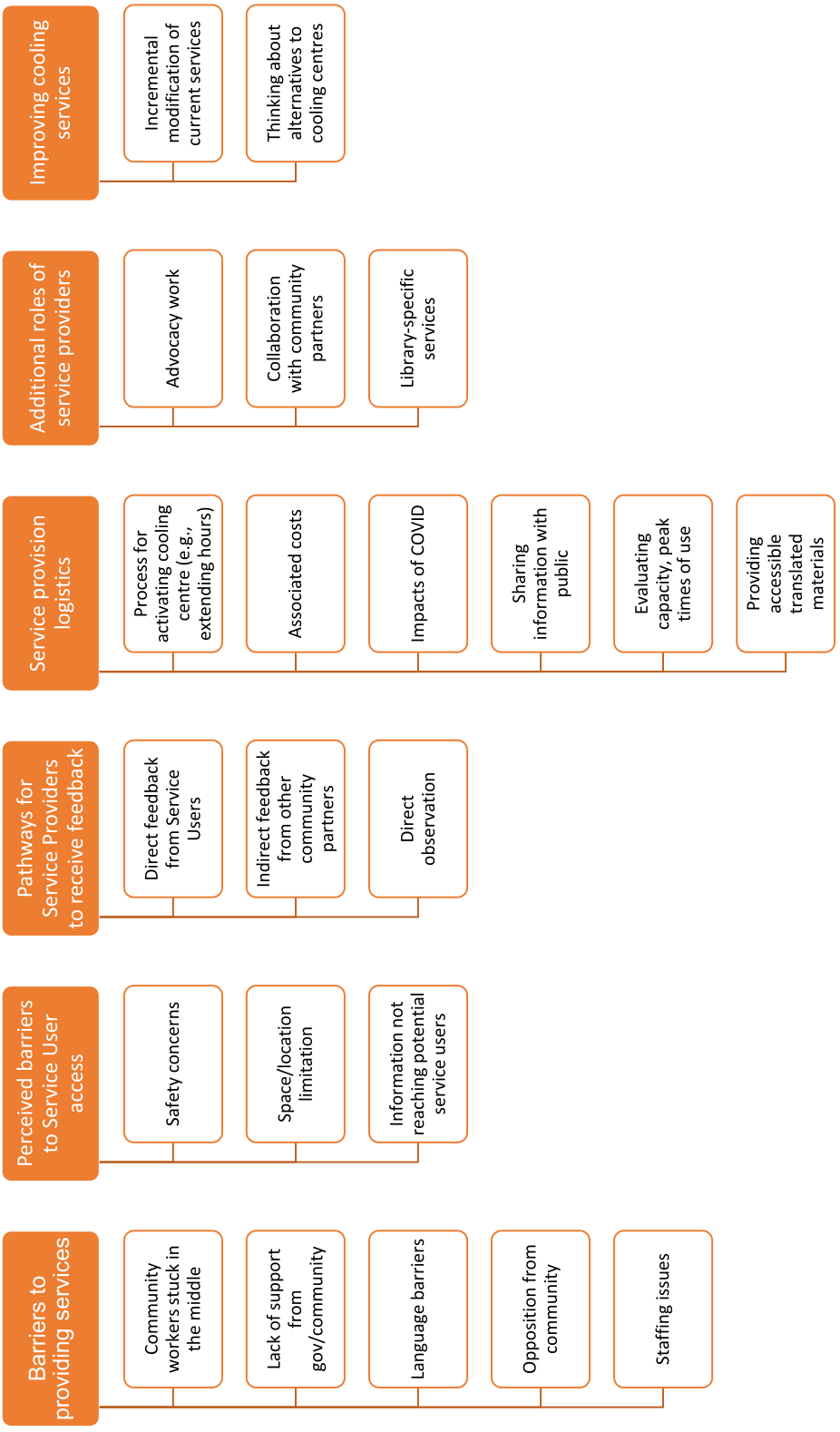

Figure 2. Summary of main categories and sub-categories of findings from Service Providers.

in another Chinese-speaking FG, participants shared that they did not know how to apply for the BC Hydro free air conditioner program either:

R27: *it is troublesome! They do not understand Chinese, and we do not understand or speak English…*
R30: *You cannot communicate. The main issue is the communication barrier.*
(R_FG06)

Participants in this FG also shared they felt it was not necessary to go to cooling centres:

R30: *We can overcome it by ourselves.*
Interviewer: *Then why not go to the community centre?*
R30: *it is not necessary. (Everyone agrees)*
R28: *Firstly, we don't feel as hot and uncomfortable as you might think. Second, we haven't been there. Um… It's all hearsay. These community centres, shelters are for people on the streets, homeless people. It's not very safe.*
R29: *The air is not good there. We are comfortable living in our own homes. Just overcome it.*
(R_FG06)

Participants often preferred their own living spaces even when their homes were very hot and insufficient to keep them safe, especially since they felt more comfortable there, even if not thermally. This is particularly important for understanding some of the reasons why those who know about cooling centres may choose not to use them.

3.1.2. Hygiene concerns

Second, hygiene concerns around the spread of disease in public cooling centres reflected a particular precarity for participants with underlying medical conditions. One participant, who self-identified as immunocompromised, expressed:

> '*People…are getting kind of scared of the implications of COVID, heat, and autoimmune diseases because…you just can't herd people together in a room and say, 'There we can cool you all down.' Sorry, but put me between two people who are coughing like mad. And not wearing masks and I have an autoimmune disease. You haven't done me any favors.*" (R01).

She went on to describe how she had gone to a cooling centre organized by a local seniors' group about seven or eight years prior to some of her medical issues, but there was not enough airflow:

> '*There should have been five purifiers around the room. And there should have been doors open. But they didn't want to disturb any of the programs that were operating outside of that gymnasium. So the doors were all shut*' (R01).

This participant's point of view particularly highlights the issue with cooling centres as a 'band-aid', one-size-fits-all solution, which can expose those who are more at-risk to illness and germs. Another participant even shared about going to the mall to stay cool:

> '*Because nowadays, there's a reason to be cautious, right? There's the flu going around, and for the past three years, COVID-19, so you're afraid*' (R_FG07).

With underlying health conditions as a specific risk factor for heat illness, understanding the potential issues with communal cooling spaces for those who are immunocompromised is extremely important.

Hygiene concerns were compounded by a common perception among those who had tried to use cooling centres but had found there was not adequate seating. One participant shared:

> '*The library, especially the one in Hastings, is always crowded. There are never any seats available*' (FG08).

Another participant questioned,

> '*How big [would] a community centre or shelter be to accommodate the neighborhood?*' (FG02).

These issues around seating are discussed further in our second findings section focused on operations.

3.1.3. Placement of responsibility

Finally, there was a split between participants who felt that the government should be providing more services for those who are dealing with extreme temperatures and those who felt that it was a question of autonomy, and they could look after their own bodies. One participant described:

> '*I don't get used to ask people to help me [with] this or that. You know, I find that if you ask people, people will feel… how would you feel? How do you feel? You feel funny, you know…You feel so… displaced… So I prefer to get it myself… I delay and delay until I solve it myself… I'm thirsty, but I don't want to get up. So I just leave it until I have to get up*' (R52).

Some participants, particularly those in our Chinese-speaking FGs, expressed a desire to not 'bother' the government for things they could do themselves in times of heat. Participants expressed that they felt cared for by current governmental interventions and did not want to 'bother' them further:

> '*We really appreciate the government, they take good care of us. In the hot year, in 2022, it was particularly hot, so they gave us an electric fan. The electric fan is quite functional, the wind is strong, it's good*' (R_FG06).

However, other participants (senior Chinese residents in a low-income area) expressed that they felt the government should be doing more to provide for low-income elderly people and had a duty of care:

> '*It's not that you can't afford to buy a fan; it's about showing that the government cares for low-income elderly people. They're not asking for much; they're just asking for the basic care they deserve. We're all human beings; we also deserve proper care, not to be left to suffer and die*' (R_FG07).

Suggestions from participants about government interventions they would like to see included more and bigger cooling spaces open for longer hours; better housing regulations for building managers and landlords to provide better living temperatures and conditions; better on-the-ground, street-level outreach from governments; services such as cool drinks and activities at cooling centres; and better and more communication over traditional public channels, such as TV and putting up posters in frequented spaces.

3.1.4. SP perspectives

SP participants noted the complexities of providing services to diverse populations with different needs during both typical weather periods and EHEs. They highlighted the role of public libraries as filling an important role as spaces that are free to use, that aim at offering services and programming to a wide range of guests:

> '*[our municipality is a] super diverse community. And I think that our demographics in the library definitely reflect that. We have all ages from little babies all the way through to seniors. Everybody from people who are newcomers, people who are not newcomers, people who are housed, people who are not housed to, you know, basically anybody who's in [our municipality] will likely be reflected here*' (SP04).

However, aiming to address the needs of these diverse populations can also create challenges. SP participants expressed sentiments, similar to those of resident participants, about residents not feeling comfortable access cooling centres due to safety concerns around public spaces and stigma around who these services are intended to serve. SP participants acknowledge that tensions can arise when a diverse population of residents need to coexist within the same space, using the same services. When EHEs occur, and diverse groups of people are accessing these cooling centres:

> '*… it means that different kinds of communities and individuals have to find a way to coexist… And it's very difficult to coexist. If somebody hasn't bathed for three days, while somebody who bathes regularly…those two folks might have difficulty coexisting side by side. So, I think for us, it's really about the fact that because we [the library] are sort of the last third place that doesn't have any financial barriers for people, that everyone is welcome, but it means that [says more slowly and deliberately] everyone is welcome. And with that comes some issues around coexistence, and just being able to be comfortable with people from all walks of life*' (SP01).

Additionally, one SP participant also acknowledged that there may be embedded barriers to accessing public or institutional spaces:

> '*I think that, as you know, in an institutional space, there are obviously some embedded barriers there. And not everyone's necessarily comfortable accessing a space like ours, just with prior experiences*' (SP04).

Although participants in our sample of residents stated they did not necessarily feel comfortable accessing cooling services, the specific barrier of discomfort with institutional spaces due to previous negative experiences was not explicitly stated.

3.2. Operational barriers

A major barrier preventing our participants from using cooling centres involved operational aspects. These included insufficient information about the centres, a lack of activities available in the facilities, and hours of operation.

3.2.1. Insufficient information

We found that some residents were simply unaware of the presence of cooling centre resources in their communities. In a FG we conducted with Vietnamese-speaking individuals, most participants admitted that

they were entirely unfamiliar with cooling centres: 'We do not know. We do not know of those places' (R_FG11). When asked whether they had ever heard of the term, one participant told us:

> *'No… I… We have the community centre about less than one kilometer away, the services disaster hub [is] there. So I assume that you have these cooling centres in them? I've never been there'* (R_32).

Similarly, even participants who claimed to have previously heard of these services seemed to conflate them with other public and private spaces they used to cool down:

> *'Oh yeah, places like Floata Restaurant, T&T Supermarket, and Sun Wah Centre, they all have cooling spots provided'* (R_FG06).

Most residents we interviewed appeared uncertain about the purpose of cooling centres, and primarily associated them with services offered to unhoused people. When asked whether they would ever go to a cooling centre in case of extreme heat, a Chinese-speaking resident shared that they would rather 'go through [the heat]':

> *'Shelters are for homeless people, both men and women. Dinner starts at 6 pm. After dinner, they provide them with mattresses and blankets for sleep. In the morning, they wake up, and they've already packed up the mattresses and everything. It's all homeless men'* (R_FG06).

Some people we interviewed knew about cooling centres and were familiar with their purpose but shared that it was not easy for them to obtain information about their specific location:

> *'In terms of hearing about it… like, I had to search, like actively look around for cooling centres (…) [Eventually], someone helped me find it. But like, we had a bit of hard time finding it'* (R_03).

Echoing this sentiment, one participant confessed that they came across a cooling centre by chance:

> *'I didn't even know there was a cooling centre in the Trout Lake Community Centre. I happened to go in for my swimming lesson and I just bumped into it'* (R_FG02).

Some participants attributed their lack of knowledge about these services' location to unclear or inadequate instructions provided by staff members operating these spaces. One participant shared:

> *'I've seen a mother coming with a stroller and a baby less than two years old. The baby's face was all red, and I'm watching. So I'm just standing there watching, what is she going to do? She goes in, she went for a long walk, she comes around, she comes outside, she's standing there. And I went to her. (…) So I said, 'you were looking for a cooling place?' She said 'yes, but there's no sign'*[1] (R_FG02).

Another participant shared that they once accompanied a person to a cooling centre and, while a sign had been placed outside of the facility to indicate that the service was there, they were ultimately not able to find it: *'I go there. Nothing. Where is the place?'* (R_FG02).

In both the English-speaking and Vietnamese-speaking FGs we conducted, participants blamed government institutions, especially at the municipal level, and staff working at the extreme temperature centres for the limited communication around these services:

> *'They really have to advertise them. Where are the centres? Many people don't know. Good advertisement will help'* (R_FG02).

A participant who had lived part of their life in Japan shared:

> *'In Japan there's a lot of education about it. We all have to know. Whereas here, generally, we either don't know or [those shelters] don't exist. I think there's not enough education about those topics. That responsibility falls on the city'* (R_FG11).

Even when information and instructions about cooling centres were clear and available, some residents—particularly those who were more dependent on cooling centres, who did not have their own air conditioners or autonomous control over comfort-enhancing appliances including heaters—still lamented that they felt excluded due to a significant language barrier:

> *'If you can't speak English, you basically can't get into the shelter. The language spoken there is all English. You can't get in with any other language'* (R_FG07).

Participants who did not speak English felt they were unable to access important information: 'I do not know anything in English, and that's why I do not know anything' (R_FG08). Those who had younger family members often relied on them for translation:

> '*You can ask the youngsters to help you. If you don't have one, you have to ask someone to help you*' (R_FG01).

In this sense, newcomers in particular faced a double barrier. On the one hand, most were not familiar with the English language, and felt like information about cooling centres and the instructions provided within the centre were exclusively in English. On the other hand, being new to the Canadian system, some were also unaware of available support networks and resources, making it even more difficult for them to access extreme temperature services (R_FG04).

3.2.2. Lack of activities

Another crucial aspect that participants reported discouraging their use of cooling centres was the lack of activities available in these facilities. Most participants who had used these services in at least one occasion shared that, often, cooling spaces consisted of a room with a few chairs and, occasionally, some water and magazines:

> '*It was literally just, 'here's a cup of water, and you can sit here for a couple of hours'. And when you've still gotta be productive during the day or do something with your day, just having access to the space doesn't help*' (R_03).

For some, having access to a stable and reliable internet connection was especially important to be able to work or occupy themselves for a few hours. Others expressed a preference for spaces that were more conducive to socializing:

> '*If you just sit around, you can't stay long, you can only stay for 30 min. It would be better if you could hang around with friends (…) you need to talk to friends and people*' (R_FG01).

Many suggestions emerged regarding potential activities that cooling centres could offer, spanning from card games, to karaoke, to tables with snacks and refreshments. One participant in particular, who was very familiar with a specific cooling centre, shared that the main issue for them was the lack of seating:

> '*There's this centre that I go to, [because] that's the nearest to my house. I feel very, very safe there (…) except for the fact that I cannot be standing for two hours. That's the only problem. Sometimes I can even go to the washroom where they have seats, you know, but other than that, I think they are not too well equipped (for lots of) seniors at one go*' (R_31).

Among other reasons, the lack of activities in extreme temperature centres led many participants to seek alternative cooling spaces, such as shopping malls or other community centres.

3.2.3. Restrictive hours of operation

One last fundamental operational factor that acted as a barrier to accessing cooling centres was that these services seemed to be unavailable when most people needed them most—namely at night. Many participants revealed that the temperature in their unit was unbearable after dusk:

> '*Especially in the summertime, places close at nine o'clock at night. That's when the heat hits you. You got to have places open till eleven, twelve o'clock*' (R_FG02).

Many cooling centres in existing community centres or public libraries have extended hours into the late evening. However, there is no comprehensive record of operating hours for all locations since many of these locations would attempt to remain open for as long as feasible (i.e. for as long as they had adequate staffing and resources), with some being open 24 h during activation periods.

One participant mentioned that, during a heatwave, she invited two elderly women from her building to stay at her unit because they did not have air conditioning:

> '*But you know (…) I couldn't always stay home so they could come to my place. And so I said [to them], 'go to the library'. But the library closes at nine o'clock at night. They told me, 'look, we're okay maybe until seven, eight. [Then we have to leave]*" (R_FG2).

People who could not find refuge at a friend's house and lacked both cooling devices and access to cooling centres operating at night were forced to endure the heat in their homes:

> '*It was around two o'clock in the night, and I just couldn't move because… it was like an oven. Yeah, like an oven. I didn't realize that was a heatwave (…) I finally realized why people died. I thought, 'geez, I could be dead*" (R_FG02).

These forms of autonomous adaptation, especially among those who choose not to use cooling centres, provide important insights, and raise questions about the role of government support, if at all.

3.2.4. SP experiences of cooling centre operational challenges

In contrast to the residents who reported a lack of information about cooling centres, our services provider participants detailed extensive efforts to ensure that information about cooling services were available to community members who may benefit from these services. One participant reported:

> '*We do quite a big push on our social media, so like through our Facebook and our Instagram, and through like the City sharing things out as well. We change our banner on our website to add like a ticker at the top. And then this year, we got sandwich boards [to place outside the cooling centre], which was super exciting*' (SP04).

Another participant detailed an even more extensive messaging effort:

> '*[as a part of a] city wide effort, [the] city communications department will use its channels, and it has a very unified approach to that messaging. So,* via *the city's website,* via *our website, the social media channels…our local print newspaper… [in addition to activating] on the ground, community connected partners throughout the city, we'll reach out… 'hey, the city has its cooling centres opening, here's, here's the map where they are.'…So really just activating the network to get the word out, whether it's verbally or in print*' (SP01).

This participant also highlighted the efforts of local health authorities, emergency services, neighbourhood associations, faith-based services, and social services, being contacted with information about the cooling centre activation and spreading information to potential cooling centre users [67].

In addition to utilizing diverse streams of communication to deliver information multilingually to possible residents, SPs reported striving to address the diverse needs and potential barriers faced by services users. SP participants reported the ability to tailor and adjust the services provided to address the needs and barriers residents may face. For example, one SP described the process of modifying their facility to allow services users to bring pets:

> '*How can we accommodate this? How can we make sure that that's not a reason why somebody's turned away [from the cooling centre]? And so that then led to the decision to purchase crates, that could be distributed to the cooling centres, so we could accommodate people with animals. And so long as they were created, or in some case, just keep them by your side, make sure they're tethered, in some way. Depending on what the facility is, so that was indirect feedback. And it was like, 'oh, yeah, that is, that is an issue'. But there's gotta be a way to address that issue*' (SP01).

However, SP participants reported that at times these additional services were underutilized, with one participant reporting:

> '*I think there [were] three pets the whole year…We sectioned off a portion in the first floor, that the pets had to be kept in their carriers…And if [the pet was] aggressive, then they might be asked to leave. And that didn't happen*' (SP_FG01).

SP participants also reported staffing challenges due to the unpredictability of EHEs In the context of locations that also serve other functions when not activated as cooling centres, participants reported difficulties with ensuring adequate staffing to extend the operating hours of locations, while respecting worker collective agreements. With one SP stating, and providing a powerful reflection on how underfunded much of the social service and care provision sectors are:

> '*I think it's difficult to I mean, you have to fund– the staff are very giving and altruistic in many ways, but at the same time that you know, they are on contract, and you have to abide by the terms of a collective agreement that, you know, rightly requires that they get paid for their work as well*' (SP01).

Potential residents described several operational barriers that impacted their use of cooling centres, including a need for more messaging surrounding cooling centres, additional activities and programming for residents, and longer hours of operation (especially into the late evening and night). Whereas SPs detailed the obstacles they faced in ensuring that cooling centres were able to operate during periods of activation, in particular SPs needed to navigate the unpredictability of EHEs while ensuring the staff were not working longer than permitted. SPs also detailed the effort and resources that had been allocated to address commonly referenced resident barriers but reported these programs went un- or under-used. A similar gap between the barriers that resident reported, and the use of additional services introduced by cooling centre SPs also extended to available infrastructure detailed in the following section.

3.3. Infrastructure

3.3.1. Transportation and mobility-related challenges

Another prominent theme of barriers that emerged was that of infrastructural barriers, such as issues related to transportation and mobility. Some participants faced transit-related challenges, lamenting unpredictable bus schedules and the discomfort of waiting in extreme heat that contribute to the difficulty in accessing cooling facilities:

> '*We'd have to wait for the bus to come, [but] we don't know when the bus will come, right? We also need to wait for the transfers and it's too hot*' (R08).

In addition to many who face transit-related obstacles that hinder their ability to reach cooling centres conveniently, these challenges are compounded for those with mobility impairments, who often encounter additional barriers such as lack of accessible transportation options or physical barriers at facilities themselves:

> '*Before I head to a shelter, I need to rest somewhere. If there is no place to rest and I have to walk for 15–20 min, I won't go*' (R39).

The distance to cooling centres also emerged as a significant barrier. For many individuals, particularly those residing in areas underserved by facilities, the proximity of cooling centres was a critical issue. Some neighbourhoods find themselves situated too far from the nearest centre, necessitating longer travel times and potentially discouraging visits altogether, especially during heat waves when timely access to cooling facilities is crucial. Moreover, the insufficient number of cooling centres in certain neighbourhoods exacerbates this problem, leaving residents with limited options for relief from extreme heat. These disparities not only reflect a logistical challenge but also raise broader concerns about equity and the need for more inclusive urban planning strategies to ensure that all communities have adequate access to essential cooling resources during times of heightened climate vulnerability.

3.3.2. SP experiences of addressing infrastructure challenges:

SP participants were aware of the difficulties for potential services users without convenient access to cooling centres. SPs expressed concern for older adults, individuals with underlying health conditions, and those with limited mobility or using mobility aids and ensuring that cooling centres could be accessible to these residents. For example, one participant recalled:

> '*There was one woman who came in, an elderly woman who came in with her walker, and what it must have taken her to move from her very hot, small apartment, to the library, with that walker was really concerning for us. So, I mean, it's fine if you're ambulatory, and you're actually mobile enough to be able to make use of a, of a place outside your home, if you have a home, to cool off. But you know, what of, what, it made us wonder what of those people who, who aren't mobile, you know, who have accessibility issues that prevent them from accessing a cooling location in their community. They are stuck, essentially, unless there's some kind of, I don't know, ambulatory option for them that can be activated. So that's just the most immediate thing that comes to mind is that, you know, it's fine if you can get to someplace, but if you can't, what are they to do?*' (SP01).

Similar to other potential barriers discussed above that service provided attempted to address, one SP participant reported that their cooling centre location arranged a ride service that would pick up residents throughout the municipality:

> *'And then last year as well, they offered a ride service. So, if somebody couldn't get to the library or couldn't get home, then there was a number that we could call to help them with that.' But this service wasn't frequently used by residents, 'Yeah, I don't know, if [the ride service] was actually used very much. To be honest, it might not have been at all. But they essentially had a driver who was ready and waiting. And somebody could call from home to get picked up and brought here or we could call for them like to take them back to where they were going*' (SP04).

As outlined in the above section, residents reported numerous factors that impacted their choices to use or not use cooling centres, which were influenced by both previous experiences and perceptions. SPs reported needed to overcome challenges associated with the unpredictable nature of EHEs and therefore needing to be flexible to ensure that these services could be provided without extensive notice. Additionally, SPs reported that many efforts to address potential service user barriers had been made, but there was often limited uptake in these services (e.g. accommodations to bring pets to cooling centres, transportation options).

4. Discussion

4.1. Summary

Our study sheds light on the complex interplay between the availability of cooling centres and individuals' preferences and practices during EHEs. We observed that while cooling centres are a key resource to reduce heat exposure, their utilization is limited by various factors, including concerns around perceptions of safety and hygiene, operational barriers such as lack of information, activities and restrictive hours of operation, as well as infrastructural barriers such as transportation and mobility-related challenges. Residents often preferred to use familiar public spaces like malls and parks or remain in their homes, even when their homes experienced high indoor temperatures. These perceived barriers were particularly notable in light of SPs' expressing that they have been responding to community needs—such as providing multilingual resources, guidance for housing providers, and accessible information about locating cooling centres. Despite these efforts, voluntary cooling centre usage for the sake of cooling remained low.

Below, we explore the tensions that emerged within our findings: namely, the complex interplay between individual and collective approaches to managing heat exposure, and the challenges associated with trying to accommodate a diverse range of needs. Following, we contextualize our findings with broader intersecting challenges, such as social isolation, housing security and quality, and underlying infrastructural and resource-related challenges. We also provide preliminary recommendations to enhance the access to, and experiences in, cooling spaces. The emerging tensions and corresponding recommendations are summarized in table 2 below.

4.2. Emerging tensions

4.2.1. Individual vs. collective or community solutions

The preference for personal, do-it-yourself (DIY) strategies as well as seeking familiar places over formal cooling centres underscores the tension between individual and collective, community-oriented solutions. While DIY approaches to managing heat, such as using home fans or seeking shelter in private spaces, provide immediate relief, they often fall short of addressing systemic issues like poor indoor environmental quality and housing inadequacies [68]. While this inclination towards individual solutions may reflect a desire for personal agency and control over one's environment, it also reflects the 'downstream drift' in public health that favours understanding health as an individual responsibility alone [69, 70].

On the other hand, residents reported a desire for structural, collective-oriented solutions, such as community-based interventions and formal cooling centres to play a vital role in protecting people from heat. However, these solutions need to be adapted to better meet the diverse needs of users. Our findings suggest that while cooling centres are beneficial, they are not a one-size-fits-all solution. The challenge lies in balancing immediate, individual coping strategies with the need for systemic, collective support [71, 72].

4.2.1.1. Recommendations

To address these challenges effectively, we recommend a shift in approach that leverages existing spaces that people already frequent, such as malls, grocery stores, pools, restaurants, and parks. Leveraging their accessibility and familiarity would be beneficial for providing cooling more effectively and widely, including those who may (mistakenly) consider themselves not to be at risk of heat-health harms [73].

Rather than creating new, separate facilities for the sole purpose of cooling, investing in community-based interventions that utilize existing public and private spaces, as well as programs in place (e.g., programs that reach homebound mobilities such as 'Meals on Wheels' as a pathway for communication [74]) can create a more resilient and responsive support network [73]. This may mean arranging agreements with local businesses to create extra seating in their businesses or liaising with a local neighbourhood group that people trust and frequent to run programming in a cool space. As such, bolstering the capacity of local communities is a crucial component of this pursuit.

4.2.2. Efforts to accommodate all can backfire

SPs often made commendable efforts to accommodate unhoused individuals and people who use substances in public cooling spaces, such as allowing in pets and shopping carts with belongings, ensuring that these vital resources are accessible to all who need them. However, this well-intentioned inclusivity seemed to have deterred other residents who may harbour stigma against unhoused individuals or those who use substances, and seemed to convey resentment that they were being 'lumped in' altogether. This creates a tension in the use of cooling centres: while the aim is to offer support and shelter to marginalized groups, the presence of these groups unfortunately made the spaces less appealing to some who might otherwise use them, thereby undermining the effectiveness of the service. The potential for conflicting preferences between diverse

Table 2. Summary of emerging tensions and corresponding study recommendations.

Tension	Recommendations
Individual vs. collective or community solutions	-Utilizing existing spaces, e.g., malls, grocery stores, pools, restaurants, parks -Investing in community-based interventions
Efforts to accommodate all can backfire	-Creating adaptable space to meet diverse needs -Sensory-friendly areas and other accommodating areas within the same building or space to cater to priority groups
Underlying infrastructural and resource-related barriers	-Free and frequent shuttle services for transporting users from and to cooling centres - Coordinating a standardized framework for activating and operating; including: pre-determined hours of operation and the deployment of shuttle services throughout the whole duration of the EHE
Social connection and isolation	-Government institutions and community organizations should leverage their established relationships with diverse populations to deliver resources and support for heat preparedness -Building 'communities of care' from the bottom-up and enhancing social capital
Housing security and quality	-Reallocation of resources so that people can be cool where they live, -Continuing and strengthening programs such as common cooling rooms in buildings and subsidized air conditioning and other cooling mechanisms -Right-to-cool initiatives that legally enshrine tenants' rights to cooling in the summer, just as heating is required in the winter—with the caveat that tenant protections must be secured to make sure that this legislation does not have negative impacts on evictions or rent increases

residents, in particular, between housed and unhoused residents, has also been noted in other public spaces such as parks [75].

While we want to emphasize that this negative sentiment was not widespread among our participants, it was nonetheless present—particularly among residents who lived near the Downtown East Side area in Vancouver, an area known to have high rates of homelessness and substance use, and also resilience and community—and speaks to a broader societal sentiment and stigma that exists against people who are unhoused and/or use substances. The tensions and conflicting preferences reflect deeper root issues that permeate the social structural support systems, including classism, racism, ableism, colonialism, and denial of rights.

4.2.2.1. Recommendations

To address this challenge inclusively, creating educational, adaptable spaces that meet diverse needs is critical. By designing sensory-friendly areas and other accommodating areas within the same building or space that cater to different priority groups, SPs can also offer a range of environments that respect the varied needs and comfort levels of all users and connect them to other user-appropriate services, thereby ensuring that public cooling spaces remain welcoming and effective for everyone [19]. In practice, this translates into the creation of more inclusive spaces, both in terms of physical design and the service provided. For physical accessibility, a key example is designing spaces that accommodate individuals with varying levels of ability [76]. This could include the incorporation of assistive technologies and the removal of physical barriers, such as steps or curbs. On the service side, which is crucial in fostering a welcoming environment, one notable example is preparing SPs to offer mental health support. For instance, the Canadian Mental Health Association provides Mental Health First Aid courses and training that can equip SPs to address mental health disorders, including those related to substance use, anxiety, trauma, and psychosis [77]. Specifically addressing substance use, Bardwell and co-authors found that shelters with supervised injection sites, where peer support and the presence of other users were available, offered several benefits, including a perception of increased safety [78]. However, the authors also suggest that normalizing drug use across various environments would be a more effective strategy for reducing stigma toward drug users, ultimately decreasing discrimination and promoting greater acceptance in various places. Overall, it is essential to recognize that not everyone

encounters the same barriers or shares the same preferences when accessing cooling spaces. Interventions must therefore be informed by socio-demographic differences [79].

Moreover, leveraging existing community infrastructure plays a critical role, as people tend to gravitate towards spaces where they already feel accepted. In this context, partnerships with community organizations, NGOs, homeless outreach programs, and senior centres become a pivotal strategy. These collaborations can help facilitate activities and events in cooling centres while also improving communication efforts to ensure broader awareness and accessibility of these spaces [79]. Incorporating diverse or culturally specific activities depending on neighbourhood context could also be beneficial, and could be implemented by partnering with community organizations that already offer these activities, which already draws in residents.

4.3. Inevitable intersections

4.3.1. Underlying infrastructural and resource-related barriers

Infrastructural and resource limitations to addressing excess heat exist in Metro Vancouver. As described previously, many municipal cooling centres are activated within spaces offering other services and programming outside of EHE periods. The interviews with SPs demonstrated the challenges created by using existing spaces like libraries and community centres to shoulder the burden of also becoming cooling centres on short notice, while continuing to provide the typical services and programming offered. Some municipalities reported programs to access additional funding to facilitate longer opening hours and increased staffing needs. However, due to the unpredictable nature of the timing of EHEs, determining staffing strategies that ensure that cooling centres are able to operate safely, while reducing the precarity around staff working hours may remain a challenge.

Both residents and providers acknowledged that inconsistencies in the services available and the hours of operation at different cooling centres tended to cause confusion. For example, when hours of operation are not standard, potential service users may decide not to make the trip to a cooling centre and risk overheating while traveling if they are unsure whether cooling services will be available.

Additional barriers were reported both by our resident participants as well as in the broader discourse surrounding community cooling centres, such as transportation challenges, lack of accessible information, lack of accommodations for pets and belongings, and lack of activities and programming at cooling centre facilities. However, the SPs we spoke to also reported that many of the initiatives to address these potential barriers were not well utilized. This may suggest that a gap remains in conveying this relevant information to potential service users, or that it was not these barriers that were preventing potential service users from accessing cooling centres. These potential inconsistencies between residents' perception of cooling centres and the reports of SPs may also extend to the impressions of cooling centre crowding. Many residents reported previous experiences or impressions of crowded cooling centres deterred them from seeking out these locations during times of hot weather. However, SPs reported ample space to accommodate many more cooling centre guests.

4.3.1.1. Recommendations

In light of these challenges, implementing programs that provide free and frequent shuttle services for transporting users from and to cooling centres is crucial. Such services would greatly benefit both mobility-impaired individuals and those lacking access to private or public transportation [19, 80]. Considering the limited resources at cooling centres and the practical difficulties of offering shuttle services for extended periods of time (e.g. months), it would be most effective to activate these shuttles only during EHEs. Furthermore, considering that many users have expressed concerns about insufficient information around cooling centres, it would be essential to actively advertise the shuttle service. This could involve utilizing a range of communication channels, including more analogue methods such as word of mouth through community organizations, and placing posters and signs in high-frequented areas like shopping malls and stores [19].

Striving for consistency across different cooling centres and spaces could greatly benefit users by setting clear expectations for their availability. Coordinating a standardized framework for activating and operating these centres would help ensure that users know when and where they can access cooling services, as was done in Maricopa County in Arizona [81]. This approach could involve developing a comprehensive heat emergency plan in advance, which all cooling centres would be required to adopt and adapt in ways that fit their immediate neighbourhood context. This plan would include pre-determined hours of operation and the deployment of shuttle services throughout the whole duration of the EHE. Additionally, with advancements in heatwave prediction models, it might become increasingly feasible for cooling centres to better plan and coordinate staff shifts in advance, prior to EHEs, to make sure they are prepared for potential day- and night-long operations.

4.3.2. Social connection and isolation

A nuanced balance between individual and collective responsibility is required in addressing heat-related challenges. While individuals are eager to take care of themselves, their ability to do so often depends on the support they receive from their social networks. The collective solutions, such as community cooling centres, are crucial, but they must be delivered and effectively communicated by someone—often a person or organization embedded within the social fabric. New York City's 'Be A Buddy' program, fostering social networks of wellness checks, is one example [82].

Our findings indicate that this dynamic applies to various aspects of cooling centres, including information about their location and function, as well as individuals' ability to address what they perceive as shortcomings of the cooling centres. For instance, individuals often rely on neighbours or friends for cooling when these centres are unavailable or inaccessible. Social networks play a crucial role in disseminating information about cooling centres, translating important information from English when required, and providing alternative cooling spaces, such as the homes of friends, neighbours, or family members equipped with cooling resources.

Generally, we found that having someone ensure another person's wellbeing and offer care is amongst the most effective responses to heat. This not only applies to cooling centres, but also extends to other measures of heat preparedness. For example, our participants shared: 'Luckily, I got air conditioning. My son-in-law installed it for me' (R_FG02) or 'My nephew gave me a little fan (…). I have a friend in the church, who calls me very often, once or twice a day. (…) And my sister-in-law calls me every day' (R_52).

The support provided by social networks is particularly important for individuals with mobility impairments or other challenges that hinder their ability to leave their homes [83–86]. In this sense, social isolation significantly contributes to exacerbating the risk of dangerous exposure to extreme heat, in that those living in isolation are less likely to receive timely assistance or access cooling resources, thus increasing their vulnerability [87, 88]. Existing guidelines such as Vancouver Coastal Health's Heat Check-in Framework [89], while thorough and resourceful, could be enhanced by considering how to further support people who need to shelter in place, and how to ensure their 'place' is safe.

4.3.2.1. Recommendations

While individuals expressed a desire to manage their own heat-related challenges, there remains a need for collective and structural support. Balancing individual and collective solutions, as well as structural ones, involve recognizing who delivers these solutions and ensuring that they are practical and accessible for everyone.

As people often rely on their friends, relatives, and neighbours to protect themselves from heat, utilizing existing social networks to disseminate information about cooling centres and other heat preparedness measures is of utmost importance. In this regard, both government institutions and community organizations should leverage their established relationships with diverse populations to deliver resources and support for heat preparedness.

The importance of building 'communities of care' from the bottom-up and enhancing social capital is well-documented in the literature [90, 91]. These elements have been shown to effectively improve community capacity to respond to heat and, more broadly, to adapt to climate change [83].

This leads to one final important point, namely the need to consider those who are excluded from these networks and live in social isolation. Programs like 'Better At Home', initiated by one of our community partners, seek to connect specifically with those who do not have social connections. Such initiatives can serve as examples and be adapted to different settings.

4.3.3. Housing security and quality

Housing security and quality have inevitable intersections with experiences of heat [8], as well as choices to use cooling centres or not. As we saw in the Findings section, for housed participants, comfort, familiarity, and accessibility are big motivators in deciding to use cooling centres or not. Many participants choose to stay at home during heat events, even when they have clear poor indoor environmental quality, including lack of access to cooling through socio-economic factors such as renting from landlords who may be hostile, or living in aging buildings [8]. Often tenants do not have control over their indoor environments and are subject to decisions of building managers and landlords, even accessing provincial programs such as B.C. Hydro's provision of free air conditioners [92, 93]. As one participant explained about not being able to access even heat in the winter, which is required of landlords, '*I have* sought *help before, but no one has addressed the issue. The quality of the management team is extremely poor. I reported this situation last year, but no action was taken. They seem only focused on making money and earning profit from us*' (FG08_SU38-41). As we know from the 2021 heat dome, in-home deaths represented 98% of deaths [2], making the study of

indoor heat and the barriers to accessing cooling mechanisms in-home significant in understanding heat exposure, especially if people are opting to stay in hot homes over seeking cooling at cooling centres.

4.3.3.1. Recommendations

As people choose—or have no choice but—to stay in their homes due to familiarity and accessibility considerations, we must turn attention to the ways in which resources can be reallocated so that people can be cool where they live, including continuing and strengthening programs such as common cooling rooms in buildings and subsidized air conditioning and other cooling mechanisms. This also means strengthening tenant protections to ensure renters can access these cooling interventions without financial, social, or political burden. Specifically, we support right-to-cool initiatives that legally enshrine tenants' rights to cooling in the summer, just as heating is required in the winter—with the caveat that tenant protections must be secured to make sure that this legislation does not have negative impacts on evictions or rent increases. Also important is to actualize government obligations to support the existing right to housing adequacy as legally enshrined in the 2019 National Housing Strategy Act [94]. These types of interventions into the housing sphere will address extreme heat at the home level, especially for those who cannot or prefer to not use cooling centres.

5. Limitations and future directions

One notable limitation of this study is the challenge of reaching unhoused individuals within our sampling frame and those who are socially isolated, which may affect the generalizability of the findings. Future research should include a more comprehensive examination of whether and how unhoused individuals access and utilize cooling facilities, identifying specific barriers and facilitators to their participation, building on some work to date in South-eastern United States [95].

Additionally, understanding how participants perceive and define 'vulnerability' is crucial, as some individuals may not recognize themselves as vulnerable to extreme heat despite being at risk [96]. This raises important questions about balancing autonomy with public health recommendations—such as whether it is patronizing to suggest a cooling centre to someone who does not see themselves as 'vulnerable'. Vulnerability is highly contextual and varies with specific local conditions; for example, in Vancouver, extreme heat intersecting with the rental housing crisis presents unique challenges compared to other locations. To address these issues, future studies would benefit from comparing cooling centre (under)utilization across different regions, investigating best practices for cooling centres and communal cooling plans in various cities and municipalities.

A culturally contextualized analysis of different groups may offer further insights into distinct needs and barriers for specific communities. Future work could benefit from a larger sample size of each cultural group, as ours may not have adequately captured the full diversity of the target communities. Additionally, examining the capacities of libraries, community centres, and other local resources in supporting cooling programming, and incorporating feedback from both residents and providers, will provide a more comprehensive view. Investigating the role of social isolation in amplifying heat risks and evaluating the effectiveness of existing community networks could further enhance strategies. Lastly, assessing whether people's perceptions of cooling centres align with actual usage, and exploring potential differences in usage across various centres, will contribute to a deeper understanding of these resources' effectiveness.

6. Conclusion

This study began with a focused inquiry into the effectiveness of cooling centres as a response to extreme heat. However, it has expanded our understanding to encompass a broader range of interconnected issues. As we navigate the complex interplay between housing, extreme heat, and public health, it is essential to adopt a multifaceted approach that acknowledges both immediate needs and systemic reforms. Drawing on Eric Olin Wright [97], we recognize that society functions like an ecosystem—where various elements interact in ways that are not always tightly controlled but can be transformed through strategic interventions. Just as introducing an alien species might alter an ecosystem, innovative and diverse solutions can gradually reshape our approaches to managing extreme heat and the broader structural inequities under which heat risks are manifesting, including rental housing insecurity.

The emerging tensions between DIY and collective solutions illustrate the diverse ways individuals manage heat and their environment. While DIY strategies offer immediate relief and a sense of personal control, they often fail to tackle deeper systemic problems such as inadequate housing and poor indoor environmental quality. Conversely, collective solutions like community cooling centres are crucial but must

be adaptable to meet varying needs effectively. Our findings suggest a need for a dual approach: enhancing grassroots initiatives while pursuing broader infrastructural improvements, and structural equality.

The concept of individual and community 'capacity' emerged as relevant, as it underscores how people and communities leverage various means and networks to manage their situations. We must therefore consider how 'capacity' and existing social networks contribute to individual and community resilience. Leveraging familiar spaces, such as libraries and community centres, and integrating them into cooling strategies can address immediate needs while fostering a more robust support network. However, understanding how these resources are perceived and utilized is crucial, as demonstrated in some participants' perceptions of those who use substances or are unhoused.

Furthermore, addressing housing insecurity and quality is pivotal. Many individuals choose to stay in their homes during heat events due to familiarity and accessibility, despite poor indoor environmental conditions. Strengthening tenant protections and supporting initiatives like the 'right to cool' framework [98], which advocates for legally enshrining access to cooling as a fundamental right, would represent a fundamental first step. This can ensure that cooling interventions are accessible and effective without exacerbating housing instability. Ensuring access to affordable, adequate housing is crucial so that individuals are not forced to choose between cooling and other basic necessities like groceries and healthcare.

Ultimately, a comprehensive approach is required to balance immediate relief with systemic reform. In other words, recognizing the urgent need for immediate interventions, while also pursuing broader systemic reforms, allows us to address both current challenges and work towards a more equitable future. By integrating both individual and collective strategies, and addressing underlying structural issues, we can enhance resilience and equity in our response to extreme heat. This approach not only mitigates the impacts of heat but also contributes to a more just society, improving overall health, wellbeing, and dignity, with no one feeling uncared for.

Data availability statement

The data cannot be made publicly available upon publication because they contain sensitive personal information. The data that support the findings of this study are available upon reasonable request from the authors.

Acknowledgment

We would like to thank the participants for their time and insights generously shared. We are grateful to our community partners: South Vancouver Neighbourhood House, South Vancouver Seniors Network, Elizabeth Fry Society, Engaged Communities Canada Society, Yarrow Intergenerational Society for Justice. We thank Sam Bradd, Olive Dempsey, and the Centre for Climate Justice at UBC for their support for the Knowledge Exchange event associated with this project and their overall support.

We thank the rest of our UBC team members: Shruti Chakravarty, Nicole Chin, Chaimae Chouiekh, Lam Liu, Aneesha Sran, Ashley Wan, Michelle Yeung. We also thank the Co-Investigators and knowledge user partners on the Grant:, Sarah Henderson, Alexis Crabtree, Michael Schwandt, Emily Newhouse, and Jonathan Carroll.

This research took place on the traditional, ancestral, unceded territory of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh) Nations, as well as the Semiahmoo, q̓i꞉c̓əy̓ (Katzie), kʷikʷəƛ̓ əm (Kwikwetlem), Q'ʷa:n̓ ƛ'ən̓ (Kwantlen), Qayqayt and sc̓əwaθən məsteyəxʷ (Tsawwassen) First Nations. The authors acknowledge our own positions as uninvited guests on these lands.

Funding

This study was supported by funding from the Canadian Institutes of Health Research—'Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2022: Mobilizing Public Health Action on Climate Change in Canada' Catalyst Grant, and the Pacific Institute for Climate Solutions—Climate Action Event Program.

Ethical statement

This study received ethical approval from the University of BC Behavioural Research Ethics Board (BREB H23-02409).

ORCID iDs

Liv Yoon https://orcid.org/0000-0003-2330-1159
Giulia Belotti https://orcid.org/0009-0006-4398-6553
Katherine White https://orcid.org/0000-0002-4319-9692
Abby Zhou https://orcid.org/0009-0006-8488-0659
Eduardo Rosales Miranda https://orcid.org/0009-0008-1774-9137
Thanh Le https://orcid.org/0009-0004-0627-4069

References

[1] Government of Canada I 2022 Surviving the heat: the impacts of the 2021 western heat dome in Canada *Innovation, Science and Economic Development Canada* (available at: https://science.gc.ca/site/science/en/blogs/science-health/surviving-heat-impacts-2021-western-heat-dome-canada) (Accessed 5 February 2023)
[2] BC Coroners Service 2022 Extreme heat and human mortality: a review of heat-related deaths in B.C. in summer 2021 (available at: www2.gov.bc.ca/assets/gov/birth-adoption-death-marriage-and-divorce/deaths/coroners-service/death-review-panel/extreme_heat_death_review_panel_report.pdf)
[3] Yoon L, Richardson G R A and Gorman M 2024 Reflections on a century of extreme heat event-related mortality reporting in Canada *GeoHealth* **8** e2023GH000895
[4] Environment Canada 2010 WindChill_factsheet_en.pdf (available at: www.ec.gc.ca/meteo-weather/80B0F2AF-9697-4BEE-AB17-D401EBBA5B4B/WindChill_factsheet_en.pdf) (Accessed 12 February 2023)
[5] Schwarz L *et al* 2022 Heat waves and emergency department visits among the homeless, san diego, 2012–2019 *Am. J. Public Health* **112** 98–106
[6] Meade R D *et al* 2020 Physiological factors characterizing heat-vulnerable older adults: a narrative review *Environ. Int.* **144** 105909
[7] BC Ministry of Health 2024 BC provincial heat alert and response system (BC HARS) (available at: www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Health-Environment/Provincial-Heat-Alerting-Response-System.pdf)
[8] Stern R N and Arefin M R 2024 Extreme heat in the home: understanding the 2021 pacific northwest heat wave through the british columbia coroners report *J. Disaster Stud.* **1** 103–18 (available at: muse.jhu.edu/article/936412)
[9] Centre for Climate Justice Right to cool forthcoming
[10] MacNicol R The case for a right to cool: too hot at home (available at: https://climatejustice.ubc.ca/news/the-case-for-a-right-to-cool-too-hot-at-home-podcast-launch/) (Accessed 30 August 2024)
[11] Berisha V, Hondula D, Roach M, White J R, McKinney B, Bentz D, Mohamed A, Uebelherr J and Goodin K 2017 Assessing adaptation strategies for extreme heat: a public health evaluation of cooling centers in maricopa county, Arizona *Weather Clim. Soc.* **9** 71–80
[12] Henderson S B, McLean K E, Lee M J and Kosatsky T 2022 Analysis of community deaths during the catastrophic 2021 heat dome *Environ. Epidemiol.* **6** e189
[13] Yumagulova L, Okamoto T, Crawford E and Klein K 2022 Lived experience of extreme heat in B.C
[14] Berry P and Schnitter R 2022 Health of Canadians in a changing climate: advancing our knowledge for action (available at: https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=329522) (Accessed 12 February 2023)
[15] Abrahamson V, Wolf J, Lorenzoni I, Fenn B, Kovats S, Wilkinson P, Adger W N and Raine R 2009 Perceptions of heatwave risks to health: interview-based study of older people in London and Norwich, UK *J. Public Health* **31** 119–26
[16] Buscail C, Upegui E and Viel J F 2012 Mapping heatwave health risk at the community level for public health action *Int. J. Health Geogr.* **11** 38
[17] Every D, Richardson J and Osborn E 2019 There's nowhere to go: counting the costs of extreme weather to the homeless community *Disasters* **43** 799–817
[18] Lee S and Chen D (BCIT School of Health Sciences EH) 2022 Knowledge of protective measures during extreme heat events among the general public *BCIT Environ. Public Health J.* 1–15
[19] Nayak S G *et al* 2019 Accessibility of cooling centers to heat-vulnerable populations in New York State *J. Transp. Health* **14** 100563
[20] Carr D, Falchetta G and Sue Wing I 2024 Population aging and heat exposure in the 21st century: which U.S. regions are at greatest risk and why? *Gerontologist* **64** gnad050
[21] Reid C E, O'Neill M S, Gronlund C J, Brines S J, Brown D G, Diez-Roux A V and Schwartz J 2009 Mapping community determinants of heat vulnerability *Environ. Health Perspect.* **117** 1730–6
[22] Gronlund C J, Zanobetti A, Wellenius G A, Schwartz J D and O'Neill M S 2016 Vulnerability to renal, heat and respiratory hospitalizations during extreme heat among U.S. elderly *Clim. Change* **136** 631–45
[23] Sampson N R, Gronlund C J, Buxton M A, Catalano L, White-Newsome J L, Conlon K C, O'Neill M S, McCormick S and Parker E A 2013 Staying cool in a changing climate: reaching vulnerable populations during heat events *Glob. Environ. Change* **23** 475–84
[24] Sanchez C Tricks of the shade: heat related coping strategies of urban homeless persons in Phoenix Arizona *M.S.* Arizona State University, United States—Arizona
[25] Gabbe C J and Pierce G 2020 Extreme heat vulnerability of subsidized housing residents in California *Hous. Policy Debate* **30** 843–60
[26] Cusack L, van Loon A, Kralik D, Arbon P and Gilbert S 2013 Extreme weather-related health needs of people who are homeless *Aust. J. Prim. Health* **19** 250–5
[27] Yazdani M and Haghani M 2023 A dynamic emergency planning system for relocating vulnerable people to safe shelters in response to heat waves *Expert Syst. Appl.* **228** 120224
[28] Peden A E, Heslop D and Franklin R C 2023 Weather-related fatalities in Australia between 2006 and 2019: applying an equity lens *Sustainability* **15** 813
[29] Coates L, Haynes K, O'Brien J, McAneney J and de Oliveira F D 2014 Exploring 167 years of vulnerability: an examination of extreme heat events in Australia 1844–2010 *Environ. Sci. Policy* **42** 33–44
[30] Loughnan M, Carroll M and Tapper N J 2015 The relationship between housing and heat wave resilience in older people *Int. J. Biometeorol.* **59** 1291–8

[31] Bittner M I and Stößel U 2012 Perceptions of heatwave risks to health: results of an qualitative interview study with older people and their carers in Freiburg, Germany *GMS Psycho. Soc. Med.* **9** Doc05
[32] Kemen J, Schäffer-Gemein S, Grünewald J and Kistemann T 2021 Heat perception and coping strategies: a structured interview-based study of elderly people in Cologne, Germany *Int. J. Environ. Res. Public Health* **18** 7495
[33] Astone R and Vaalavuo M 2022 Climate change and health: consequences of high temperatures among vulnerable groups in Finland *Int. J. Health Serv. Plan. Adm. Eval.* **53** 207314221131208
[34] Mücke H G and Litvinovitch J M 2020 Heat extremes, public health impacts, and adaptation policy in Germany *Int. J. Environ. Res. Public Health* **17** 7862
[35] Eady A, Dreyer B, Hey B, Riemer M and Wilson A 2020 Original mixed methods research—reducing the risks of extreme heat for seniors: communicating risks and building resilience *Health Promot. Chronic Dis. Prev. Can. Res. Policy Pract.* **40** 215–24
[36] Doris S N 2020 Energy access and extreme heat events: a case study of seniors in Ottawa, Ontario *M.A.* The University of Western Ontario (Canada), Canada—Ontario, CA
[37] Pfaff R 2016 Disarming the 'Silent Killer' reducing the vulnerability of Toronto's elderly to extreme heat *Master's Thesis* Lund University
[38] Spannagel E 2021 Record canada heat harms older people and people with disabilities | human rights watch (available at: www.hrw.org/news/2021/07/09/record-canada-heat-harms-older-people-and-people-disabilities) (Accessed 29 August 2024)
[39] Shingler B 2024 Heat waves linked to higher mortality rates, especially in cities with more renters *CBC News* (available at: www.cbc.ca/news/health/extreme-heat-mortality-statistics-canada-1.7239455) (Accessed 29 August 2024)
[40] De Flaviis S (CTVNews) 2023 Protecting seniors during extreme heat waves is critical, advocate says (available at: www.ctvnews.ca/climate-and-environment/protecting-seniors-during-extreme-heat-waves-is-critical-advocate-says-1.6478329) (Accessed 29 August 2024)
[41] Government of Canada SC 2022 A portrait of Canadians who have been homeless (available at: www150.statcan.gc.ca/n1/pub/75-006-x/2022001/article/00002-eng.htm) (Accessed 7 2023 February)
[42] Gronlund C J, Sullivan K P, Kefelegn Y, Cameron L and O'Neill M S 2018 Climate change and temperature extremes: a review of heat- and cold-related morbidity and mortality concerns of municipalities *Maturitas* **114** 54–59
[43] Divo M J, Martinez C H and Mannino D M 2014 Ageing and the epidemiology of multimorbidity *Eur. Respir. J.* **44** 1055–68
[44] Watts N *et al* 2021 The 2020 report of the lancet countdown on health and climate change: responding to converging crises *Lancet* **397** 129–70
[45] Chambers J 2020 Global and cross-country analysis of exposure of vulnerable populations to heatwaves from 1980 to 2018 *Clim. Change* **163** 539–58
[46] Government of Canada SC 2022 Population estimates on July 1st, by age and sex (available at: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501) (Accessed 19 February 2023)
[47] Hernández D 2016 Understanding 'energy insecurity' and why it matters to health *Soc. Sci. Med.* **167** 1–10
[48] Hernández D 2013 Energy insecurity: a framework for understanding energy, the built environment, and health among vulnerable populations in the context of climate change *Am. J. Public Health* **103** e32–4
[49] Kosatsky T, King N and Henry B 2005 How toronto and montreal (Canada) respond to heat *Extreme Weather Events and Public Health Responses* ed W Kirch, R Bertollini and B Menne (Springer) pp 167–71
[50] Staff D C (Daily Courier) 2021 Cooling centres in Kelowna, West Kelowna served little purpose (available at: www.kelownadailycourier.ca/news/article_9e8c1e40-d9dc-11eb-8208-0b3ffb7ff5b4.html) (Accessed 12 February 2023)
[51] Keith L, Meerow S, Hondula D M, Turner V K and Arnott J C 2021 Deploy heat officers, policies and metrics *Nature* **598** 29–31
[52] Mallen E *et al* 2022 Extreme heat exposure: access and barriers to cooling centers—Maricopa and Yuma Counties, Arizona, 2010–2020 *Centers for Disease Control and Prevention (U.S.)* (MMWR. Morbidity and mortality weekly report) (available at: https://stacks.cdc.gov/view/cdc/118336) (Accessed 23 January 2023)
[53] Paulsen M (The Tyee) 2009 The trouble with tracey (The Tyee) (available at: https://thetyee.ca/News/2009/12/18/TroubleWithTracey/) (Accessed 6 February 2023)
[54] Quick M, Christidis T, Olaniyan T, Newstead N and Pinault L 2023 Exploring the associations between cooling centre accessibility and marginalization in Montreal, Toronto, and Vancouver, Canada *Can Geogr. Géographies Can* **67** 352–65
[55] Gorman A, Greenhaw M and Zaslavsky D An investigation into informal cooling centres and people's perceptions of and experiences at these places
[56] White R *et al* 2022 The unprecedented pacific northwest heatwave of June 2021 (available at: www.researchsquare.com/article/rs-1520351/v1) (Accessed 12 December 2022)
[57] Kallio H, Pietilä A M, Johnson M and Kangasniemi M 2016 Systematic methodological review: developing a framework for a qualitative semi-structured interview guide *J. Adv. Nurs.* **72** 2954–65
[58] Corrente M and Bourgeault I 2022 Innovation in transcribing data: meet otter.ai (SAGE Publications, Ltd) (available at: https://methods.sagepub.com/case/innovation-in-transcribing-data-meet-otter-ai) (Accessed 29 August 2024)
[59] Brislin R W 1970 Back-translation for cross-cultural research *J. Cross-Cult. Psychol.* **1** 185–216
[60] Braun V and Clarke V 2022 Conceptual and design thinking for thematic analysis *Qual. Psychol.* **9** 3–26
[61] Braun V and Clarke V 2019 Reflecting on reflexive thematic analysis *Qual. Res. Sport Exerc. Health.* **11** 589–97
[62] Dedoose. Dedoose *User Guide* (available at: www.dedoose.com/userguide/appendix) (Accessed 30 August 2024)
[63] Boyatzis R E 1998 *Transforming Qualitative Information: Thematic Analysis and Code Development* (Sage)
[64] Beresford M *et al* 2022 Coding qualitative data at scale: guidance for large coder teams based on 18 studies *Int. J. Qual. Methods* **21** 16094069221075860
[65] Giesen L and Roeser A 2020 Structuring a team-based approach to coding qualitative data *Int. J. Qual. Methods* **19** 1609406920968700
[66] Saldaña J 2016 *The Coding Manual for Qualitative Researchers* (Sage Publications)
[67] City of Vancouver 2024 Stay safe in the summer heat translated resources (available at: https://vancouver.ca/home-property-development/stay-safe-in-the-summer-heat-translated-resources.aspx) (Accessed 27 October 2024)
[68] Singh R 2024 DIY passive cooling techniques for residents of vancouver downtown eastside: addressing heat-related vulnerabilities in marginalized populations living in social housing in the DTES region (UBC Sustainability Hub) (available at: www.sustain.ubc.ca/sites/default/files/2023-079_DIY%20Passive%20Cooling%20Techniques_Singh.pdf)
[69] Hughes K 2003 Health as individual responsibility: possibilities and personal struggle *Mainstreaming Complementary and Alternative Medicine* (Routledge)

[70] Traina G, Martinussen P E and Feiring E 2019 Being healthy, being sick, being responsible: attitudes towards responsibility for health in a public healthcare system *Public Health Ethics* **12** 145–57
[71] Guardaro M, Hondula D, Ortiz J and Redman C 2022 Adaptive capacity to extreme urban heat: the dynamics of differing narratives *Clim. Risk Manage.* **35** 100415
[72] Turek-Hankins L *et al* 2021 Climate change adaptation to extreme heat: a global systematic review of implemented action *Oxf Open Clim. Change* **1** kgab005
[73] Uberoi M, Asher A, Irani K and Serwin A 2020 Meeting people where they are: extending services building capacity in black communities *J. Race Inequal Soc. Mobil. Am.* **2** 1–12 (available at: https://journals.library.wustl.edu/jrisma/article/id/9/)
[74] Vancouver Coastal Health 2024 Meals on Wheels (available at: www.vch.ca/en/service/meals-wheels) (Accessed 30 August 2024)
[75] Pitas N, Rose J, Mullenbach L and Russell Z 2024 Unhoused users in parks and public greenspace: an intergroup conflict approach *Landsc. Urban Plan.* **249** 105113
[76] U.S. Centers for Disease Control and Prevention 2024 Common barriers to participation experienced by people with disabilities (Disability and Health Promotion) (available at: www.cdc.gov/ncbddd/disabilityandhealth/disability-barriers.html#Physical) (Accessed 22 October 2024)
[77] Canadian Mental Health Association 2023 Mental health first aid (Mental Health First Aid) (available at: https://cmhavf.ca/programs/mental-health-first-aid/) (Accessed 22 October 2024)
[78] Bardwell G, Boyd J, Kerr T and McNeil R 2018 Negotiating space & drug use in emergency shelters with peer witness injection programs within the context of an overdose crisis: a qualitative study *Health Place* **53** 86–93
[79] Vasconcelos L, Langemeyer J, Cole H V S and Baró F 2024 Nature-based climate shelters? Exploring urban green spaces as cooling solutions for older adults in a warming city *Urban For. Urban Green.* **98** 128408
[80] Mattson J 2011 Transportation, distance, and health care utilization for older adults in rural and small urban areas *Transp. Res. Rec.* **2265** 192–9
[81] Maricopa Association of Governments 2024 Heat relief network (available at: https://azmag.gov/Programs/Heat-Relief-Network) (Accessed 19 October 2024)
[82] NYC Mayor's Office of Climate and Environmental Justice 2022 NYC Mayor's office of climate and environmental justice (Be a Buddy) (available at: https://climate.cityofnewyork.us/initiatives/be-a-buddy/) (Accessed 19 October 2024)
[83] Guardaro M, Hondula D M and Redman C L 2022 Social capital: improving community capacity to respond to urban heat *Local Environ.* **27** 1133–50
[84] Wilhelmi O 2010 Connecting people and place: a new framework for reducing urban vulnerability to extreme heat *Environ. Res. Lett.* **21411** 70–59
[85] Yao T *et al* 2024 Vulnerable communities in the face of heat: a pilot study on perceptions, behaviors, and support networks during heat events *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 10711813241261378
[86] Kafeety A, Henderson S B, Lubik A, Kancir J, Kosatsky T and Schwandt M 2020 Social connection as a public health adaptation to extreme heat events *Can. J. Public Health* **111** 876–9
[87] Orlando S *et al* 2021 The effectiveness of intervening on social isolation to reduce mortality during heat waves in aged population: a retrospective ecological study *Int. J. Environ. Res. Public Health* **18** 11587
[88] Kim Y O, Lee W, Kim H and Cho Y 2020 Social isolation and vulnerability to heatwave-related mortality in the urban elderly population: a time-series multi-community study in Korea *Environ. Int.* **142** 105868
[89] Vancouver Coastal Health 2022 Heat check-in support framework (available at: www.vch.ca/sites/default/files/import/documents/Heat-check-in-support-framework.pdf) (Accessed 19 October 2024)
[90] Held V 2006 *The Ethics of Care: Personal, Political, and Global* (Oxford University Press) pp 222
[91] Putnam R 2010 Social capital: measurement and consequences *Can. J. Policy Res.* **25** 2
[92] Weichel A 2023 Landlord refusals turning B.C.'s air conditioner giveaway into hot mess, renters say (CTV News) (available at: https://bc.ctvnews.ca/landlord-refusals-turning-b-c-s-air-conditioner-giveaway-into-hot-mess-renters-say-1.6494298) (Accessed 13 August 2023)
[93] Judd A and Nolin J 2023 Renters in B.C. building told they can't have air conditioners | globalnews.ca (Global News) (available at: https://globalnews.ca/news/9848854/bc-renters-air-conditioners-letter/) (Accessed 13 August 2023)
[94] Legislative Services Branch 2019 Consolidated federal laws of Canada, National Housing Strategy Act (available at: https://laws-lois.justice.gc.ca/eng/acts/n-11.2/FullText.html) (Accessed 27 October 2024)
[95] Cronley C, Fackler A, First J M, Lee S and Tsouris I 2024 Persons experiencing homelessness during extreme temperatures: lessons for promoting socially inclusive adaptive capacity *Int. J. Environ. Res. Public Health* **21** 1–16
[96] Buse C G and Patrick R 2020 Climate change glossary for public health practice: from vulnerability to climate justice *J. Epidemiol. Commun. Health* **74** 867–71
[97] Wright E O 2013 Transforming Capitalism through Real Utopias
[98] UBC Centre for Climate Justice Right to cool: re-orienting how we think about cooling in the context of tenant housing security and quality (tentative title). forthcoming