

# **Perceptions of Extreme Heat and Cooling Centres in Downtown Hamilton, Ontario**

*An investigation into informal cooling centres and people's perceptions of and experiences at these places.*

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## Abstract

With climate change, Ontario has seen an increase in extreme weather - namely, prolonged heat events. This has significant implications for public health and service provision in the City of Hamilton. In addition to formal cooling centres provided by the City, residents also find informal places and ways to cool down. Throughout this study, we interviewed residents, mapped locations they frequented, and conducted thematic analysis to understand perceptions and experiences. In particular, health and safety were seen to be of interest when it comes to extreme heat events. Through our research, we have identified two recommendations on how the City can better serve citizens most vulnerable during extreme heat events. Current City protocol is the *Community Heat Response Initiative*, which opens municipally owned 'cool places' to the public during severe heat events. Our study found that residents rarely, if ever chose official cooling centres. This suggests a need to rethink how official services are provided. Our primary recommendation is to review and revise the existing response plan to better meet the concerns we have outlined. We also recommend including the voices of Beasley residents and, by extension, citizens of Hamilton, in the creation of a public emergency response policy.

## Key Words

*Cooling Center, Climate Change, Extreme Heat, Urban Heat, Qualitative Data Analysis, Thematic Analysis*

## Introduction

### **Climate Change and Extreme Heat**

With climate change, Ontario has seen an increase in extreme weather (Imhoff, 2017). In recent years, warmer winters and hotter summers with a greater number of heat waves have been recorded (Imhoff, 2017). This trend is expected to continue, with extreme heat events of increasing frequency and severity. Hamilton has already experienced increasing temperatures in the spring and summers, requiring the introduction of heat warnings in Hamilton that began in 2008 (Imhoff, 2017). The average mean temperature has already increased by 0.9°C since 1970 (Imhoff, 2017 & International Council for Local Environmental Initiatives [ICLEI], 2016). Reports indicate that in the 2020s Hamilton can expect an increase in temperatures by approximately 1.5°C, and an increase in the frequency of heat days (>30°C) and warm nights of 20 days (Imhoff, 2017 & ICLEI, 2016). It is important for municipalities such as Hamilton to prepare for the future, if they are to be resilient in the face of health implications and stress on hard and soft infrastructure. Actions are required to address climate change's impacts to infrastructure, as well as social and physical health.

### **Urban Heat Islands and Human Health**

In the majority of large cities, air temperature at the core of the city is warmer than the surrounding rural areas; this phenomenon known as the urban heat island effect (Nuruzzaman, 2015). More specifically, when large natural areas are replaced by man-made surfaces, the absorption patterns of solar radiation react differently, resulting in increased heat and discomfort for city dwellers (Nuruzzaman, 2015). The increase in temperature associated with urban heat islands has the potential to have a significant impact on the health and welfare of urban residents (Wong et al., 2018). Research has found relationships between temperature and an increase in physical illnesses like pre-existing conditions, vector borne diseases such as lyme disease transmitted by ticks, psychological illnesses, general health and well-being, as well as mortality (Vardoulakis et al., 2016; Glaser et al., 2016; Campbell-Lendrum et al., 2015; Isaken et al., 2015; Kjellstrom et al., 2016 as cited in Wong et al., 2018 & Kalkstein & Smoyer 1993a,b as cited in Smoyer et al., 2000). These studies identified that urbanization may be a potential risk factor in heat-stress mortality, noting that in vulnerable populations, these relationships were seen to be even stronger.

## **Summer Heat Stress in Beasley, Downtown Hamilton**

This study was conducted in Beasley, a neighbourhood in downtown Hamilton. The residents in this neighbourhood are particularly vulnerable, as the poverty rates in Beasley are three times higher than the average for the city of Hamilton, with 57% of Beasley residents living below the poverty line when compared to Hamilton's 18% (Mayo et al., 2012). Beasley is located in the downtown core of Hamilton, resulting in these residents suffering the brunt of the heat island effect. For many members of the community, air conditioning is not an option. Additionally, many apartment buildings are constructed to retain heat in the winter, making the temperature during the summer months unbearable. These temperatures increase the chance of residents experiencing heat related illness (Jagai et al., 2017).

For the past several years, Thompson and Thompson have been examining how heat waves impact residents in Beasley. They define residential heat stress as air temperatures greater than 30°C threshold with humidex (Thompson & Thompson, 2014, 2018). In June of 2013, they calculated that residents spent approximately 50% of the study period with air temperatures above the heat stress threshold. They found that cumulative temperatures in an attic residence reached as high as 34°C, while humidity levels reached as high as 58% relative humidity during a heat wave (Thompson & Thompson, 2014). As well, they found that apartment units experience four to five times more frequent night heat stress hours compared to the Hamilton airport, which is where temperature readings are measured for the city of Hamilton (Thompson & Thompson, 2014, 2018) With these levels of heat in their homes, residents often seek other, cooler, places to go.

### **Formal Cooling Centers**

Formal cooling centres offered by the City of Hamilton are available in the event of a City issued heat warning. The City defines a heat warning as two consecutive days of daytime high temperatures of 31° or greater, while an *extended* heat warning (or heat emergency) is three days of 31° or higher (City of Hamilton, 2019). In the event of a heat warning, the City makes formal cooling centres available. Their most popular 'cooling centre' strategy is to provide free admission to all public pools, as well as advertising City facilities like libraries, public beaches, shelters, municipal service centres, and Service Ontario locations (City of Hamilton, 2019). Community centres are also available as official cooling centres, with the City offering free water bottles, sun hats, and sunscreen at those locations (City of Hamilton, 2019).

In the past, residents of Hamilton have voiced issues regarding the City's emergency heat response and official cooling centres (Huang, 2013; Robertson, 2013). Anecdotal criticisms brought forward have been about the hours that cooling centres operate (typically business hours, closed on weekends) and the undesirability of certain centres, such as shelters. Residents and communities have developed informal cooling strategies, which are often known only within communities and exist formally undocumented. An informal cooling centre is any area that residents use during heat emergencies that is not provided or documented by the City of Hamilton. They can range from 'that one big tree in the park' to spontaneous, community organized water balloon fights (M. Thompson, personal communication, September 18 2019). The purpose of this study is to determine where people go during extreme heat events, what characterizes the places they choose to go to, and gain detailed accounts of their experiences at these informal cooling centres.

## **Structure and Scope**

This paper first outlines the methods researchers used to carry out studies. After outlining the methods, we move into a summary of the results, split first into themes, and then into our mapping activity. This is followed by a discussion of our results, and a brief outlining of the actions we believe the City of Hamilton should take with regards to extreme heat. This project's scope includes an analysis of collected data within the framework of thematic analysis, as outlined in Braun and Clarke (2009), with the addition of some academic work for context. A specific policy recommendation is outside the scope of this project.

## **Methods**

The aim of this research project was to gather detailed accounts of where residents of the Beasley community go during extreme heat events and what characterizes these spaces they chose to use to cool down, with a particular focus on 'informal' cooling centres. From this collected data, the researchers aimed to synthesize important themes and produce a cohesive report to put before the Hamilton City Council to encourage an examination of the current approach to heat, and an eventual restructuring of the strategies used to address heat.

Research took place between November 2019 and April 2020, and involved a thematic analysis framework, as outlined by Braun and Clarke (2006). This approach involves conducting a series of open ended interviews with residents, and then transcribing them and identifying key themes. For the purposes of this research, a theme was taken as a persistent and recurring comment informing the understanding of how and where residents of the Beasley community cool down. We aimed to create a rich description of the data set. We chose an inductive thematic analysis, purely looking at the data and not informing our analysis through theory. We also chose to look for latent themes, as we want to understand perceptions, rather than simply experiences. In our study, emotionality and social baggage attached to informal cooling centres is of interest. All of the research was conducted within an essentialist/realist paradigm, meaning that we are looking at the way people experience heat, and what meanings they draw from these events. We were not focused on the way meaning and experience are produced socially.

To recruit participants, we turned to several methods. Participants were recruited through a Beasley Neighbourhood Association (BNA) Meeting, poster around the Beasley Neighbourhood, and through participants identified through contact with the Community Project Champion, Matt Thompson. It should be noted that these recruitment methods were skewed towards English speaking residents, as well as residents with email or phone access. A total of 9 interviews were conducted at Bill Simone Hall, in the Beasley Neighbourhood, ranging between half an hour and an hour long. They were open ended and consisted of 8 questions (refer to Appendix A). All participants were compensated with a \$10 Tim Hortons gift card. All recruitment and interview materials were approved by the McMaster Research Ethics Board. Following the physical interview, recordings were transcribed both using Temi, a transcription software, and manually by researchers. Transcriptions were then imported into NVivo to conduct thematic analysis. Questions that guided theming were, 'what are the physical, social, and accessibility characteristics of the spaces people prefer?', 'what pre-existing knowledge do people have around cooling centres?', 'how do people perceive their health being affected by heat?', and 'how does heat affect daily tasks?'. Each researcher independently coded the findings using the NVIVO software, and then coding between researchers was compared to ensure consistency.

To supplement the research, at the Beasley Winterfest, a community festival held at Beasley Park on February 8, 2020, we conducted an informal mapping activity. Participants

over the age of 18 were able to mark informal cooling centres on a large map of Beasley with pins. We had 41 people participate in this activity and mapped their responses using ArcGIS Online. See Figure 1 for the results and Figure 2 for our initial map we used in the activity.

## Results

Through thematic analysis of the dataset, 5 themes were synthesized: nature of the space, health, water, daily tasks, and knowledge. Sub themes were used to bring nuance to the 'nature of space' theme, and included social nature of the space, public vs. private spaces, and physical nature of the space. Themes are listed in order of prominence. It should be noted that the 'nature of the space theme' encompasses a broad set of results, and this influences its ranking.

### 1. *Nature of the Space*

Under this theme, we chose to code any mention of what makes a space good or bad for cooling off. Given the broad nature of this theme, it was divided into more specific sub-themes exploring the social and physical nature of the space, as well as what influence public vs. private ownership has on the decision to use a place as a cooling centre.

#### 1.1. *Public vs Private Spaces*

Coded under the 'public vs. private spaces' theme were any mentions of the nature of a preferred cooling space that related to whether the space was publicly owned or privately owned. Many feelings of stigma around using public spaces became apparent here. Overwhelmingly, participants said that they wanted to be able to do an activity while they cooled down - be it eating at a restaurant, reading a book, or surfing the web. At the same time, people identified cost as a barrier - they perhaps wanted to occupy a private space with activities, but were unable to for fear of being asked to leave if they did not buy anything. To some individuals, paying to be at a private cooling location - a restaurant, a cafe, or similar - was preferable to being at a free cooling location. The idea behind this opinion comes from feelings of discomfort and not belonging when spending a greater amount of time than normal at a formal cooling

centre. People feel like they can't spend all day someplace unless they pay money to be there, and feel more comfortable in areas they pay to access.

### *1.2. Physical nature of the space*

Coded under this theme were mentions of what physically characterized a space that makes it a preferred cooling centre. Physically, people indicated they generally sought out spaces with air conditioning, and a place to fill up a water bottle or drink some water. If they were not seeking out indoor spaces, they were generally seeking out shaded parks. Trees and greenspace were mentioned multiple times as being ideal and desirable - two of the informal cooling centres most often cited, and that had the most pins in our mapping activity, were Beasley and McLaren Parks. These parks comprise some of the sparse greenspace in the neighbourhood. Further, people reported travelling even further outside their neighbourhood in the heat, going to Bayfront Park, Cootes Paradise, or dog parks further south or north (see Figure 1).

### *1.3. Social Nature of the Space*

Coded under this theme were comments on how people felt they fit into a space from a social standpoint, social stigmas around a space, and the social activities they can participate in when they occupy a particular space. Different participants had different social desires when cooling off - some wanted lots of interaction with other people, and some preferred quieter, less socially stimulating spaces. Some participants also indicated they felt social stigma in certain spaces - people with children often indicated they felt bad bringing in their kids, and worried their kids would be disruptive or affect others enjoyment of the space.

## *2. Health*

Coded under the 'health' theme were any mentions of how extreme heat affects participants' physical or mental health. Participants said in extreme heat events, they often felt sluggish, or less capable of completing tasks. Some said heat affected their capacity to sleep. In other cases, participants called back to times they had been severely affected by heat, and how this has influenced their reactions to heat now. Often, people developed very specific responses

to heat in order to keep their bodies cool. The most prominent strategy was an intentional increase in the amount of water they consume. Some participants noted that they have a high heat tolerance.

### 3. *Water*

People identified water for recreation use as a major factor in deciding where they chose to cool off. It was significant enough that it was assigned its own theme. Responses were rooted in the ways water was used to cool off. From bathing in public pools, which links deeply to our theme of public vs private, to preference for parks with splash pads and a beach to swim at, water emerged as integral to the way people cool off.

### 4. *Daily Tasks*

Coded under the 'daily tasks' theme were any mentions of the way in which people's execution of their daily tasks is affected by extreme heat. Daily tasks were most commonly impacted negatively, with respondents reporting an increase in lethargy, low energy, and impacted mobility outside. Several respondents reported having difficulties travelling throughout their day, especially if using public transportation and having to wait for the bus outside or cycling outdoors. The capacity to go about daily living extended beyond the workday, with several accounts of being impacted by heat late into the night as well.

### 5. *Knowledge*

Coded under the 'knowledge' node were mentions of people knowing (or not knowing) where they could cool off. People's mental map of the places they can go is complex and nuanced, and was encompassed under this theme. People often did not know where official cooling centres were located. Participants' chosen cooling centres ranged from one or two spots near home they chose to use to cool down and a system of cool spaces ranging across large areas.

The mapping exercise served to supplement the qualitative data gathered through interviews, and showed physically where people choose to cool down. Results from the mapping exercise helped visualize and provide context for the interviews, and mapped alongside them were the official cooling centres, retrieved from the City of Hamilton's 2019 Heat Emergency response website. This is seen in Fig. 1, along with an interactive version created in ArcGIS Online (<https://arcg.is/1aKian0>).

## Discussion

From our research, we were able to identify physical and social characteristics that make a space more or less desirable as a cooling centre. Often, City of Hamilton official cooling centres lack these characteristics, and often have characteristics participants identified as negative. Given that heat was identified as having a huge impact on health by participants, as well as in the broader literature, cooling centres are vital to the health and resilience of a community. Given that there is little overlap between desirable characteristics of cooling centers and the cooling centres provided by the City of Hamilton, and cooling is so imperative to health, we assert that the City of Hamilton could be more effectively allocating resources regarding extreme heat.

### **Characteristics of desired cooling centres**

Participants in the study identified a number of characteristics that made an informal cooling centre desirable. First, the opportunity to engage in some sort of activity is something that patrons valued, and was a significant contributing factor to whether or not they frequented a space. Participants widely cited the Hamilton Public Library (Central Branch) as a preferred place to cool off because they could participate in activities, access the internet, and cool off at the same time. It should be noted that although the library is an excellent space, this did not cater to the needs of all residents. In a similar vein, opportunity for social interaction was mentioned multiple times in several interviews. Participants tended to seek out opportunities for either increased or decreased social interaction, depending on their preference. For example, Hamilton City Centre (Jackson Square) was one of the most popular *informal* cooling centres and many respondents cited its social environment as that reason - talking to and being around groups of people was one of the most cited factors for using one cooling centre over another.

Social stigma was also an important theme discussed by participants. The feeling of social 'belonging' when visiting a space was extremely important to people, and served as the basis for our social nature of the space theme. Though social nature of the space was a significant theme, physical nature of the space was equally as prominent. Physical attributes of the space, and their capacity to cool people down were significant factors in deciding what spaces participants used as well. These include things such as air conditioning, water for recreation, such as splash pads and pools, and greenery and shade.

### **Characteristics of undesired cooling centres**

Though informal and formal cooling centres help some residents, no one place met everyone's needs. Through the interview process, we were also able to collect data on what makes a space less appealing as a cooling centre. Social characteristics, coded under the *social nature of the space* theme, were prominent - for example, the Hamilton Public Library is one of the most used formal cooling centres, but in terms of social characteristics, is a very specific environment that only appeals to a certain demographic. Some respondents described how the environment at the library isn't welcoming towards their young children, or their dogs, and how that is one of the greatest deciding factors in what cooling locations they choose to use. Participants indicated that there are also other factors which may drive them away from a cooling centre - social stigma attached to being seen in certain places, such as shelters, influenced decisions, as did cost barriers and a perceived 'right' to the space.

### **Informal vs Formal Cooling Centres**

The question remains, how do informal and formal cooling centres compare? Figure 1 depicts the locations of informal vs formal cooling centres, and although they are very near one another, the distance between them is much more than one or two blocks. Our results showed that the most used cooling centres were the two parks (Beasley Park, McLaren Park) and the Hamilton Public Library. These places were only treated as official cooling centres during City business hours - 9 am to 5 pm, Monday to Friday. Those times are helpful during the day, but do not service the actual needs of the people who responded to our project. Having someplace to go outside those hours (i.e. evenings), and during the weekends, is critical. We found that the issue was in the home, and not in the workplace or workday, which is when most of our

respondents (all over 18) expressed a need for cooling centres. Cooling centres from the City of Hamilton do not fulfill this gap in people's needs.

### **Implications for health**

From the literature, it is obvious that heat affects health. This was reflected in our interviews. Participants emphasised their experiences of adverse health effects in the heat, exacerbated by it being necessary to leave their overheated homes. Participants vividly recounted how heat had previously affected their health, cementing it as a significant event in their personal history. Given that the effects of heat on health, particularly on vulnerable communities, are so well documented, it is obvious that cooling people down is essential to grow resilient, healthy communities. The current approach is not addressing the needs of the community, and this is having effects of health. There has been at least one documented death as a result of extreme heat in Hamilton (Huang, 2013), but it should be noted that Ontario has a very narrow definition for heat-related death, and this number is likely much higher (Shihpar, 2018). Hamilton, and particularly Beasley, have high numbers of emergency room visits and ambulance calls. Cooling people down more effectively could have a positive effect on the health of the community, as well as expenditures the City of Hamilton must make on cooling and healthcare.

### **Call to action**

The health of Beasley residents is negatively affected by insufficient formal cooling centres in Hamilton. Multiple accounts of disrupted daily living routines, lowered productivity, and actual mortality (Thompson and Thompson, 2014) come together to illustrate just how harmful heat emergencies are for the Beasley community. It is clear that the official response and response plan (City of Hamilton, 2019) do not meet the needs of the community. Our recommendations are to review and revise the existing protocol to better meet the concerns we have outlined. As well, we recommend including the voices of Beasley and, by extension, the city of Hamilton, in the creation of future public emergency response policy. Many of the gaps in the service could be relieved if public input and consultation was implemented more thoroughly, with the community determining locations, hours, and nature of the service. Having the community figure out the best way to ensure their own health aligns with Hamilton's own vision and priorities.

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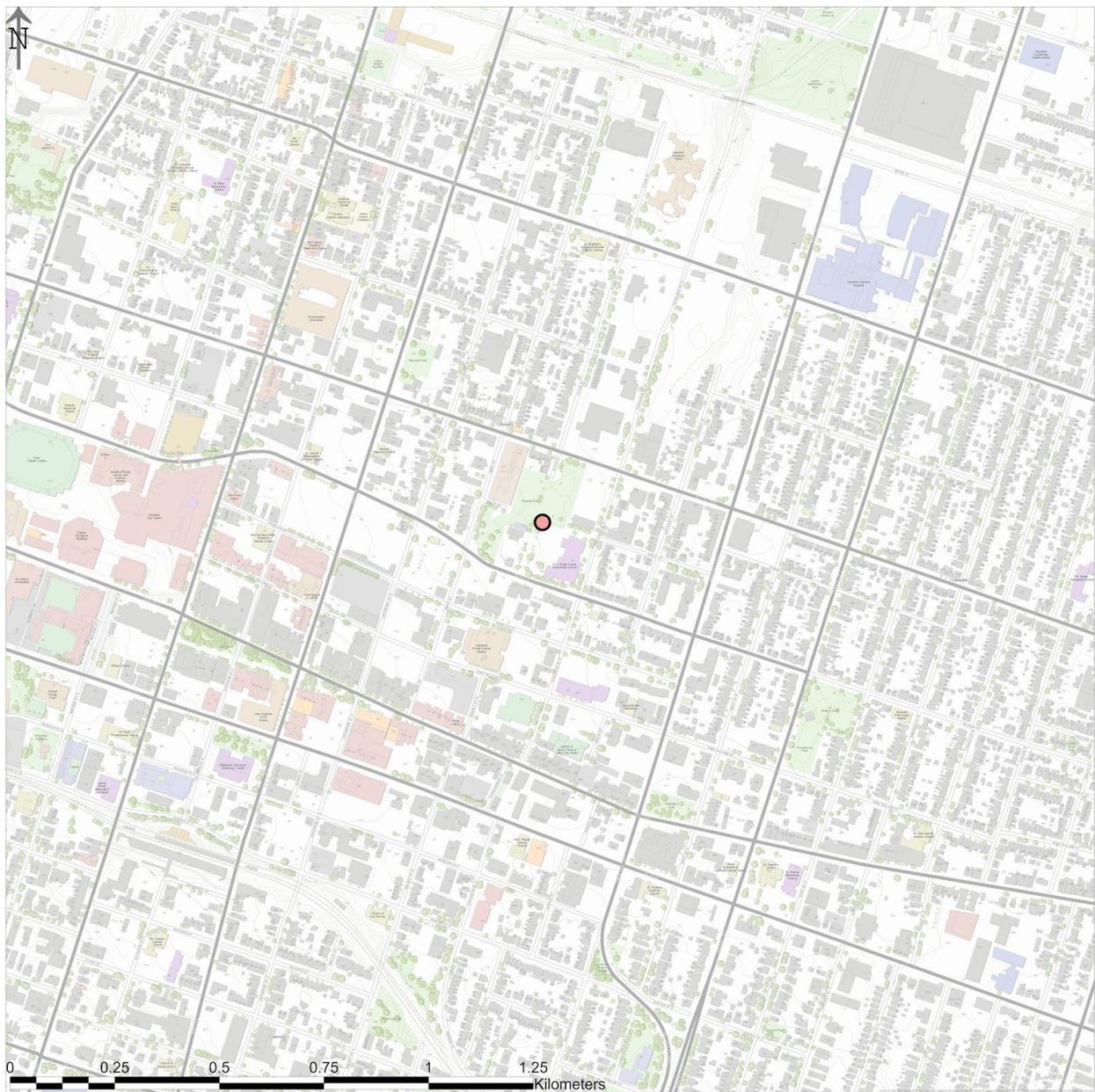


Figure 2: Map depicting Beasley Neighbourhood. This is the image used in our public mapping activity. The geographic boundaries of Beasley, of James St to the east, Wellington St to the west, Main St to the south and the Canadian National Railway to the north. Centre point is Beasley Neighbourhood Community Centre and Beasley Park, the informal centre of Beasley.

## Appendix A

### **Interview Questions:**

1. Do you experience extreme heat waves or heat emergencies in your home?
2. What does extreme heat wave or heat emergency mean to you?
3. How do heat emergencies affect your capacity to go about your daily life?
4. What strategies do you use to cope with heat emergencies? Do you go to cooler places?
5. How do you feel about the places you go to cool down?
6. What are characteristics of places you go to cool down that you like?
7. What events characterize your experiences during these heat waves?
8. Are there any important questions we forgot to ask, or anything you would like to add?