

**Human Heat Vulnerability and Strategies for Coping with Heat in Winnipeg,
Manitoba**

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Executive Summary

While Winnipeg is known for its frigid winter temperatures, heatwaves are becoming more dangerous for all Canadian cities. The purpose of this research was to assess whether the literature showing that certain demographic groups are more vulnerable to heat applies to Winnipeg. As cities manage the local impacts of climate change, it is important to understand which neighbourhoods and demographic groups are at higher risk from heat. Cities can then make policy decisions to protect the most vulnerable. This research used data from the 2021 Canadian Census of Population and an online survey to investigate heat vulnerability and coping strategies in four Winnipeg neighbourhoods: River Heights, South St. Vital, Downtown, and the North End. The census data analysis showed that lower income neighbourhoods have higher concentrations of some demographic groups identified as more vulnerable in the literature (e.g. renters, Indigenous people, people living in unacceptable housing). However, income is not the only factor involved, as there are differences between neighbourhoods of similar incomes. The survey results demonstrated a connection between access to air conditioning and the use of additional coping strategies, which is related to income, dwelling type, and age of construction. The survey results also suggest that, in Winnipeg, higher-risk groups may include renters, people living in apartment buildings, LGBTQ+ people, and Indigenous people, while moderate-risk groups may include young adults and people who are disabled or chronically ill. Respondents made policy suggestions for the City of Winnipeg, including enhancing the urban tree canopy, offering more public locations for cooling and access to drinking water, and subsidizing the cost of air conditioning. This research shows that there is no silver bullet for addressing heat vulnerability. Planners must respect the complex, intersecting factors that produce vulnerability and work to reduce inequity to protect those who are most at-risk.

1.0 Introduction

Climate change is rapidly altering global temperatures, leading to more frequent and extreme heatwaves. As cities continue to warm, existing discrepancies in temperature between high and low areas of heat vulnerability will only intensify. Current research demonstrates that individuals belonging to marginalized communities are more likely to live in neighbourhoods experiencing more heat. This project investigates whether these patterns apply to four Winnipeg neighbourhoods. This research is important because, by determining which neighbourhoods are more vulnerable to extreme heat and understanding existing coping strategies, the City of Winnipeg can develop policies targeting these areas to help protect Winnipeggers from the effects of climate change.

This research uses a combination of census data analysis and surveys to answer the following questions:

1. What are the demographics and housing types and quality in areas of Winnipeg with more exposure to heat and in areas with less exposure to heat?
2. What strategies do people living in areas of Winnipeg with different levels of heat exposure use to cope with heat?
3. What are the implications of this research for climate-informed planning in Winnipeg?

The structure of this report is as follows. First, I provide an overview of the methods used. This begins with a description of how the four study neighbourhoods - River Heights, South St. Vital, Downtown, and the North End - were selected. The methods section also includes a description of how data from the 2021 Canadian Census of Population was collected and analyzed, as well as the process for recruiting participants for the online survey. The section concludes with a description of the limitations of this research.

Next, I review the literature informing this project. This begins with a discussion of environmental justice as a guiding concept for this work. The review then explores the literature on heat equity and how certain demographics are more vulnerable to heat than others. Kemen et al.'s (2021) three types of heat-related coping strategies are introduced as a framework for classifying coping strategies. The literature review concludes with the implications of heat inequity for planners and the role planners can play in finding solutions.

The results of the research are broken down into two sections, presenting the census data and survey results. In the census data analysis, the information is grouped by statistic and compared across the four neighbourhoods. This comparison starts with income, followed by housing characteristics and personal demographic information. The survey results are organized by survey question, exploring the themes emerging from the data across the four study neighbourhoods. This includes both quantifying the number of responses in multiple choice questions, as well as summarizing the qualitative data.

In the discussion section, the census data and survey results are compared, looking for trends within and differences between neighbourhoods. This analysis is guided by the three research questions above and discusses how the results of this research answer those questions. Survey results are also cross tabulated to compare coping strategies across demographic groups and among people with different housing types and tenures. This section also highlights how the results of this research compare to claims made in the literature, as well as policy suggestions for the City of Winnipeg brought forward by survey respondents. This is followed by a brief conclusion describing the key findings and takeaways from this research.

2.0 Methods

2.1 Overview and Neighbourhood Selection

This research was undertaken using two methods - census data analysis and an online survey - to study the demographics and heat-related coping strategies of four Winnipeg neighbourhoods. I began by referencing a map of Winnipeg sourced online which tracked relative temperatures in July 2017. This map is based on data from the City of Winnipeg Urban Forestry Strategy. In ArcGIS, I overlaid Statistics Canada census tracts onto this heat data to visually assess areas of Winnipeg experiencing cooler or warmer average temperatures (see Figure 1). I then referenced data from the 2021 Canadian Census of Population to compare the median total (before-tax) income in the census tracts within these areas to the median for the City of Winnipeg. Higher income areas were defined as those above the City of Winnipeg median total income, and lower income areas as those below the City of Winnipeg median total income. Using this information, I selected four study neighbourhoods with the following characteristics:

- 1) Higher Temperatures & Higher incomes: South St. Vital
- 2) Higher Temperatures & Lower Incomes: Downtown
- 3) Lower Temperatures & Lower Incomes: North End
- 4) Lower Temperatures & Higher Incomes: River Heights

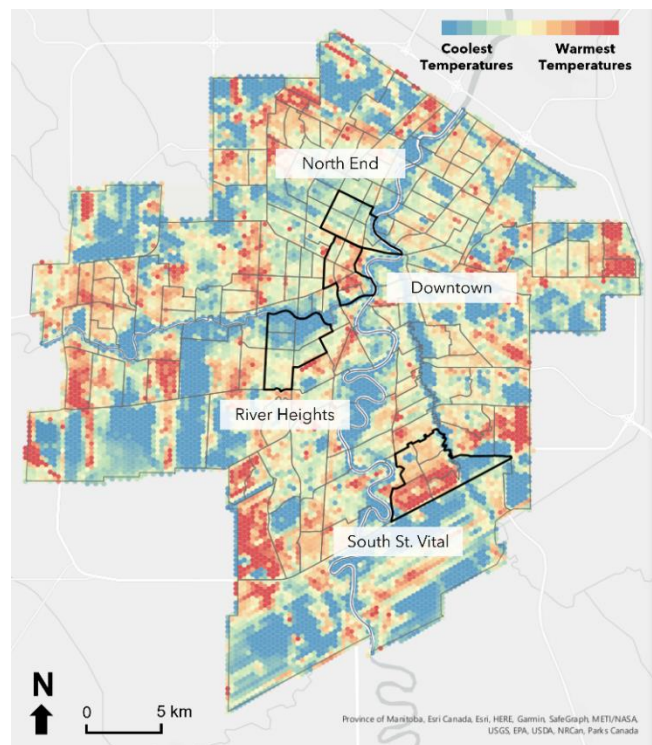


Figure 1: Selected Study Neighbourhoods

2.2 Census Data Analysis

For the census data analysis portion of this research, census tracts were selected that approximately aligned with the boundaries of each neighbourhood. A total of 22 census tracts were included: six from Downtown, six from the North End, five from South St. Vital, and five from River Heights. Data collected for each census tract from the 2021 Canadian Census of Population included:

- Total population, population change (2016-2021), and population density
- Gender
- Age
- Dwelling type and age of construction
- Household tenure and size
- Income
- Indigenous identity
- Racialized identity
- Citizenship status and immigration history
- Dwelling condition and core housing need
- Highest level of education achieved
- Employment and participation rates
- Main mode of commuting

See Appendix B for a complete list of metrics included in the census data analysis. The census data was analyzed by taking the mean values across all census tracts of each neighbourhood and comparing these values across the four neighbourhoods. The collection of this data is appropriate for the research questions of this project because of existing research showing that certain demographics are more vulnerable to extreme heat, as is explored more fully in the literature review in Section 3 of this report.

2.3 Online Survey

I created an online survey using Google Forms to hear from people living in the four study neighbourhoods about the impacts of heat on their lives and the coping strategies they may implement. The survey began with an informed consent process and asked participants to confirm that they: understood the details of the consent form, were at least 18 years old, and agreed to participate in the study. This was followed by two screening questions, which asked participants to confirm, using the maps provided (see Figure 2), that they lived within one of the four study neighbourhoods and that they have lived in that neighbourhood for more than one summer.

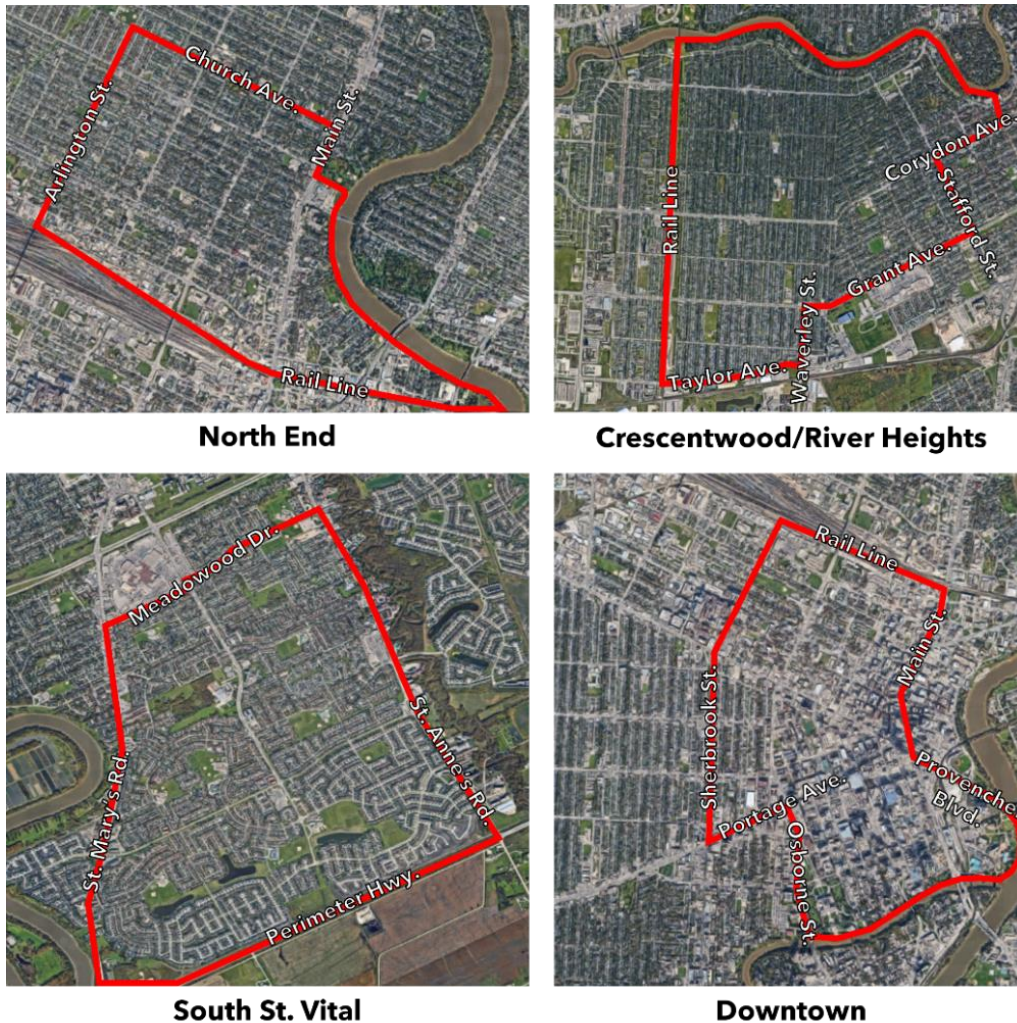


Figure 2: Boundaries for Survey Inclusion Criteria

The main portion of the survey asked participants ten questions about access to air conditioning, heat-related coping strategies, whether they feel that heat is a health risk for themselves or someone they know, and their ideas of what the City of Winnipeg could do to help mitigate heat in their neighbourhood. See Appendix A for the complete survey. The survey concluded with several demographic questions to better understand the participants. These survey questions are supported by findings in the existing literature about the types of coping strategies commonly used in different contexts (Kemen et al., 2021). These connections are outlined in detail in the literature review below.

The survey was distributed by contacting the provincial elected representatives (Members of the Legislative Assembly, or “MLAs”) in each neighbourhood, as well as local community organizations and Facebook groups. Table 1 shows all organizations and elected officials who helped facilitate the dissemination of the survey.

Table 1: Individuals and Groups Who Distributed Survey

River Heights	MLA Dr. Jon Gerrard
South St. Vital	“River Park South and Lovin’ It” Facebook Group
Downtown	MLA Uzoma Asagwara Spence Neighbourhood Association University of Winnipeg Wesmen
North End	MLA Bernadette Smith William Whyte Neighbourhood Association North End Women’s Centre

The surveys were analyzed using an inductive coding approach for all qualitative data. Codes were established by reviewing the survey comments and sorting them thematically into appropriate categories. Data from multiple choice questions was analyzed based on counting the number of responses. This

methodology reflects the frequent use of surveys in the literature to understand heat-related coping strategies.

2.4 Limitations

This research and its applications are limited in a few ways. First, survey recruitment was not equally successful across all four neighbourhoods. The goal of the study was to collect 10 to 15 responses per neighbourhood, so that a range of perspectives could be included while maintaining a feasible sample size for the scope of this project. This was exceeded in River Heights and South St. Vital. Recruitment from Downtown was within this range, but recruitment from the North End did not meet this goal. Similar methods were used to recruit from each neighbourhood. This difference in outcomes could mean that people in different neighbourhoods have different levels of interest in research surveys, or different priorities that might make surveys less or more appealing.

The demographics of the survey respondents also do not reflect the demographics of their entire neighbourhoods, as explored in the census data analysis. This, alongside the small sample size, means that these surveys should not be taken as representative of the views or experiences of their entire neighbourhoods. However, this data does demonstrate general trends in each neighbourhood and provides important anecdotal information about how respondents are coping with heat.

Neighbourhood boundaries are defined differently by different groups, organizations, and even individuals within communities. These social boundaries do not necessarily align with statistical or administrative boundaries, such as census tracts. As a result, the areas under consideration in the census data analysis and survey portions of this research are very similar, but not identical. The census data also shows that neighbourhoods are not homogenous and can have pockets of very different demographics or housing types. As a result, generalizing and taking averages across neighbourhoods minimizes this intra-neighbourhood diversity.

Lastly, this research regarding the impacts of extreme heat was conducted during the winter. It is possible that, with the passage of time, respondents' memories of any challenges they faced because of heat may have faded. They may also be facing different challenges during the winter, which feel more intense because they are currently happening. People in Winnipeg also tend to romanticize whatever season it is not currently - in the summer people wish for winter and in the winter people wish for summer. It would be beneficial for future researchers to repeat this study during the summer, in order to understand if people's perceptions of their own heat vulnerability are different during summer compared to winter.

3.0 Literature Review

It is well-established in the literature that climate change is increasing global temperatures, as well as the frequency and intensity of extreme heat events around the world (IPCC, 2018; Prairie Climate Centre, 2019; Singer et al., 2016; Hammer et al., 2020; Kaswan, 2012). Extreme heat leads to disastrous human health outcomes (Klinenberg, 2002; IPCC, 2007; Meerow & Keith, 2022; Shandas et al., 2020), which are expected to worsen with further increases in global temperature. As the urgency surrounding climate change has intensified since the beginning of the twenty-first century, researchers have studied both the physical and social conditions that influence how extreme heat events are experienced by different populations.

This literature review explores the strengths, weaknesses, and gaps associated with key areas of literature in relation to heat vulnerability and related coping strategies. The review is structured as follows. First, it examines the literature on environmental justice, which lays the foundation for the more specific literatures on heat equity and coping strategies for heat. This is followed by a brief discussion about planning for extreme heat and some concluding comments. This review demonstrates the importance of understanding the conditions that impact individual vulnerability to heat on a local scale, so that resources for heat mitigation and adaptation can be distributed equitably.

3.1 Environmental Justice

In reviewing the literature on heat vulnerability and related coping strategies, a central tenet of these issues is environmental justice. The environmental justice literature “documents the unequal burdens of environmental hazards on marginalized populations” (Harlan et al., 2006, p. 2849). The study of environmental justice began with a focus on the location of hazardous materials (Harlan et al., 2006; Welz et al., 2014), but has since expanded to include broader environmental impacts, including climate change (Schosberg & Collins, 2014; Voelkel et al., 2018). This literature acknowledges that marginalized populations are most vulnerable to the effects of climate change, despite contributing to it the least. Scholars also argue that countries that have historically contributed most to climate change should bear the fiscal burden of dealing with the consequences and protecting those who are most harmed (Ikeme, 2003).

Existing research has extensively explored the link between vulnerability to heat and various socio-demographic characteristics (Bednar et al., 2017; Burbidge et al., 2022; Harlan et al., 2006), but less research has been done on how to use this data to help those at risk. A beneficial framework emerging from this literature is Alice Kaswan’s (2012) seven principles for equitable adaptation, which are paraphrased as follows:

- 1) The role of government in implementing comprehensive adaptation initiatives, given the “likelihood that market forces will fail to adequately protect people from harm” (p. 43).
- 2) Designing adaptation measures so that they account for inequality and vulnerability.
- 3) Providing culturally sensitive communications and services to diverse populations.
- 4) Developing bottom-up participatory processes.

- 5) Reducing underlying non-climate environmental risks that can be exacerbated by climate change (e.g. improving inadequate storm water management).
- 6) Addressing adaptation/mitigation trade-offs (i.e. reducing situations where mitigation measures negatively impact adaptation and vice versa).
- 7) Building equitable adaptation into a comprehensive socioeconomic agenda that addresses the “underlying causes of vulnerability, including the structural inequalities that create and sustain poverty and constrain access to resources” (p. 46).

This framework has been used by scholars studying heat inequality in the United States (Heger, 2022). Future research could explore how the principles of equitable adaptation can be implemented in other countries experiencing increased extreme heat events.

In Canada and other settler colonial states, environmental justice must be viewed through the lens of Indigenous rights. This is because, as Tsosie (2007) argues, adaptation policies alone, without recognition of Indigenous Peoples’ right to self-determination, will ultimately be harmful for Indigenous Peoples, whose lands are already more vulnerable to climate change (Deen et al., 2021). Efforts to relocate Indigenous communities facing climate impacts mirror the historic dispossession of Indigenous lands by colonizers, so adaptive strategies are necessary to prevent the need for relocation (Tsosie, 2007). Similarly, adaptation measures focused on compensation for damages risk perpetuating the notion that the destruction of Indigenous lands due to climate change is a foregone conclusion, when there is still time to prevent this loss (Tsosie, 2007). The Indigenous land rights movement has been an integral part of the environmental justice discourse for decades (Schlosberg & Collins, 2014), but there is a gap in the research regarding heat justice for Indigenous communities. There is likely a connection between heat vulnerability and insufficient housing quality on-reserve that should be explored in the context of the environmental justice and heat equity literatures. More Canadian research is needed to investigate

how extreme heat is impacting both urban and rural Indigenous communities in Canada and to identify policy measures that address these impacts equitably.

3.2 Heat Equity

The danger associated with heat in urban environments is frequently attributed to the urban heat island effect. This is defined broadly as the phenomena whereby areas with dense buildings and pavement experience temperatures as much as several degrees warmer than areas that are predominately vegetation (Guardaro et al., 2022; Heger, 2022; Hintz et al., 2018; Kaswan, 2012; Kemen et al., 2021; Pasquini et al., 2020; Voelkel et al., 2018). While it seems intuitive that the concrete-intensive conditions that characterize many downtown environments would produce the most heat, not all scholars agree. Stone and Rodgers (2001) studied thermal efficiency in relation to housing density in Atlanta, Georgia and found that large, suburban housing parcels emitted more thermal energy per parcel than those in dense urban areas, because the suburban parcels had more lawn than tree cover. This demonstrates the importance of tree canopy and that lawns alone do little to reduce the heat island effect.

While the scientific explanation for the heat island effect is clearly understood, it is important to note that the distribution of heat islands in cities is not equal. The literature shows that certain socio-demographic factors increase vulnerability to heat, including age (Pasquini et al., 2020), gender (Zander et al., 2019), disability (Shonkoff et al., 2011; Wolbring, 2009), race (O'Neill et al., 2005), and income (Bednar et al., 2017; Berger et al., 2022; Harlan et al., 2006). These vulnerabilities are compounded by historic policy decisions that have produced vulnerability within certain groups. For example, in Portland, larger trees have historically been planted in higher income neighbourhoods (Voelkel et al., 2018). Access to greenspace in low-income neighbourhoods is similarly scarce in some North American and European cities (Sanchez, 2019; Burbidge et al., 2022).

Historic housing discrimination, particularly in the United States context, has segregated Black, Indigenous, and People of Colour (BIPOC) communities to the inner

city, where the urban heat island effect tends to be stronger (Shonkoff et al., 2011; Heger, 2022), though as previously established this is not always the case (Stone & Rodgers, 2001). The common factor for many who are more vulnerable – regardless of intersecting factors like age, ability, or race – is income. Specifically, the lack of agency over housing choice for low-income individuals makes them increasingly vulnerable to heat, as the housing they can afford is typically of poorer quality (Bednar et al., 2017; Berger et al., 2022; Hlahla & Hill, 2018; Pasquini et al., 2020; Pham et al., 2012; Voelkel et al., 2018).

Low-income individuals have access to fewer resources, reducing their adaptive capacity, or ability to personally adapt to the effects of climate change in their lives (Ford & Berrang-Ford, 2011; Guardaro et al., 2022; Hammer et al., 2020; Pasquini et al., 2020; Schlosberg & Collins, 2014; Singer et al., 2016; Voelkel et al., 2018). For these reasons, those experiencing poverty or homelessness are often considered the most vulnerable to extreme heat. Guardaro et al. (2022) noted that this forced exposure to heat can generate unique forms of adaptive capacity that have not been formally recognized. This is not a desirable outcome and should not be promoted over taking steps to reduce these systemic vulnerabilities. Researchers may, however, be able to learn from the measures that vulnerable groups have taken to protect themselves, so that policy makers can incorporate local knowledge instead of imposing external best practices.

3.3 Coping Strategies

Scholars define heat vulnerability as the combination of heat exposure, personal sensitivity, and adaptive capacity (Guardaro et al., 2022; Pasquini et al., 2020; Voelkel et al., 2018). The intersection of these factors influences how different individuals cope with heat. This review explores research conducted across several countries to study heat-related coping strategies, including in India, Austria, the U.S.A., South Africa, Germany, Tanzania, Indonesia, Malaysia, the Philippines, and Australia (Berger et al., 2022; Guardaro et al., 2022; Hlahla & Hill, 2018; Kemen et al., 2021; Pasquini et al.,

2020; Zander et al., 2019; Zander et al., 2021). Interviews and surveys were common methods in this literature. This diverse body of literature provides broad perspectives on coping strategies used in different contexts. Notably, the Canadian context is missing from this literature.

Kemen et al. (2021) divided coping strategies into three categories: body-related strategies, home-protective strategies, and activity-related strategies. Body-related strategies include wearing thinner clothing, drinking more fluids, frequent baths or showers, cooling arms or feet with water, and using wet towels. These strategies were found to be common among participants in some studies (Pasquini et al., 2020; Zander et al., 2019; Hlahla & Hill, 2018), particularly the use of water as a cooling agent, which Kemen et al. (2012) found was more common among low-income groups due to a lack of access to other strategies.

Home-protective strategies include using blinds or shutters, opening windows for ventilation, using thinner bedding, and turning on a fan or air conditioning (Kemen et al., 2012). These strategies appeared in the literature in the form of fan use (Hlahla & Hill, 2018), designing buildings for better ventilation (Berger et al., 2022), the use of shutters or shades (Berger et al., 2022; Zander et al., 2021), and air conditioning (Harlan et al., 2006; Huang et al., 2011; Guardaro et al., 2022; Larsen et al., 2022; O'Neill et al., 2005; Sanchez, 2019; Voelkel et al., 2018; Zander et al., 2021). This body of research acknowledges the importance of air conditioning to protect vulnerable groups during extreme heat events. However, some scholars raise concerns about energy use and how using more air conditioning may worsen greenhouse gas (GHG) emissions and, in turn, climate change (Berger et al., 2022; Heger, 2022; Kaswan, 2012; Larsen et al., 2022). Air conditioning will inevitably increase in global popularity as climate change worsens. Related GHG impacts can be mitigated by using renewable energy sources (Larsen et al., 2022) and by reducing the need for air conditioning using green roofs (Sanchez, 2019) or positioning trees relative to buildings to maximize energy savings (Huang et al., 2011).

The last of Kemen et al.'s (2021) three categories is activity-related coping strategies, which focuses on behavioural changes such as reducing and rescheduling physical activities. Staying inside more was a common coping strategy in some studies (Zander et al., 2021; Guardaro et al., 2022; Hlahla & Hill, 2018). In other contexts, people preferred to leave home to go to air-conditioned public facilities (Huang et al., 2011) or spend time outside, including sleeping outdoors (Harlan et al., 2006; Pasquini et al., 2020). Staying outdoors at night creates risk for some, including personal safety from crime and, in some regions, health risks from bug bites (Pasquini et al., 2020; Harlan et al., 2006). While Kemen et al. (2021) compares experiences of heat strain in higher and lower income areas of Cologne, Germany, it would be beneficial for more researchers globally to investigate how these three categories of coping strategies are used across groups of different income levels.

3.4 Planning for Extreme Heat

As cities work to mitigate and adapt to the impacts of extreme heat, planners have an important role to play. Planning has historically contributed to some of the inequities that make marginalized groups more vulnerable to heat (Meerow & Keith, 2022; Burbidge et al., 2022; Voelkel et al., 2018). For example, the patterns established through the practice of red lining - which excluded BIPOC people from home ownership in parts of many U.S. cities - continue to correlate with higher heat island effects (Meerow & Keith, 2022). Planners thus have a responsibility to contribute to developing equitable heat adaptation policies that protect the most vulnerable.

Planners have contributed to the extreme heat literature through the collection of data on land surface temperatures and mapping or modeling this data (Hammer et al., 2020; Deen et al., 2021; Huang et al., 2011; Bednar et al., 2017; Pham et al., 2012; Sanchez, 2019; Burbidge et al., 2022; Grossman-Clarke et al., 2010; Steinberg & Sprigg, 2016). This quantitative data is beneficial but lacks analysis of the reasons behind certain temperature patterns. Meerow and Keith (2022) attempted to address this gap by surveying U.S. planners about their perspectives on heat planning issues.

They found that planners face several barriers to conducting heat planning, including lack of funding, higher priority issues, lack of leadership, lack of public support, lack of expertise and knowledge, and a lack of coordination across jurisdictions (Meerow & Keith, 2022). While it is helpful to understand these barriers, these issues are generalizable to all policy issues and do not provide direction on how to make heat a planning priority.

Planners have experience with developing participatory solutions (Heger, 2022), which is a key part of implementing measures for equitable adaptation (Kaswan, 2012). It is important for planners to identify who has historically been left out of planning processes so that their interests can be included in heat planning initiatives (Singer et al., 2016). In municipal planning documents to date, heat planning is more likely to be considered as part of a hazard plan or climate plan, as opposed to general development plans (Turner et al., 2022; Meerow & Keith, 2022). This illustrates a research gap that needs to be addressed on how to integrate heat planning into urban planning more broadly. Planners should continue to work to bridge these related fields of research.

This literature review revealed that the urban heat island effect is not felt equally by all people. Those with lower incomes are more likely to be at risk from extreme heat, even more so for those with other intersecting vulnerabilities, including seniors, people of colour, and those with chronic illnesses or disabilities. The literature suggests that vulnerable people have differing access to coping strategies and use different means to cope than those with more resources, which is closely linked to issues of environmental justice. This literature is strengthened by its geographic diversity but is lacking work done in the Canadian context. Studying heat equity in Canada is important because Canadian cities are projected to experience an increasing number of extreme heat events (Prairie Climate Centre, 2019). Planners are implicated in these questions of equity, as planning has historically contributed to social inequities and planners have the power to make equitable policy and design decisions for the future.

The theoretical basis for this project is supported by the literature analyzed in this review. Research has clearly shown that marginalized groups are more likely to experience heat vulnerability, but this has not yet been investigated in many Canadian cities, including Winnipeg. The mixed-methods approach of this project also addresses the disconnect between data-based research and policy-based research identified in this review. The project will contribute to the growing body of heat vulnerability literature by evaluating whether demographic trends identified in other cities apply to Winnipeg, as well as documenting coping strategies used in the Winnipeg context. This literature review demonstrates that this research topic is of urgent importance as climate change progresses and is relevant for modern planning practice.

4.0 Results

The following section presents the results of the two research methods (census data analysis and surveys) separately, comparing data across the four study neighbourhoods: River Heights, South St. Vital, Downtown, and the North End.

4.1 Neighbourhood Census Data Comparison

Each neighbourhood is comprised of multiple census tracts (five in River Heights, five in South St. Vital, six in Downtown, and six in the North End). The following results show, in many cases, the average statistic for a neighbourhood (i.e. the mean value of all of its census tracts). Large amounts of variation within a single neighbourhood are highlighted as needed. See Appendix B for the complete set of data used in this analysis.

4.1.1 Income

Comparing the median total incomes of neighbourhoods across Winnipeg was an early step in determining the four study neighbourhoods of this project. In 2020, the median total before-tax income of the City of Winnipeg was \$39,600. Study neighbourhoods were selected that had incomes notably above or below this city-

wide average. Table 2 shows the median total incomes of each neighbourhood in comparison to the City of Winnipeg.

Table 2: Median Total Incomes in 2020

Winnipeg	River Heights	South St. Vital	Downtown	North End
\$39,600	\$54,240	\$47,440	\$30,033	\$28,367

The 2021 Canadian Census of Population tracked the number of individuals who received COVID-19 financial assistance from the federal government. This provides a view of the number of people who may have been struggling financially during the pandemic in each neighbourhood. This is not a perfect measure, as the inclusion criteria for these benefits was wide enough that people who were less in need of financial assistance could still access some benefits. I have standardized this data by converting all values into the percentage of the total population and taken the mean value across each neighbourhood (see Table 3). The data shows that individuals living in neighbourhoods with a lower median total income were more likely to have accessed COVID-19 government benefits.

Table 3: Percentage of People Who Received COVID-19 Government Financial Assistance

Winnipeg	River Heights	South St. Vital	Downtown	North End
21.45%	17.56%	17.32%	27.33%	29.29%

Statistics Canada defines the low-income cut-off, after tax (LICO-AT) as an income threshold below which individuals would likely have devoted a larger than average share of their after-tax income to the necessities of food, shelter, and clothing. The data on the prevalence of low income is separated by age (0-17, 18-64, and 65+) and compared across neighbourhoods in Table 4. There is a large difference between lower and higher income neighbourhoods in these statistics.

Table 4: Percentage of People Below Low-Income Cut-Off, After Tax (LICO-AT)

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Age 0-17	9.60%	4.76%	4.16%	27.33%	22.30%
Age 18-64	9.10%	5.22%	3.38%	24.93%	21.23%
Age 65+	4.10%%	2.60%	1.85%	15.50%	14.53%

4.1.2 Dwelling Type and Household Size

Dwelling type varies widely across the four neighbourhoods (see Table 5). Single-detached houses are most common in River Heights and least common in Downtown. Smaller apartments are most common in Downtown and the North End and taller apartments are most common in Downtown. To summarize the large amounts of data for 22 census tracts, proportions of each dwelling type are presented as the mean value among census tracts for that neighbourhood.

There is a notable amount of variation of dwelling types between census tracts within each neighbourhood. For example, the proportion of single-detached houses in River Heights ranges from 49.8% to 99.2% in different census tracts. Another example is the proportion of dwellings in apartment buildings five or more storeys tall, ranging from 17.8% to 87.3%. This makes sense because different housing types may be clustered in certain areas of a neighbourhood. While the mean values in Table 5 cannot reflect this variation within neighbourhoods, it still shows a large amount of variation between neighbourhoods.

Table 5: Dwelling Types

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Single-detached house	57.51%	77.98%	68.78%	9.92%	44.11%
Semi-detached house	4.00%	0.79%	3.61%	1.38%	5.65%
Row house	3.89%	0.13%	16.58%	1.54%	4.48%
Duplex	1.84%	2.67%	N/A	3.06%	11.26%
Apartment building fewer than 5 storeys	18.78%	8.76%	16.97%	26.47%	21.23%
Apartment building 5+ storeys	13.67%	9.66%	4.29%	57.44%	12.56%
Other single-attached house	0.09%	N/A	N/A	0.19%	0.73%
Movable dwelling	0.22%	N/A	3.03%	N/A	N/A

The average household size in the City of Winnipeg is 2.5 persons. Taking the mean values of all census tracts within each neighbourhood, this value is 2.4 persons in River Heights, 2.6 persons in South St. Vital, 2.0 persons Downtown, and 2.5 persons in the North End.

4.1.3 Household Tenure and Rooms per Dwelling

The proportion of household tenures (owners versus renters) is markedly different between the higher income and lower income neighbourhoods (see Table 6). River Heights and South St. Vital are communities of predominately homeowners, while Downtown and the North End have predominately renters. The North End is the most evenly distributed for household tenure, with approximately one third owners and two thirds renters, while the other neighbourhoods are all more heavily weighted in one direction.

Table 6: Household Tenure

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Owner	63.10%	78.82%	88.43%	13.51%	37.54%
Renter	36.90%	21.18%	11.57%	86.49%	62.47%

Another interesting statistic is the average number of rooms per dwelling. This provides an indication of the average dwelling size in each neighbourhood. The City of Winnipeg average is 5.7 rooms per dwelling. Rooms per dwelling vary across the four study neighbourhoods, with 7.0 rooms in River Heights, 6.5 rooms in South St. Vital, 3.5 rooms in Downtown, and 5.0 rooms in the North End.

4.1.4 Age of Construction

Different neighbourhoods in Winnipeg were constructed at different times. The age of construction may impact the materials used, the quality of insulation, or other factors affecting how residents experience heat. Table 7 shows the mean values for age of construction across all census tracts in each neighbourhood. River Heights is the oldest neighbourhood, with 91.7% of dwellings constructed before 1981. South St. Vital has, on average, the most recent construction, with 50.7% of dwellings constructed between 1981 and 2000 and 35.6% of dwellings constructed in 2001 or later.

Table 7: Age of Construction

	Winnipeg	River Heights	South St. Vital	Downtown	North End
1960 or before	31.29%	78.75%	0.88%	37.08%	60.70%
1961 to 1980	30.76%	12.94%	12.87%	28.95%	19.96%
1981 to 1990	12.18%	2.99%	34.57%	12.55%	5.30%
1991 to 2000	6.33%	1.84%	16.08%	6.22%	4.79%
2001 to 2005	3.22%	0.64%	9.76%	1.55%	1.17%
2006 to 2010	4.01%	0.70%	8.22%	3.33%	2.69%
2011 to 2015	5.16%	0.65%	11.44%	4.28%	2.42%
2016 to 2021	7.04%	1.50%	6.19%	6.05%	2.97%

4.1.5 Acceptable Housing

Acceptable housing refers to whether a household meets each of the three indicator thresholds established by the Canada Mortgage and Housing Corporation for housing adequacy, suitability, and affordability. Adequate housing is reported by residents as not requiring any major repairs. Affordable housing has shelter costs equal to less than 30% of total before-tax household income. Suitable housing has enough bedrooms for the size and composition of the household. In the City of Winnipeg, 68.6% of dwellings meet all three thresholds to be deemed acceptable housing, while 31.4% do not. Table 8 shows how this city-wide average compares to

the four study neighbourhoods. South St. Vital has the highest rate of acceptable housing, while Downtown has the least.

Table 8: Rate of Acceptable Housing

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Acceptable housing	68.57%	75.87%	83.07%	51.21%	53.70%
Not acceptable housing	31.43%	24.13%	16.93%	48.79%	46.30%

4.1.6 Age and Gender

Age and gender data help provide a picture of the general population living in each neighbourhood (see Table 9). River Heights and South St. Vital are both slightly older than the average for the City of Winnipeg, while Downtown and the North End are both slightly younger. The North End has the largest proportion of its population aged 0 to 14, at 21.7%. Downtown has the largest proportion of the population that is aged 15 to 64, at 72.7%. River Heights has the largest proportion of the population that is aged 65 and older, at 20.1%.

Data on gender in the census is aggregated into “Men +” and “Women +”, which incorporates data from non-binary individuals. Statistics Canada says this protects the confidentiality of individuals where the number of responses would be very small. This is not a perfect solution for respecting gender identity, as it is still lumping people into a “male” or “female” category. All four neighbourhoods have a fairly equal split between Men + and Women +, with both River Heights and South St. Vital having slightly more Women + and both Downtown and the North End having slightly more Men +.

Table 9: Age and Gender Distribution

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Age 0-14	16.6%	14.4%	16.3%	15.8%	21.7%
Age 15-64	66.4%	65.5%	64.3%	72.7%	64.8%
Age 65+	17.0%	20.1%	19.4%	11.5%	13.4%
Average age	40.3	43.3	42.4	37.3	37.8
Median age	38.8	44.4	44.1	34.6	36.5
Men +	49.3%	47.8%	48.3%	53.0%	50.8%
Women +	50.8%	52.2%	51.7%	47.0%	49.2%

4.1.7 Indigenous Identity

Indigenous people in Winnipeg make up 12.1% of the total population, including people who identify as First Nations, Metis, Inuit, or multiple Indigenous identities. The proportion of people identifying as Indigenous in each of the four study neighbourhoods is as follows:

- River Heights: 5.8%
- South St. Vital: 8.3%
- Downtown: 17.5%
- North End: 40.6%

The proportion of people identifying as Indigenous is lower than the City of Winnipeg proportion in both River Heights and South St. Vital, slightly higher in Downtown, and substantially higher in the North End.

4.1.8 Citizenship

In the City of Winnipeg as a whole, 86.1% of people are Canadian citizens, while 13.9% are not. River Heights, South St. Vital, and the North End all have a higher proportion of people who are Canadian citizens, while Downtown has a much lower proportion (see Table 10).

Table 10: Rate of Canadian Citizenship

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Canadian citizens	86.13%	94.51%	91.98%	69.82%	90.48%
Not Canadian citizens	13.87%	5.49%	8.02%	30.17%	9.52%

4.1.9 Immigration History

In the City of Winnipeg, 28.45% of people are immigrants, while 71.55% of people are non-immigrants. River Heights, South St. Vital, and the North End all have a higher proportion of the population who are non-immigrants (Table 11). Downtown has the lowest percentage of non-immigrants and has had the most recent influx of immigration, with 25.43% of individuals living Downtown having immigrated since 2011. In the Canadian Census of Population, non-immigrants are defined as persons who are Canadian citizens by birth.

Table 11: Rate of Immigration Over Time

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Non-immigrant	71.55%	85.44%	77.10%	57.22%	77.19%
Immigrant before 1980	4.12%	5.04%	3.47%	3.16%	2.85%
Immigrant 1980 to 1990	2.45%	1.41%	2.23%	3.54%	2.64%
Immigrant 1991 to 2000	2.41%	1.65%	2.08%	2.84%	2.24%
Immigrant 2001 to 2010	6.83%	2.51%	5.73%	7.82%	6.27%
Immigrant 2011 to 2021	12.64%	3.95%	9.40%	25.43%	8.82%

4.1.10 Racialized Population

The term “racialized population” has come to replace the use of “visible minority” as of the 2021 Census of Population. Data on racialized populations is separate and distinct from data on Indigenous Peoples. In the City of Winnipeg, 34.43% of people identified as racialized, while 65.67% did not. River Heights, South St. Vital, and the North End all have a smaller proportion of their respective populations that identify as racialized, while Downtown has a larger proportion (see Table 12).

Table 12: Percentage of the Population Identifying as Racialized

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Racialized population	34.43%	10.80%	28.42%	53.75%	26.13%
Rest of the population	65.67%	89.20%	71.58%	46.25%	73.87%

4.1.11 Level of Education Achieved

In the City of Winnipeg, 14.60% of individuals have not completed a high school level education (see Table 13). For the rest of the population, the highest certificate achieved is either a high school diploma or equivalent (29.86%), a postsecondary certificate or diploma below bachelor level (26.36%), or a bachelor's degree or higher (29.18%). Notable deviations from these averages across the four study neighbourhoods include higher proportions of people with no certificate, diploma, or degree in both Downtown and the North End. There is also a much higher proportion of individuals with a bachelor's degree or higher in River Heights and a much lower proportion in the North End. Postsecondary certificates or diplomas below a bachelor level are much less common in River Heights, which could be because more individuals have achieved a bachelor's degree instead.

Table 13: Highest Level of Education Achieved

	Winnipeg	River Heights	South St. Vital	Downtown	North End
No certificate, diploma, or degree	14.60%	8.91%	11.35%	23.73%	34.99%
High school diploma or equivalent	29.86%	22.41%	27.86%	29.52%	32.59%
Postsecondary certificate or diploma below bachelor level	26.36%	17.70%	28.31%	21.61%	22.01%
Bachelor's degree or higher	29.18%	50.97%	32.48%	25.45%	10.40%

4.1.12 Labour Force Data

As of 2021, the labour participation rate for the entire City of Winnipeg is 65.7% and there is an employment rate of 59.8% and an unemployment rate of 8.9%. These values are fairly consistent across the four study neighbourhoods (see Table 14), with a few exceptions. Namely, both the participation rate and employment rate in the North End are lower than in the other three neighbourhoods. The unemployment rate is also much higher in Downtown and the North End compared to River Heights and South St. Vital.

Table 14: Participation Rate, Employment Rate, and Unemployment Rate

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Participation rate	65.7%	68.9%	65.1%	61.8%	49.4%
Employment rate	59.8%	63.7%	60.5%	53.7%	40.7%
Unemployment rate	8.9%	7.4%	7.0%	13.3%	17.7%

4.1.13 Mode of Commuting

Winnipeg is a very car-dependent city, with over 80% of individuals using a vehicle as their main mode of commuting, either as a driver or passenger (Table 15). Public transit, walking, biking, and other modes are much less common. River Heights and South St. Vital are fairly close to these same rates, with South St. Vital having an even higher rate of individuals using a vehicle as a driver. In Downtown and the North End, using a vehicle as a driver is less common, while taking public transit is more common. Walking is also much more common as the main mode of commuting for people living Downtown.

Table 15: Main Mode of Commuting

	Winnipeg	River Heights	South St. Vital	Downtown	North End
Vehicle as driver	73.37%	71.45%	81.74%	42.55%	59.18%
Vehicle as passenger	9.20%	7.84%	7.53%	8.86%	12.62%
Public transit	9.34%	6.07%	5.34%	26.41%	18.60%
Walked	4.75%	6.87%	2.72%	18.75%	6.52%
Biked	1.31%	4.55%	0.48%	1.16%	1.60%
Other	2.04%	3.21%	2.18%	2.28%	1.48%

4.2 Survey Results

The purpose of conducting the online survey was both to gain a better understanding of heat-related coping strategies being used in Winnipeg, as well as to compare survey responses to both the census data analysis and to themes in the literature, which will be explored in the discussion below. A total of 70 individuals responded to the survey. Six individuals were screened out because they do not live within the established boundaries of the four study neighbourhoods, leaving a total of 64 completed surveys. The survey responses were split between the four neighbourhoods as follows:

- River Heights: 24
- South St. Vital: 23
- Downtown: 12
- North End: 5

The survey recruitment goal was to collect 10 to 15 responses in each neighbourhood. Recruiting survey respondents was most challenging in the North

End neighbourhood, where only five responses were collected. While the sample size of these survey responses is not enough to be statistically significant, it still provides informative data about possible trends in each neighbourhood. This section will present the results of the online survey, with the data grouped thematically.

4.2.1 Demographics of Survey Respondents

Table 16 provides a summary of the demographic characteristics of the respondents living in each of the four study neighbourhoods. Generally speaking:

- Respondents living in River Heights are predominately over the age of 50, female, long-time residents of the neighbourhood, and living in single-detached homes.
- Respondents living in South St. Vital are predominately between the ages of 30 and 70, female, medium to long-term residents of the neighbourhood, and living in single-detached homes.
- Respondents living Downtown are predominately between the ages of 31 and 50 and living in apartment buildings. There is a near even split between dwelling ownership versus rental tenure and there is a diverse mix of genders, length of time in the neighbourhood, and other identities.
- Respondents living in the North End are of mixed age, predominately female, and have lived in the neighbourhood less than 10 years. Those who live in single-detached homes are owners, while those living in other dwelling types are renting or in another living arrangement.

Table 16: Demographics of Survey Respondents

	River Heights	South St. Vital	Downtown	North End
Age				
18-30	2	2	2	2
31-50	4	9	7	2
51-70	12	12	3	1
71+	6	0	0	0

Gender*				
Female	16	21	7	4
Male	8	1	4	1
Non-binary	0	1	2	0
Transgender man	0	0	0	0
Transgender woman	0	0	0	0
Two-spirit	0	0	1	0
Prefer not to say	0	0	0	0
Other	0	0	1	0
Length of time in neighbourhood				
1-5 years	0	3	3	3
5-10 years	3	6	4	2
10-20 years	6	4	3	0
More than 20 years	14	12	2	0
Commented specific number of years	1	1	0	0
Select all identities that apply*				
LGBTQ+	1	1	4	1
Indigenous (First Nations, Metis, or Inuit)	0	4	5	2
BIPOC (Black, Indigenous, People of Colour)	3	0	0	0
Disability/Chronic Illness	3	1	1	1
Recent Immigrant to Canada (less than 5 years)	0	0	1	0
None of the above/no response	15	19	4	2
Prefer not to say	3	0	0	0
Type of dwelling				
Single-detached house	20	19	1	3
Semi-detached house	1	0	0	0
Duplex	0	1	0	1
Row house	0	1	0	1
Apartment building fewer than 5 storeys	2	1	2	0
Apartment building 5 or more storeys	1	1	8	0
Other	0	0	1	0

Housing tenure				
Own	23	20	6	3
Rent	1	3	5	1
Something else (e.g. living with someone)	0	0	1	1

**Some people selected more than one option, so the total count may be more than the number of respondents.*

4.2.2 Air Conditioning

Survey Question: Is your place of residence air conditioned? Please provide any additional details in the space provided under "other".

Of the 24 respondents living in River Heights, 11 have central air conditioning (see Figure 3). Five respondents have a window unit air conditioner, while five have no air conditioning at all. One respondent selected "other", commenting that they have a "ductless mini-split system", and two respondents selected multiple responses, in this case both the central air conditioning and window unit options.

In South St. Vital, 20 of the 23 respondents have central air conditioning. Two respondents have a window unit air conditioner. One respondent selected "other", commenting that they have a "mini-split air conditioner". No additional comments were left by these respondents.

Of the 12 respondents living in Downtown, two have central air conditioning. Four respondents have a window unit air conditioner, while five do not have any type of air conditioning. One respondent did not select an option and commented that they use water evaporation for air cooling. The only other comment left on this question was that one person who selected "window unit" said that theirs does not work well and is too noisy to use while sleeping.

In the North End, one of the five respondents has central air conditioning. One respondent has a window unit air conditioner, while three do not have any type of air conditioning. No additional comments were left by these respondents.

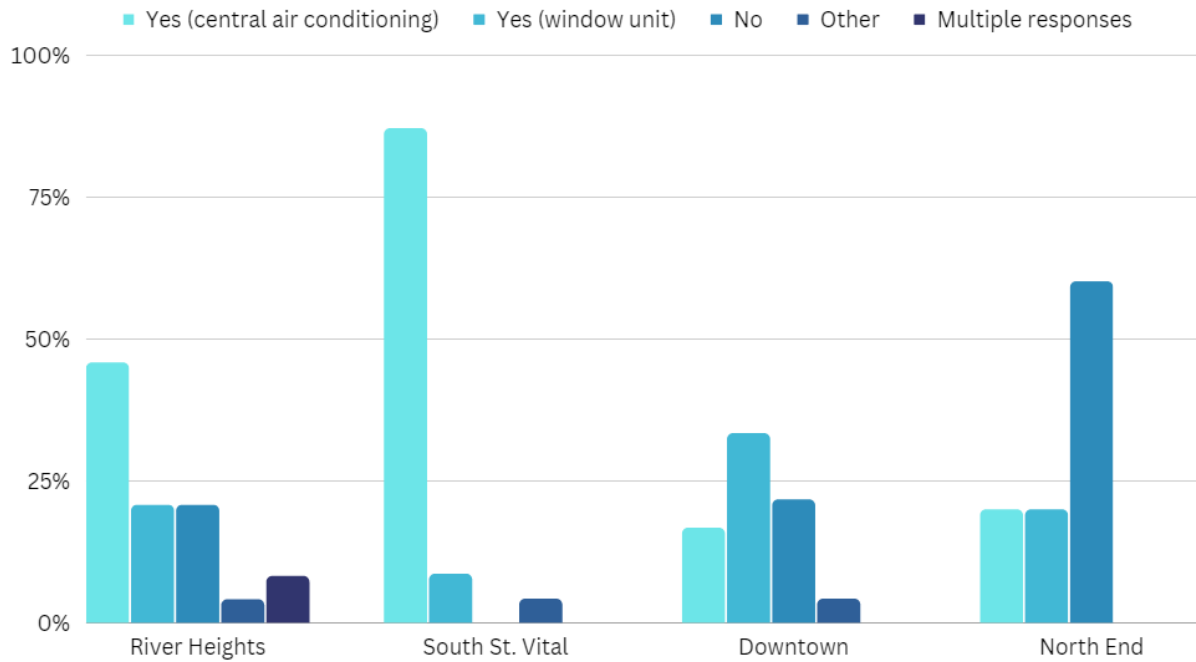


Figure 3: Prevalence of Air Conditioning in Study Neighbourhoods

4.2.3 Fan Use

Survey Question: In the summers (June to September) of 2021 and 2022, did you ever need to rely on electric or handheld fans to keep cool? Please provide any additional details in the space provided under "other".

In River Heights, five of the 24 respondents responded “never”, four responded “occasionally”, four responded “sometimes”, and 11 responded “frequently” (see Figure 4). Six respondents left additional comments:

- One respondent who selected “sometimes” said that they use a fan to direct air flow from the second floor to the main floor.
- Five respondents who selected “frequently” left comments, including that fans were used mostly in bedrooms or to circulate air around the house.

Of the 23 respondents living in South St. Vital, nine responded “never”, four responded “occasionally”, three responded “sometimes”, six responded “frequently”, and one made a comment without selecting an option, which is reflected here as “other”. Five respondents left additional comments:

- Two respondents who selected “occasionally” left comments, including using fans to move the air or using fans if outside (presumably handheld fans).
- One respondent who selected “sometimes” said that their second floor gets hot in the summer, so their children sleep with electric fans running.
- One respondent who selected “frequently” said that they use fans on their second floor.
- The comment classified as “other” was that they chose to use fans but did not need to.

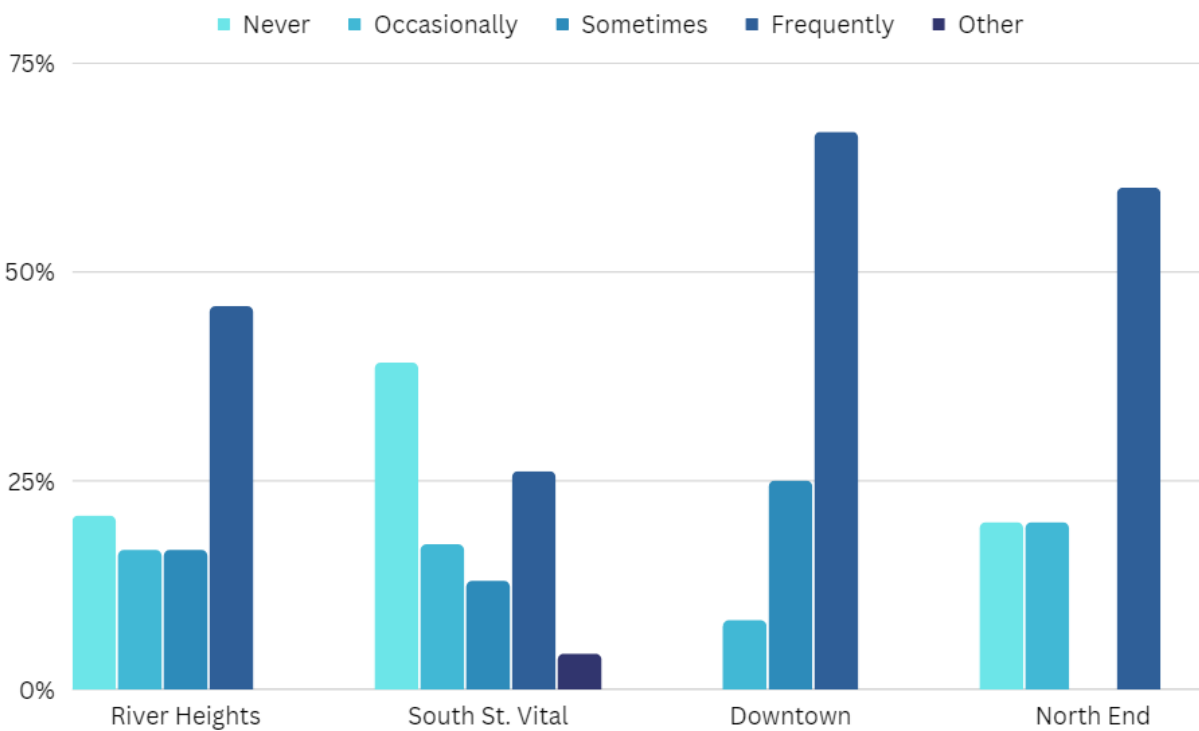


Figure 4: Frequency of Fan Use for Cooling in Study Neighbourhoods

In Downtown, zero of the 12 respondents responded “never”, one responded “occasionally”, three responded “sometimes”, and eight responded “frequently”. One respondent commented that they can only use fans because air conditioning is outside of their budget and their windows cannot accommodate an air conditioning unit.

Of the five respondents living in the North End, one responded “never”, one responded “occasionally”, zero responded “sometimes”, and three responded “frequently”. No additional comments were left by these respondents.

4.2.4 Water Use

Survey Question: In the summers (June to September) of 2021 and 2022, did you ever need to rely on water to keep cool (e.g. a cold bath/shower, damp cloths, etc.)? Please provide any additional details in the space provided under “other”.

Of the 24 respondents living in River Heights, 11 responded “never”, 10 responded “occasionally”, two responded “sometimes”, zero responded “frequently”, and one respondent selected both occasionally and sometimes, which was classified under “other” (see Figure 5). One respondent who said “occasionally” and one who said “sometimes” both made the comment that they use showering as a way to cool down.

In South St. Vital, 16 of the 23 respondents responded “never”, two responded “occasionally”, one responded “sometimes”, three responded “frequently”, and one respondent selected both never and occasionally, which was classified under “other”. One respondent who said “frequently” commented that they have a pool which they use to cool down.

Of the 12 respondents living Downtown, four responded “never”, three responded “occasionally”, one responded “sometimes”, and four responded “frequently”. One respondent who said “frequently” commented that they use damp

cloths and cold showers constantly to cool down and especially after cycling in the summer which is their main form of transportation.

In the North End, one of the five respondents responded “never”, two responded “occasionally”, zero responded “sometimes”, and two responded “frequently”. One respondent who said “frequently” commented that they take cool baths at night, use damp towels, use ice packs, and drive to the beach.

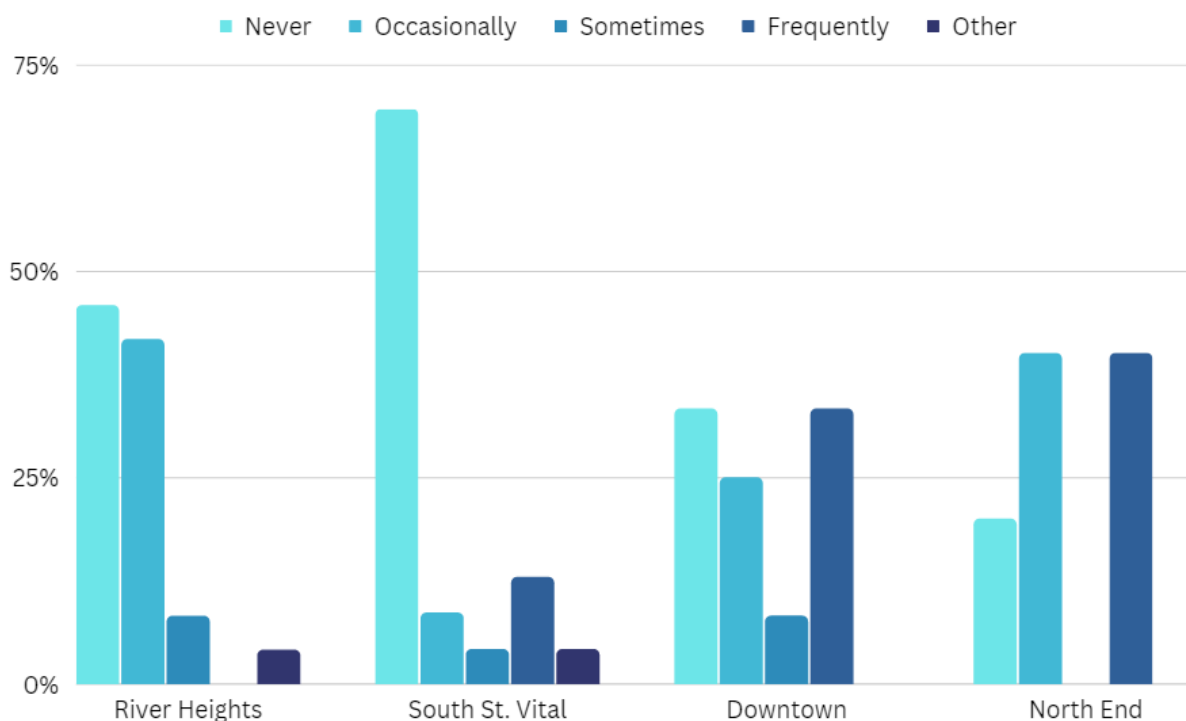


Figure 5: Frequency of Using Water for Cooling in Study Neighbourhoods

4.2.5 Difficulties Sleeping Due to Heat

Survey Question: In the summers (June to September) of 2021 and 2022, did you ever have trouble sleeping because of heat? Please provide any additional details in the space provided under "other".

In River Heights, eight of the 24 respondents responded “never”, nine responded “occasionally”, six responded “sometimes”, and one responded “frequently” (see Figure 6). The only comment left by these respondents was that one

individual (who responded “occasionally”) had trouble sleeping when their window air conditioning unit was not enough to cool the entire house.

Of the 23 respondents living in South St. Vital, nine responded “never”, seven responded “occasionally”, two responded “sometimes”, four responded “frequently”, and one respondent selected both never and occasionally, which was classified under “other”. Two comments were left by these respondents. One individual who responded “occasionally” said that they used a fan in their room to sleep. Another, who responded “frequently”, commented that their bedrooms are on the second floor.

In Downtown, two of the 12 respondents responded “never”, three responded “occasionally”, two responded “sometimes”, and five responded “frequently”. One of the individuals who responded “frequently” said that they were always tired and averaged 3-6 hours of sleep nightly in the summer because their apartment was uncomfortably warm.

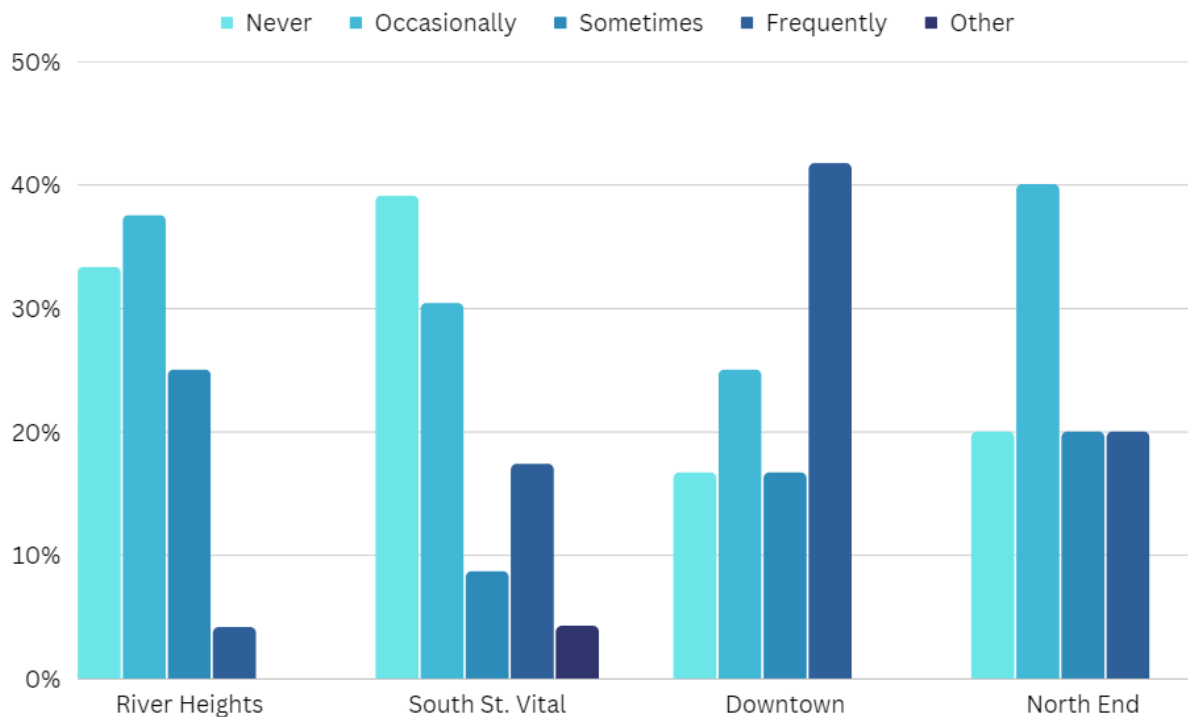


Figure 6: Frequency of Sleeping Difficulties Due to Heat in Study Neighbourhoods

Of the five respondents living in the North End, one responded “never”, two responded “occasionally”, one responded “sometimes”, and one responded “frequently”. The individual who responded “frequently” said that they often cannot sleep until three or four in the morning when the second floor of their house has cooled off.

4.2.6 Leaving Home Due to Heat

Survey Question: In the summers (June to September) of 2021 and 2022, did you ever need to leave your home to keep cool? Please provide any additional details in the space provided under “other”.

Of the 24 respondents living in River Heights, 14 responded “never”, seven responded “occasionally”, one responded “sometimes”, one responded “frequently”, and one left a comment without selecting a frequency, which is counted here as “other” (see Figure 7). That comment was that they did not specifically choose to leave home because of heat but welcomed activities that involved going elsewhere. Two other comments were left by people who selected occasionally. One said they would go to the shopping mall and the other said that they did not need to leave home, but sometimes found it more pleasant to be outside in the shade.

In South St. Vital, 18 of the 23 respondents responded “never”, two responded “occasionally”, two responded “sometimes”, zero responded “frequently”, and one left a comment without selecting a frequency, which is counted here as “other”. That comment was that they felt the need to leave home before purchasing air conditioning. No other comments were left by these respondents.

Of the 12 respondents living Downtown, three responded “never”, six responded “occasionally”, two responded “sometimes”, and one responded “frequently”. The person who responded “frequently” commented that they cannot afford an air conditioner, but that they were able to use money from a tax refund to stay at a motel for one night to feel more comfortable.

In the North End, two of the five respondents responded “never”, two responded “occasionally”, zero responded “sometimes”, and one responded “frequently”. The person who responded “frequently” commented that they drive themselves to the beach if it gets to be 30° Celsius or hotter.

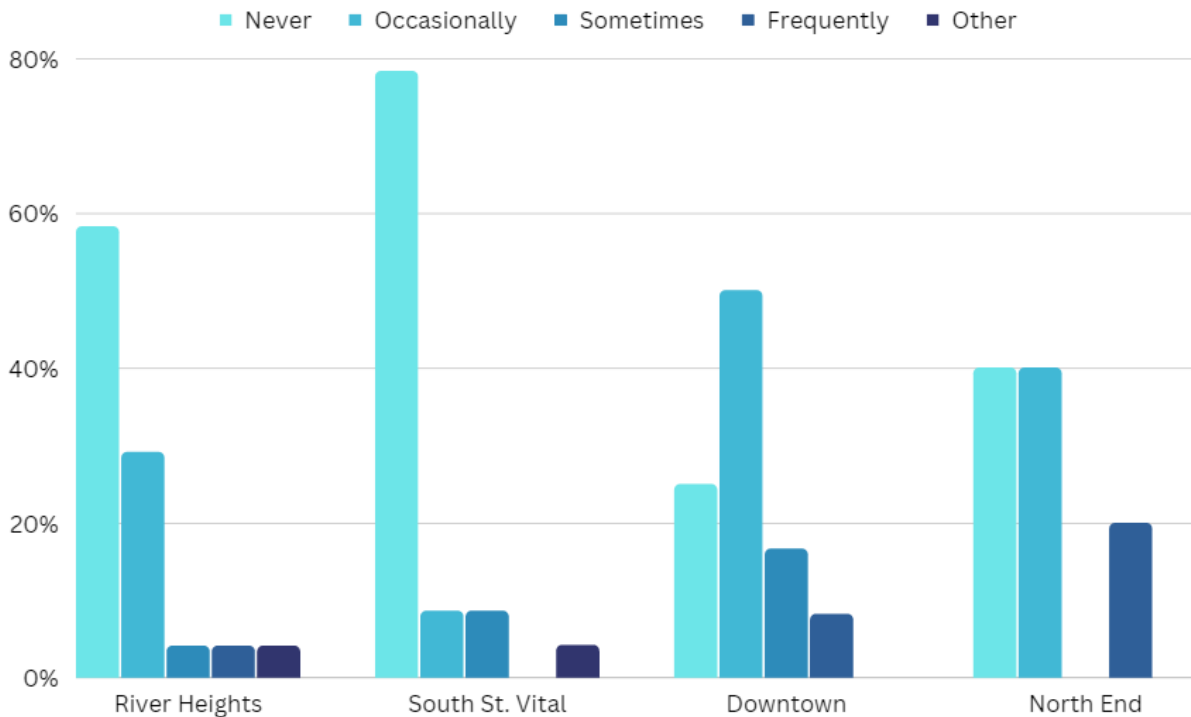


Figure 7: Frequency of Leaving Home Due to Heat in Study Neighbourhoods

4.2.7 Cooling Locations Outside of the Home

Survey Question: If you left your home in the summers (June to September) of 2021 and 2022 to keep cool, where did you go? Please provide any additional details in the space provided under "other".

In River Heights, 11 of the 24 respondents said this question was not applicable to them (see Figure 8). One said they go to a friend or family member’s house. No one said that they go to a public place (except for one person who gave multiple responses). Five people said they go to a privately-owned place. One said that they would go somewhere else (cottage on a lake). Two people selected multiple responses: one said both a friend or family member’s house and a public place, the

other selected every option and provided examples of where they go (forests, rivers, lakes, farms, libraries, galleries, open markets). The four responses under "other/no response" include one person who selected none of the options and commented that they go outside or to the basement, as well as three people who left the question blank.

Of the 23 respondents living in South St. Vital, 17 said this question was not applicable to them. Two said they go to a friend or family member's house. No one said that they go to a public place. Three people said they go to a privately-owned place. One person selected multiple responses, choosing both going to a friend or family member's house and going to a privately-owned place.

In Downtown, three of the 12 respondents said this question was not applicable to them. One said they go to a friend or family member's house. Three said that they go to a public place. No one said they go to a privately-owned place (except for those who selected other or multiple responses). One person did not select a response but commented that they go to the mall or movies, which would be classified as a privately-owned place. Four people selected multiple responses, with combinations of responses as follows:

- One person selected going to a friend or family member's house, going to a privately-owned place, and going somewhere else.
- One person selected going to a friend or family member's house and going to a privately-owned place.
- One person selected going to a public place and going to a privately-owned place.
- One person selected all four options.

The examples left by those who selected somewhere else were going to a motel and going for a drive in an air-conditioned car.

Of the five respondents living in the North End, two said this question was not applicable to them. One said they go to a friend or family member's house. No one

said that they go to a public place. No one said they go to a privately-owned place (except for those who selected multiple responses). Two people selected multiple responses, with combinations of responses as follows:

- One person selected going to a friend or family member’s house and going somewhere else (beaches, provincial parks with lakes).
- One person selected going to a public place and going to a privately-owned place.

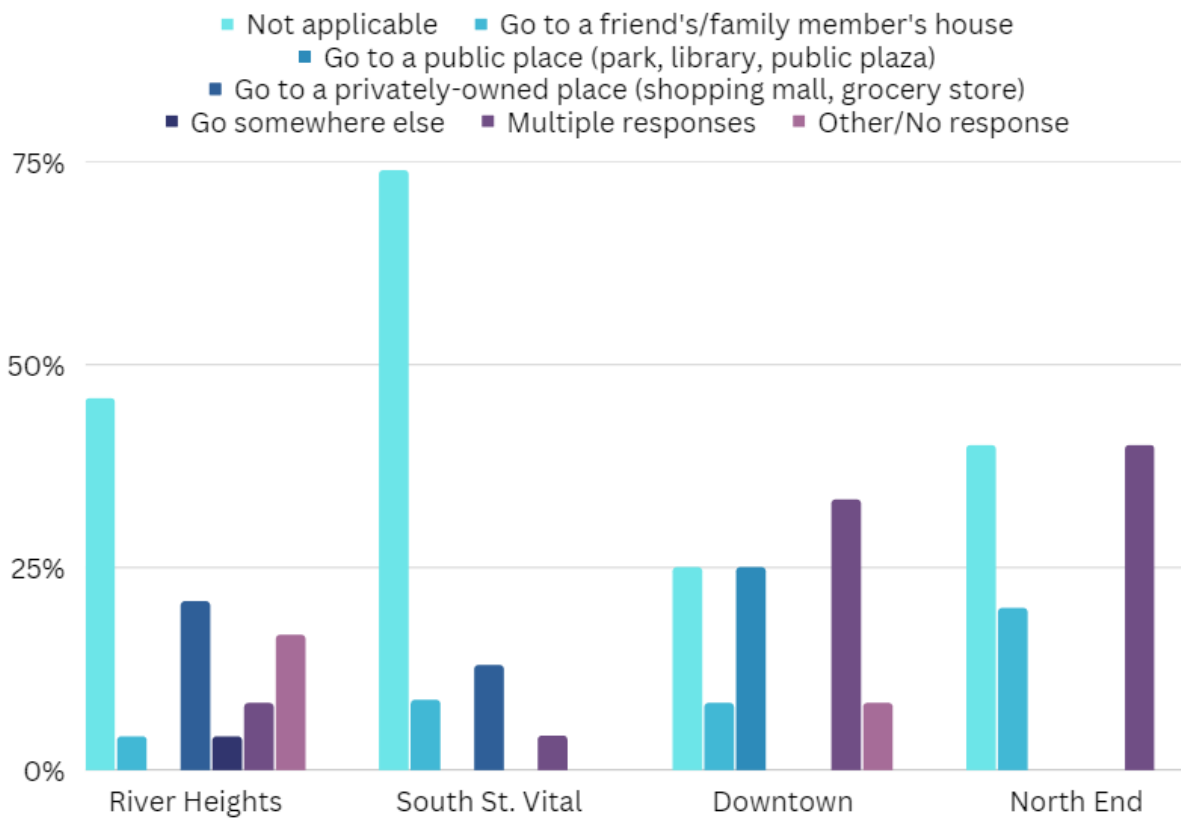


Figure 8: Cooling Locations Outside of the Home in Study Neighbourhoods

4.2.8 Other Cooling Strategies

Survey Question: What other strategies, if any, do you use to keep cool during the summer?

This question allowed respondents to provide additional information about their coping strategies, including any that were not covered by the previous questions. Themes emerging among respondents from River Heights included:

- Trees: noticing a loss of trees in the neighbourhood, planting more trees themselves
- Curtains: closing curtains or blinds to prevent their residence from heating up
- Windows: opening windows for air circulation or closing them to keep hot air out
- Ovens: limiting the use of appliances to avoid adding more heat
- Light clothing: wearing less and looser fitting clothing
- Avoidance: going to the basement or the lake to avoid heat, sleeping on the floor, and planning activities to avoid the hottest parts of the day
- Water: swimming pools, drinking fluids, and eating high-fluid foods like fruit

Themes emerging among respondents from South St. Vital included:

- Curtains: closing curtains or blinds to prevent their residence from heating up
- Avoidance: going to the basement, staying in the shade when outdoors, and using umbrellas for shade
- Water: swimming pools and other water play, cold showers, and drinking fluids
- Fans: using fans to cool off

Themes emerging among respondents from Downtown included:

- Curtains: closing curtains or blinds to prevent their residence from heating up
- Windows: closing windows to keep out heat
- Light clothing: wearing less and loose clothing
- Avoidance: sleeping outdoors, staying in the shade when outdoors, and planning activities to avoid the hottest parts of the day
- Water: swimming pools and drinking fluids

Themes emerging among respondents from the North End included:

- Curtains: closing curtains or blinds to prevent their residence from heating up
- Avoidance: leaving home to go to the movies or a resource centre
- Water: damp cloths, ice packs, and watering the lawn to get cooled by the spray

4.2.9 Heat-Related Health Risk

Survey Question: Have you ever felt that your health or the health of someone in your neighbourhood is at risk because of heat? If so, please describe in the space provided under "other".

This question is an indication of self-perceived heat risk. Of the 24 respondents from River Heights, one said they have felt that the heat is a risk to their own health (see Table 17). Four people said the heat has been a risk to the health of someone they know and 16 people said that heat has not been a risk for themselves or someone they know. Of the three responses under "other/multiple responses", one person selected that heat has been a risk to both themselves and someone they know. All three respondents left comments, which included concerns for others more generally (those without air conditioning, the unhoused, the elderly), reduced work efficiency, and needing to modify or cancel activities due to heat.

Table 17: Perceived Heat Health Risk to Self and Others

	River Heights	South St. Vital	Downtown	North End
Yes, myself	1	1	1	1
Yes, someone I know	4	5	3	1
No	16	17	5	2
Other/Multiple responses	3	0	3	1

In South St. Vital, one of the 23 respondents said they have felt that the heat is a risk to their own health. Five people said the heat has been a risk to the health of someone they know and 17 people said that heat has not been a risk for themselves or someone they know. No one selected multiple responses. The one respondent who selected that their own health is at risk from heat left a comment that they have severe asthma.

Of the 12 respondents from Downtown, one said they have felt that the heat is a risk to their own health. Three people said the heat has been a risk to the health of someone they know and five people said that heat has not been a risk for themselves or someone they know. Of the three responses under "other/multiple responses", one person selected that heat has been a risk to both them and someone they know. The other two respondents commented that they are concerned for people who are unhoused or who live in apartment buildings without air conditioning.

In the North End, one of the five respondents said they have felt that the heat is a risk to their own health. One person said the heat has been a risk to the health of someone they know (their child getting dehydrated) and two people said that heat has not been a risk for themselves or someone they know. One respondent did not select an option but left a comment that they are concerned for both themselves and others. They feel that the heat impacts their sleep, they worry for those who cannot

leave the city, and they fear for the potential closure of wading pools and recreation facilities within the North End.

4.2.10 Suggestions for the City of Winnipeg

Survey Question: What do you think the City of Winnipeg should do to help people in your neighbourhood keep cool during the summer?

This was an open-ended question for respondents to highlight actions they would like to see the City of Winnipeg take regarding heat. The themes that emerged among respondents from River Heights included:

- Trees: planting more trees; maintaining the existing tree canopy; incentives for homeowners to preserve trees on their property; greening pavement areas like parking lots.
- Public education: using newspapers and other media to educate people about precautions they can take and services available.
- Cooling centres: having places to go that are well-advertised; providing transportation to help people get there; 24/7 services; could use existing spaces like libraries, shopping centres, and museums.
- Outdoor pools/splash pads: opening more pools/splash pads; having them open every day and for longer hours.
- Urban Design: updating building standards to require air conditioning and require that new builds maintain some trees/green space.
- Policy actions: subsidizing the cost of air conditioning; improving public transit services to decrease traffic; providing incentives for eco-friendly cooling technologies.
- Drinking water: having public drinking water fountains.

The themes that emerged among respondents from South St. Vital included:

- Trees: planting more trees and replacing ones that have died.

- Cooling centres: opening malls, community centres, and libraries for longer hours (including weekends); offer seating, wifi, and security; places to cook so that people do not have to heat up their homes.
- Outdoor pools/splash pads: opening water parks and pools for longer hours; having more outdoor pools in this neighbourhood; “misting stations” to help people cool off; free admission to pools.
- Urban design: having more shade covers in public spaces, white-painted concrete to reflect heat.
- Policy actions: helping people afford a more comfortable standard of living; lower water/electricity costs; caring for the environment; helping people get access to air conditioning.
- Drinking water: providing bottled water to people at risk; drinking water stations.

The themes that emerged among respondents from Downtown included:

- Trees: planting more trees for shade; increased funding for restoring tree canopy.
- Cooling centres: have facilities with air conditioning where people can cool off; extend library hours; better cooling mechanisms for other public places (e.g. blinds in libraries and sky-walk).
- Outdoor pools/splash pads: having longer hours at pools and splash pads; having more splash pads and pools available free of charge; “misting stations” for people to cool off.
- Urban design: putting water on the roads for cooling; updating building standards to require air conditioning; installing more geothermal heat pumps.
- Policy actions: subsidizing the purchase of air conditioning units; implementing climate policies.
- Drinking water: having public drinking fountains; hosting events with frozen treats.

The themes that emerged among respondents from the North End included:

- Trees: prioritize tree replacement in the North End and Downtown.
- Cooling centres: keep community centres open for longer hours during heatwaves; provide more air-conditioned areas.
- Outdoor pools/splash pads: longer hours at public pools; open more splash pads and pools in the neighbourhood.
- Urban design: provide more shaded areas.
- Policy actions: free public transit to pools; offer incentives and/or rebates for installing air conditioning in homes.
- Protecting the vulnerable: provide additional support for Elders and children.

4.2.11 Additional Comments

Survey Question: Do you have any other comments about how heat impacts you and your neighbourhood that were not covered by this survey?

Given the limitations of survey design to capture all relevant information, it was important to provide respondents with an opportunity to provide any additional feedback. In some cases, these comments reiterated feedback from earlier in the survey, but demonstrated which issues are most important to the people responding.

The comments provided by respondents from River Heights are summarized as follows:

- Heat can increase social isolation when people stay indoors.
- Trees in River Heights are not being replaced as quickly as they are being lost.
- Need equitable tree canopy everywhere, not just in some parts of the city.
- Many people in this neighbourhood are able to go away to a lake, which is a privilege that helps with heat.

- Need early intervention into heat and climate change to help protect people's health and reduce costs in the long run.
- People with no air conditioning need public places to cool off.
- Infill developments sometimes fill the entire lot with a dark-coloured building, absorbing more heat and taking away trees for shade.

The comments provided by respondents from South St. Vital are summarized as follows:

- The neighbourhood is generally well-treed on both public and private property.
- When it is hot and humid, air pollution is much more noticeable.

The comments provided by respondents from Downtown are summarized as follows:

- The heat can impact personal relationships when sleeping in the same bed is uncomfortable.
- Expressed concern for those who are unsheltered or who cannot afford an air-conditioned apartment, because they do not get to choose whether they are outside in the heat or in an air-conditioned space.

The comments provided by respondents from the North End are summarized as follows:

- The City of Winnipeg does the best they can.
- The City is supporting recreation centres in suburban communities at the expense of smaller facilities in older neighbourhoods.
- People living in the centre of the city have less access to cars and cannot commute long distances to a pool or other cooling space.
- COVID-19 impacted access to swimming pools because you had to book online and many people in this neighbourhood do not have reliable internet access.

- People making decisions about planning for heat need to listen to the local issues in communities.
- Older homes are harder to retrofit with air conditioning and can become a health hazard in the summer.
- There should be requirements for landlords to keep their building temperatures below 25°C.
- The city needs more design interventions like green spaces, shade, and green roofs.
- Industrial businesses create noise and pollution that can prevent people from being able to open their windows, making it harder to cope with heat.

The implications of these findings and connections between the census data analysis and survey results will be discussed in the following section.

5.0 Discussion

This section explores how the results of the census data analysis and online surveys answer the research questions posed by this project:

1. What are the demographics and housing types and quality in areas of Winnipeg with more exposure to heat and in areas with less exposure to heat?
2. What strategies do people living in areas of Winnipeg with different levels of heat exposure use to cope with heat?
3. What are the implications of this research for climate-informed planning in Winnipeg?

This discussion also analyzes how the trends emerging from this data compare to the findings of existing research.

What are the demographics and housing types and quality in areas of Winnipeg with more exposure to heat and in areas with less exposure to heat?

The neighbourhood demographics of this study were influenced by the methodological choice to compare neighbourhoods of both higher and lower

income, as well as higher and lower average temperatures (see Table 18). As a result, it was not surprising when the census data confirmed that there is a higher proportion of those considered low-income as well as those who received COVID-19 government benefits in the two lower income neighbourhoods. Where the data becomes more interesting is to compare the different income and heat levels with trends in other demographic data, specifically regarding housing and personal characteristics, as discussed below.

Table 18: Income-Temperature Matrix

	Higher Temperatures	Lower Temperatures
Higher Incomes	South St. Vital	River Heights
Lower Incomes	Downtown	North End

Housing Demographics

The data around household size did not show much variation across the four neighbourhoods. Compared to the City of Winnipeg average of 2.5 persons per household, only Downtown was noticeably lower at 2.0 persons. This implies that there are smaller families and potentially more single adults living in Downtown. Since Downtown is already prone to warmer temperatures, living alone could put people at higher risk of suffering due to heat if they do not have anyone to check on them. Elderly people living alone are especially vulnerable (Voelkel et al., 2018).

Census data on dwelling types shows that higher income neighbourhoods have a higher proportion of single-detached housing and a lower proportion of apartment buildings. However, while Downtown and the North End are both lower income neighbourhoods, they have very different distributions of dwelling types, with the North End having approximately 44% single-detached houses and 34% apartments and Downtown having approximately 10% single-detached houses and 84% apartment buildings. There are also pockets of different dwelling types within all neighbourhoods, which is difficult to assess at this scale.

These trends are consistent with the results of the survey data, showing that while there are not enough responses to be a truly representative sample of the neighbourhood, these respondents accurately reflected the variety of dwelling types within their neighbourhoods. The data from the census on number of rooms per dwelling also showed that dwellings in higher income neighbourhoods have more rooms per dwelling, which could be influenced by both income and dwelling type.

Housing tenure data in the census showed that higher income neighbourhoods tend to have more people who own their dwellings, while lower income neighbourhoods tend to have more renters. The demographics of the survey respondents aligned with this trend in the higher income neighbourhoods but were less accurate in Downtown and the North End, where renters should have outnumbered owners but did not. It would have been beneficial to hear from more renters in the survey because the literature shows that renters have less control over their utilities than homeowners do (Zander et al., 2021), which makes them unable to adjust temperatures to their comfort level as easily.

The age of construction of a dwelling can impact the type of materials used, the quality of insulation, or other factors impacting how a building's occupants experience heat (Larsen et al., 2022). River Heights has the oldest average age of construction among the four neighbourhoods, followed by the North End, Downtown, and South St. Vital. It is interesting that the oldest two neighbourhoods are also the two lower-temperature neighbourhoods. This could be connected to the higher amounts of mature trees in these neighbourhoods, as trees planted at their time of construction have had more time to grow. Older homes are typically warmer due to single-pane windows and a lack of insulation (Larsen et al., 2022), but the tree canopy in these neighbourhoods could help mitigate this effect.

The survey did not ask directly about the age of people's dwellings, but respondents from both River Heights and the North End commented on the quality of the tree canopy. The survey also asked how long respondents have lived in their

neighbourhood and River Heights had the largest proportion of people who answered “more than 20 years”. However, this seems to be more closely tied to income than age of construction, as South St. Vital also had many people select that option, while Downtown and the North End did not.

The data on acceptable housing is where housing quality can be assessed. As defined above, acceptable housing must meet the three criteria of being adequate (no major repairs needed), suitable (has enough bedrooms for the size and composition of the household), and affordable (costing no more than 30% of the household’s before-tax income). Compared to the entire City of Winnipeg, River Heights and South St. Vital have an above average rate of acceptable housing, while Downtown and the North End have a below average rate. This means that, in Winnipeg’s lower income neighbourhoods, there are likely more people living in dwellings that are too crowded or that need repairs, which makes these households more vulnerable to heat. Existing research shows that heat-related deaths disproportionately occur in areas with substandard housing (Burbidge et al., 2022). When households also need to spend a larger portion of their income on housing, this means that they have less income available to spend on other heat-related coping strategies.

While air conditioning is not a requirement of defining acceptable housing, the survey results show that people living in lower income neighbourhoods are also less likely to have access to air conditioning, especially central air conditioning. Air conditioning has also been shown in the literature to be a common coping mechanism for heat (Zander et al., 2021). As climate change progresses, making heatwaves more common in many cities, air conditioning may need to become a factor in what is considered acceptable housing. This will have to be balanced with the trade-offs of energy use and possible pollution described in the literature (Larsen et al., 2022), as well as ensuring that air conditioning is equitably provided to those who cannot otherwise afford it (Heger, 2022).

Other Demographic Characteristics

Age and gender data provide a basic picture of who is living in a neighbourhood. In the City of Winnipeg, the average age is 40.3 years old. The data from the four study neighbourhoods shows that River Heights and South St. Vital both have a higher average age (43.3 and 42.4 years old, respectively) and Downtown and the North End both have a lower average age (37.3 and 36.5 years old, respectively). This pattern was similar among survey respondents, with more respondents aged 50 and older in the higher income neighbourhoods and more people under 50 in the lower income neighbourhoods. Older people tend to be at a higher risk from heat, both due to personal health factors and increased isolation (Harlan et al., 2006; Kaswan, 2012; Kemen et al., 2021; Meerow & Keith, 2022; Pasquini et al., 2020).

The “Men +” and “Women +” gender categories in the census are meant to include all genders. As discussed above, this is not a perfect inclusionary solution as it still imposes binary genders onto people who do not identify as a man or a woman. The split between Men + and Women + in the four study neighbourhoods is close to equal, with slightly more Women + in River Heights and South St. Vital and slightly more Men + in Downtown and the North End. Based on this data, the survey respondents in this study were disproportionately female, with 48 out of 64 people selecting that option, or 75% of all respondents. The survey recruitment strategy was not gender-specific, so possible explanations for this are that the groups contacted may have more women or that women were more interested in completing the survey. Some research has shown that women can be more vulnerable to the impacts of heat (Kemen et al., 2021), but this trend was not apparent among the survey respondents.

In the City of Winnipeg as a whole, approximately 12% of people identify as Indigenous (First Nations, Metis, or Inuit). In River Heights and South St. Vital, this percentage was lower, in Downtown it was slightly higher, and it was highest in the North End at 40%. There is limited research so far on how Indigenous people living in

cities are impacted by heat. Due to the ongoing intergenerational impacts of colonialism, Indigenous people in cities are more likely to be experiencing poverty or be unhoused (Silver, 2016), making them more vulnerable to extreme heat. Since Downtown and the North End are both already lower income communities, it is likely that Indigenous people living in these neighbourhoods are especially vulnerable to extreme heat events, particularly those living in inadequate housing.

Newcomers may also struggle to find acceptable housing, making them more vulnerable to heat. In Winnipeg, 86% of people are Canadian citizens. This percentage is higher in River Heights, South St. Vital, and the North End, and lower in Downtown. Twenty-eight percent of Winnipeggers are considered immigrants, meaning that they are not Canadian citizens by birth. Downtown has the largest percentage of people identified as immigrants, with 25% of those people arriving since 2011. In the survey results, only one individual self-identified as a recent immigrant to Canada (less than five years) and this person lives Downtown. This means that the survey data does not reflect the experiences of those who have recently settled in Winnipeg. This research would have benefitted from hearing from more recent immigrants, as they are a demographic that is considered highly vulnerable to heat in the literature (Burbidge et al., 2022; Kaswan, 2012).

The literature on heat equity has also shown that, in some contexts, racialized communities are more vulnerable to the impacts of heat (Heger, 2022; O'Neill et al., 2005; Sanchez, 2019; Voelkel et al., 2018). In Winnipeg, approximately one third of people identify as racialized. In three of the four study neighbourhoods this percentage was lower, but in Downtown approximately 54% of people identify as racialized. Given the higher incidence of low-income and less acceptable housing in Downtown described above, people who identify as racialized living in Downtown Winnipeg may be more vulnerable to heat. In the survey results, only three respondents self-identified as BIPOC (Black, Indigenous, and People of Colour), all of whom live in River Heights. This is too small of a sample size to draw any conclusions and there were no noticeable trends in the anecdotal data among these respondents.

Future research could focus on recruiting from these communities specifically to gain a better understanding of their level of vulnerability and preferred coping strategies.

The three statistics from the census data analysis that were not covered in the survey were education, employment, and mode of commuting. These topics were less directly relevant to heat vulnerability, and it is important to keep surveys short enough that people choose to complete them. As a result, the analysis of these topics is solely based on census data.

The analysis of education was based on the highest level of education achieved by individuals. This can be connected to income, but lower levels of education does not always mean lower incomes. The two lower income neighbourhoods have a higher proportion of people with no diplomas or degrees and the North End has the lowest percentage of people with bachelor's degrees or higher. However, both lower income neighbourhoods have rates of post-secondary achievement below a bachelor level near the City of Winnipeg average. This could include trades or technology-related programs leading to jobs with good incomes, so it is difficult to draw any conclusions about how this educational data corresponds to income and related heat vulnerability. The literature claims that land surface temperature is statistically higher in areas characterized by less education, among other factors like low income, high poverty, and more racialized people (Huang et al., 2011; Voelkel et al., 2018). Heat can also contribute to lower educational outcomes (Turner et al., 2022), which reinforces these trends. While Downtown and the North End both share some of the above characteristics, the North End has on average much cooler temperatures than Downtown, meaning that this trend is not universal in all cities.

The employment data across the four neighbourhoods is in line with what would be expected based on average incomes. The participation and employment rates in three of the four neighbourhoods are within a few percentage points of the City of Winnipeg rate, with the North End having a much lower rate. Unemployment

is much higher in both the North End and Downtown compared to River Heights and South St. Vital. Not having access to income can put people at a higher level of heat vulnerability because they may not have the discretionary income to access goods or services to protect themselves from the heat (Guardaro et al., 2022; Pasquini et al., 2020; Voelkel et al., 2018).

Looking at modes of travel can also provide information about the people living in each neighbourhood. Winnipeg is predominately a car-oriented city and the higher income neighbourhoods have particularly high rates of people commuting by vehicle, either as a driver or passenger. This rate is much lower in Downtown and the North End, with more public transit use instead. Downtown also has a much higher rate of commuting by walking.

While the survey did not ask about commuting, some people did mention using a vehicle to cool off, either by driving around with the air conditioning on or going somewhere specific to cool off (e.g. a lake or beach). Access to a vehicle gives people more agency to find ways to cool off, because there is a lack of consistent public transit available to access all of these same places. Those who rely on walking or cycling to commute within the city are also at a higher risk of heat exhaustion or heat stroke during extreme heat events.

It is extremely complex to assess people's heat vulnerability based on demographic characteristics. This is because there are a myriad of factors that impact an individual's vulnerability and even more intersections between them. The factors discussed above - including very different considerations like age, acceptable housing, ethnic background, and education - all intersect to form every person's individualized experience of heat. The analysis of these four neighbourhoods showed that there appears to be a strong connection between income and several other demographic characteristics. The results of the census data analysis and their comparison to the demographics of the respondents showed more similarities between neighbourhoods based on income, rather than based on the average

temperature of those areas. That being said, there were more differences between Downtown and the North End than between River Heights and South St. Vital, demonstrating that income is clearly not the only factor determining who lives in a given neighbourhood.

What strategies do people living in areas of Winnipeg with different levels of heat exposure use to cope with heat?

The existing literature has shown that people respond to heat in a variety of ways, which can be sorted based on Kemen et al.'s (2021) framework into body-related, home-protective, and activity-related coping strategies. The survey covered a few coping strategies and issues that people may have regarding heat and asked them to rate the frequency of each on the following scale: never, occasionally, sometimes, or frequently. The survey also left several open-ended opportunities for respondents to add additional information or to expand on their ideas.

Coping Strategies by Neighbourhood

The first question on coping strategies asked how frequently respondents need to use a fan (either electric or handheld) to keep cool. This home-protective strategy was the most common coping strategy across all neighbourhoods, though it was notably less common in South St. Vital. Fans are a cost-effective way to circulate air, which can produce a cooling effect, and so it makes sense that many people use this strategy. "Frequently" was the most common response to this question in River Heights, Downtown, and the North End. South St. Vital was the exception, where 9 out of 23 respondents selected "never".

I had been expecting that the survey results on coping strategies would follow similar patterns to the census data analysis, with higher income and lower income neighbourhoods behaving similarly. However, in this case, the responses from River Heights and South St. Vital were very different. This shows that having a higher income does not preclude the necessity of using fans for cooling. The difference in this case is likely the age of construction, with South St. Vital being a more recently built

neighbourhood. These newer homes are more likely to have central air conditioning, which was also reflected in the survey responses. Kemen et al. (2021) found that, in their study in Germany, all participants who have access to air conditioning use air conditioning.

The second coping strategy question asked how frequently people use water in some form for cooling. This body-related strategy was generally less common, but also less consistent across the four neighbourhoods. In South St. Vital, the majority of respondents said “never”. In River Heights, “never” and “occasionally” made up most responses. Responses Downtown were largely split between “never” and “frequently”, with few in between. The North End had only five responses, but two of those were “frequently”, two “occasionally”, and one “never”. Cold showers/baths were mentioned in River Heights, Downtown, and the North End. Damp cloths were mentioned in both Downtown and the North End. Swimming pools were only mentioned in South St. Vital and one person in the North End mentioned ice packs and driving to the beach. It is possible that swimming pools and driving to the beach were mentioned infrequently because of financial or logistical barriers. Using showers or cloths for cooling is more accessible because it is something anyone can do at home.

The next question asked people how frequently the heat interferes with their sleep during the summer. Those living Downtown had the most trouble with sleep, with five of the twelve respondents selecting “frequently”. Trouble sleeping was less frequently a problem for many people in South St. Vital and River Heights, and responses were varied among respondents from the North End. A commonly reported problem was that people’s bedrooms are on the second floor which gets too warm, takes a long time to cool off, and cannot be effectively cooled by smaller air conditioning systems. Across all neighbourhoods, 23 people selected “sometimes” or “frequently” on this question, 17 of whom do not have central air conditioning, reinforcing the connection between heat vulnerability and having inadequate (or no) air conditioning.

If a person feels the need to leave home for a reprieve from the heat, this activity-related coping strategy is a strong indicator of their level of vulnerability. Only three of the 64 survey respondents reported needing to leave home frequently. Most people across all neighbourhoods selected “never” or “occasionally”. It was interesting to hear from respondents about where they like to go when the heat at home is uncomfortable. In River Heights, it was most common to go to a privately-owned place. In South St. Vital, comments were split between going to a friend or family member’s place or a privately-owned place. In Downtown, more people said that they go to a public place than to a privately-owned place or a friend or family member’s house. Responses in the North End were diverse, but it was slightly more common to go to a friend or family member’s house.

Some unique places that respondents commented outside of these options included a motel, public transit, near a river, driving in a car, and a cottage at a lake. Of course, the ability to go somewhere else is a privilege based on the ability to access transportation and/or pay to access some privately-owned spaces. I was expecting for this reason to see more people choosing public spaces. The fact that this was not the case could mean that Winnipeg is in need of more public places to cool off. Also, not all privately-owned places require payment for entry (e.g. shopping malls), so they can function as public spaces. However, some groups of people experience profiling and exclusion from these spaces, so they are not truly public.

Coping Strategies by Select Demographics

The online survey collected several pieces of demographic information (see Appendix A). This allows for an assessment of how frequently different coping strategies are used by select demographic groups. The four that will be discussed here are self-identified social demographics, dwelling types, housing tenure, and age.

Self-identified Social Demographics

The survey asked people to self-identify whether several different demographic groups applied to them, including LGBTQ+, Indigenous (First Nations, Metis, or Inuit),

BIPOC (Black, Indigenous, People of Colour), Disability/Chronic Illness, and Recent immigrant to Canada (less than five years). The question also gave respondents the option to select “none of the above” or “prefer not to say”.

Forty-three of the 64 respondents selected either “none of the above” (n = 40) or “prefer not to say” (n = 3), from a mix of the four neighbourhoods (Table 19). Across the different questions, these respondents selected “never” most often, followed by “occasionally”, “frequently”, and “sometimes”. Generally, most responses were for “never” and “occasionally”, showing that these respondents are less vulnerable to heat. The exception to this is that many people reported frequently using fans. Of those 18 responses, 13 do not have access to central air conditioning, reinforcing the strong connection between air conditioning and the need to use other coping strategies.

Table 19: Survey Responses Among Respondents Who Did Not Self-Identify any Demographic Characteristics

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling*	13	6	6	18
Using water for cooling**	27	12	3	2
Trouble sleeping due to heat**	17	16	7	4
Leaving home due to heat***	31	8	1	2
Total responses	88	42	17	26

*One respondent did not select an option and commented that they chose to use a fan but did not need to.

**At least one respondent selected more than one option.

***One respondent did not select an option and commented that they did not directly leave home due to heat but did so indirectly.

Seven respondents identified as LGBTQ+, from a mix of all four neighbourhoods. Across the different questions, these respondents selected “frequently” most often, followed by “occasionally”, “never”, and “sometimes” (Table 20). This is a higher rate of people answering “frequently” than among those who did not self-declare any of the demographic identities. This could mean that LGBTQ+ people in Winnipeg are a group facing higher levels of heat vulnerability.

Table 20: Survey Responses Among LGBTQ+ Respondents

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	2	1	4
Using water for cooling	2	2	0	3
Trouble sleeping due to heat	1	2	1	3
Leaving home due to heat	3	1	2	1
Total responses	6	7	4	11

Eleven respondents identified as Indigenous (First Nations, Metis, or Inuit), from three of the four neighbourhoods (none from River Heights). Across the different questions, these respondents selected “frequently” most often, followed by “occasionally”, “sometimes”, and “never” (Table 21). The fact that “frequently” was the most-selected and “never” the least-selected could mean that Indigenous people in Winnipeg also face higher levels of heat vulnerability.

Table 21: Survey Responses Among Indigenous Respondents

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	1	0	3	7
Using water for cooling	2	2	1	6
Trouble sleeping due to heat	1	3	2	5
Leaving home due to heat*	2	5	2	1
Total responses	6	10	8	19

*One respondent did not select an option but commented that they did leave home before purchasing air conditioning.

Three respondents identified as BIPOC (Black, Indigenous, People of Colour), all from River Heights. These individuals appear to have a lower to moderate level of heat risk based on the frequencies they selected in the questions reflected in Table 22, specifically the fact that they did not select “frequently” for any of the questions. This is contrary to literature from the United States that suggests that BIPOC individuals are more vulnerable to heat due to social inequities (Shonkoff et al., 2011; Heger, 2022).

In the case of this survey, all three respondents have access to central air conditioning and live in the same neighbourhood, so their need to use heat-related coping strategies may be more related to housing age and location than the fact that they identify as BIPOC.

Table 22: Survey Responses Among BIPOC Respondents

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	2	1	0
Using water for cooling*	0	3	1	0
Trouble sleeping due to heat	0	1	2	0
Leaving home due to heat	1	2	0	0
Total responses	1	8	4	0

*At least one respondent selected more than one option.

Six respondents identified as disabled or chronically ill, from a mix of all four neighbourhoods. Responses selected by these respondents were fairly equal, with slightly more people choosing “frequently”, in particular for using fans and trouble sleeping due to heat (Table 23). This suggests that some disabilities or chronic illnesses may contribute to people being more vulnerable to heat, while others may not. Those who receive disability employment and income assistance may also struggle with living on a low income (Bergen, 2022), which is linked to higher heat vulnerability.

Table 23: Survey Responses Among Disabled and Chronically Ill Respondents

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	1	1	1	3
Using water for cooling	2	2	0	2
Trouble sleeping due to heat	1	0	2	3
Leaving home due to heat*	1	2	2	0
Total responses	5	5	5	8

*One respondent did not select an option but commented that they did leave home before purchasing air conditioning.

Only respondent identified as a recent immigrant to Canada of less than five years. This individual lives Downtown and reported that while they occasionally use fans to keep cool, they never use water for cooling, have trouble sleeping, or leave home to avoid heat. The experience of one person cannot be generalized to the experience of all recent immigrants in Winnipeg.

Dwelling Type

The survey asked people what type of dwelling they live in. Options included a single-detached house, a semi-detached house, a duplex, a row house, an apartment building fewer than five storeys, or an apartment building with five or more storeys.

Of the 64 respondents, 43 live in single-detached houses (Table 24). Across the four questions, the most common response by far was “never”, followed by “occasionally”, then “sometimes” and “frequently”. This suggests that people living in single-detached houses are generally less vulnerable to heat. This of course will vary across neighbourhoods, as well as different housing ages and conditions.

Table 24: Survey Responses Among Respondents Living in Single-Detached Houses

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	15	6	8	13
Using water for cooling*	27	13	3	1
Trouble sleeping due to heat*	17	16	8	3
Leaving home due to heat**	33	7	0	2
Total responses	92	42	19	19

**At least one respondent selected more than one option.*

***One respondent did not select an option and commented that they did not directly leave home due to heat but did so indirectly.*

Only one respondent lives in a semi-detached house. This individual selected that they occasionally need to use fans for cooling and leave home to avoid heat, they sometimes have trouble sleeping due to heat, and selected both occasionally and

sometimes using water for cooling. They also selected that they have access to central air conditioning, which would mitigate their need to use other coping strategies.

Two respondents live in duplexes. One of them selected frequently for everything, except leaving home due to heat, where they commented that they did this before purchasing a window unit air conditioner. The other respondent (who has no air conditioning) selected occasionally for three of the four questions and frequently use fans for cooling. It is interesting in this case that the person with some access to air conditioning reported more frequent use of additional coping strategies than the person who has no access to air conditioning. This could be related to other housing or personal characteristics making this individual more vulnerable to heat.

Two respondents live in row houses. One has central air conditioning and the other has no air conditioning. Both reported frequently using fans and water for cooling. The person with no air conditioning reported occasionally having trouble sleeping and leaving home due to heat, while the person with no air conditioning reported sometimes having these issues. Again, these differences could be due to personal characteristics or differences in self-perceived heat risk.

Five respondents live in apartment buildings fewer than five storeys tall, with a mix of people from three of the four neighbourhoods (none from the North End). Across the four questions, the most common response was "frequently", followed by "occasionally", "never", and "sometimes" (Table 25). This suggests that people living in apartments are more vulnerable to heat compared to those living in single-detached houses. This may be because they are more likely to be renting, and as a result have less control over the heating and cooling of their living space (Zander et al., 2021).

Table 25: Survey Responses Among Respondents Living in Apartment Buildings Fewer Than Five Storeys Tall

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	2	0	3
Using water for cooling	2	1	0	2
Trouble sleeping due to heat	1	1	1	2
Leaving home due to heat	1	2	1	1
Total responses	4	6	2	8

Ten respondents live in apartment buildings five or more storeys tall, with a mix of people from three of the four neighbourhoods (none from the North End). Across the four questions, the most common response was “frequently”, followed by “occasionally”, “never”, and “sometimes” (Table 26). This is a similar distribution to responses from those living in smaller apartment buildings, which suggests that the level of heat risk is likely similar in apartment buildings of all sizes.

Table 26: Survey Responses Among Respondents Living in Apartment Buildings Five or More Storeys Tall

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	1	2	7
Using water for cooling	3	3	1	3
Trouble sleeping due to heat	2	3	1	4
Leaving home due to heat	3	4	3	0
Total responses	8	11	7	13

Housing Tenure

The survey asked respondents whether they own or rent their place of residence or have some other type of living arrangement. Fifty-two of the 64 respondents reported that they own their place of residence. Across the four questions, “never” was by far the most common response, followed by “occasionally” and then “sometimes” and “frequently” (Table 27) This suggests that people who own their place of residence

are generally less vulnerable to heat and need to use fewer other coping strategies. It is worth noting that 33 of these 52 respondents (63%) reported having access to central air conditioning, which would help reduce their vulnerability.

Table 27: Survey Responses Among Respondents Who Own Their Dwelling

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling*	15	10	8	18
Using water for cooling**	31	14	5	2
Trouble sleeping due to heat**	19	19	11	4
Leaving home due to heat***	36	13	0	2
Total responses	101	56	24	26

*One respondent did not select an option and commented that they chose to use a fan but did not need to.

**At least one respondent selected more than one option.

***One respondent did not select an option and commented that they did not directly leave home due to heat but did so indirectly.

Ten respondents reported that they rent their place of residence. Across the four questions, “frequently” was by far the most common response, followed by “sometimes” and “occasionally”, then “never” (Table 28). This suggests that renters experience much higher levels of heat vulnerability than those who own their dwellings, which aligns with existing literature on the subject (Zander et al., 2021).

Table 28: Survey Responses Among Respondents Who Rent Their Dwelling

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	0	1	9
Using water for cooling	1	2	0	7
Trouble sleeping due to heat	0	2	1	7
Leaving home due to heat*	0	3	5	1
Total responses	1	7	7	24

*One respondent did not select an option but commented that they did leave home before purchasing air conditioning.

The last two respondents reported that they have a living arrangement that is neither ownership nor rental. One of them lives Downtown and reports having access to a window unit air conditioner, while the other lives in the North End and has no air conditioning. The individual with no air conditioning reported that they frequently use fans for cooling and that they occasionally use water for cooling, have trouble sleeping, and leave home due to heat. The individual with air conditioning reported sometimes using fans for cooling and never using water for cooling, having trouble sleeping, or leaving home due to heat. These differences may be exclusively due to the presence or absence of air conditioning but could also be related to other factors such as housing conditions or personal levels of vulnerability.

Age

The survey asked respondents to identify their age based on four ranges: 18-30, 31-50, 51-70, and 71+. Eight of the 64 respondents selected that they are 18 to 30 years old, from a mix of the four neighbourhoods. Across the four questions, the most common response was “occasionally”, followed by “sometimes”, “frequently”, and “never” (Table 29). This suggests that young adults may have a moderate level of heat vulnerability, depending on their living situations and personal characteristics.

Table 29: Survey Responses Among Respondents Aged 18 to 30

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	0	2	3	3
Using water for cooling*	1	4	2	2
Trouble sleeping due to heat	1	2	4	1
Leaving home due to heat	3	5	0	0
Total responses	5	13	9	6

**At least one respondent selected more than one option.*

Twenty-two of the 64 respondents selected that they are 31 to 50 years old, from a mix of the four neighbourhoods. Across the four questions, the most common response was “never”, followed by “occasionally”, “frequently”, and “sometimes”. Using

fans for cooling was especially common and using water for cooling and leaving home due to heat were both very uncommon (Table 30). This suggests that respondents of this age group are able to mitigate heat with fans and do not need to rely on other coping strategies as much.

Table 30: Survey Responses Among Respondents Aged 31 to 50

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	5	4	2	11
Using water for cooling*	11	6	1	5
Trouble sleeping due to heat*	6	8	4	5
Leaving home due to heat	11	6	4	1
Total responses	33	24	11	22

*At least one respondent selected more than one option.

Twenty-eight of the 64 respondents selected that they are 51 to 70 years old, from a mix of the four neighbourhoods. Across the four questions, the most common response was “never”, followed by “occasionally”, “frequently”, and “sometimes” (Table 31). The distribution of responses for this age group is similar to that of the 31 to 50 year-old respondents, but with a higher proportion of responses for “never”, suggesting a lower level of overall heat vulnerability. Compared to 31 to 50 year-old respondents, 51 to 70 year-old respondents were more likely to live in a single-detached house and own their place of residence, which could contribute to lower levels of vulnerability.

Table 31: Survey Responses Among Respondents Aged 51 to 70

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling*	8	3	4	12
Using water for cooling	17	7	2	2
Trouble sleeping due to heat	9	11	3	5
Leaving home due to heat**	17	6	1	2
Total responses	51	27	10	21

**One respondent did not select an option and commented that they chose to use a fan but did not need to.*

***One respondent did not select an option but commented that they did leave home before purchasing air conditioning.*

Six of the 64 respondents selected that they are age 71 or older, all living in River Heights. Across the four questions, “never” was the most common response, followed by “occasionally”, then “sometimes” and “frequently” (Table 32). This is interesting because much of the literature on heat vulnerability says that the elderly are at an extremely high risk of suffering due to heat. It is possible that this discrepancy is because this group of respondents does not reflect the experience of seniors more broadly. The six seniors aged 71 or older who filled out the survey are a fairly homogeneous group. They are all from the same higher income neighbourhood (River Heights), live in single-detached houses, own their homes, and did not select any of the self-identified demographic groups discussed above. Five of the six also have access to some form of air conditioning. All things considered, this group of seniors is likely much less vulnerable than many other seniors in Winnipeg.

Table 32: Survey Responses Among Respondents Aged 71 and Older

	Never	Occasionally	Sometimes	Frequently
Using fans for cooling	2	1	1	2
Using water for cooling	4	2	0	0
Trouble sleeping due to heat	4	1	1	0
Leaving home due to heat	6	0	0	0
Total responses	16	4	2	2

Additional Coping Strategies

The last question on coping strategies asked respondents for any additional coping strategies they use to deal with heat. Three common themes emerged across all four neighbourhoods. First, many people close their curtains or blinds to prevent

their dwelling from heating up (home protective strategy). Second, people reiterated the use of water to cool off, both by drinking more fluids and by swimming or using cloths, showers, etc. (body-related strategies). Third, respondents described several strategies for avoiding the heat (activity-related strategies), including: staying in the basement, going to a lake, finding shade outdoors or using an umbrella, going to the movies, sleeping outdoors or on the floor, and planning activities to avoid the hottest times of day.

A few other themes appeared in the comments from individual neighbourhoods. Respondents in River Heights and Downtown both mentioned using windows to reduce heat, either by opening them for air circulation or by closing them to keep hot air out (a home-protective strategy). Wearing lighter and looser clothing was also mentioned as a coping strategy by people in both of these neighbourhoods (a body-related strategy). In South St. Vital, one person reiterated the use of fans to cool off. Lastly in River Heights, people mentioned limiting the use of their ovens and one person said that they are planting more trees on their property for shade. This last point is interesting because it is a more long-term home-protective coping strategy, while most other strategies are for finding immediate relief.

The survey data shows that some types of coping strategies are common across different neighbourhoods, regardless of differences in income or temperature. People are also more likely to adapt how they live at home, using body-related or home protective coping strategies, rather than travel somewhere else to avoid heat or use other activity-related coping strategies. Having widespread access to central air conditioning generally reduces the need for other coping mechanisms, which can be seen in the differences between South St. Vital and other neighbourhoods. This has implications for how to increase access to air conditioning in a way that is sustainable and will not cause pollution that worsens extreme heat.

What are the implications of this research for climate-informed planning in Winnipeg?

This research has demonstrated the coping strategies that Winnipeggers in four neighbourhoods use to deal with heat and shown some demographic trends in areas of the city that experience warmer and cooler average temperatures. While these results should not be generalized across all of Winnipeg, these results and comments from survey respondents have the potential to inform future policy decisions about how to mitigate the impacts of heat in Winnipeg.

One of the biggest concerns with extreme heat is the risk it poses to human health (Burbidge et al., 2022; Hammer et al., 2020; Hintz et al., 2018; Hlahla & Hill, 2018; Klinenberg, 2002). The survey asked respondents to consider whether they have ever felt that their own health or the health of someone in their neighbourhood has been put at risk due to heat. Seven of the total 64 respondents said that they have felt concerned for their own health, with issues including asthma and the impacts of a lack of sleep on both their mental and physical health. There were people in all four neighbourhoods who expressed concern for people they know or for others more generally (i.e. people who are unhoused, elderly, or without air conditioning). Health concerns regarding heat were slightly more common in Downtown and the North End, which could mean that these neighbourhoods are feeling the health impacts of heat more acutely. The City of Winnipeg may want to take this into account when making choices about heat-related policies and programs.

Survey respondents were also asked specifically about what they think the City of Winnipeg should do to help people in their neighbourhood stay cool during the summer. Similar ideas emerged from all four neighbourhoods, with several key themes. Winnipeggers are concerned about the city's tree canopy. Many people want to see the city planting more trees (in particular, mature trees) and quickly replacing trees that have died. Cooling centres came up frequently, with location suggestions including libraries, shopping malls, museums, community centres. People commented

that they would like to see the hours on these facilities extended so that people can spend more time away from the heat.

Pools and splash pads are also essential for communities to have outdoor public spaces to cool off. Respondents suggested having more locations that are open for longer hours and that the City should ensure these facilities have free admission. Other water-based suggestions included public drinking fountains and “misting stations” for people to cool off. The City has been doing some of these things already. During heatwaves in the summer of 2021, the City opened nine community centres as heat relief spaces, opened a heat relief tent in Central Park, handed out nearly 24,000 bottles of water at libraries, and placed water tanks in four key locations providing an average of 1,050 gallons of water daily (City of Winnipeg, 2021). The survey responses show that there is demand for these services and that they may need to be better communicated so that people are aware of the supports available.

Respondents also had some larger scale suggestions for policy and urban design that could help mitigate the impacts of heat in their communities. Design suggestions included installing more geothermal heat pumps, providing more shaded areas, painting concrete white to reflect heat instead of absorbing it, and updating building standards to require air conditioning and require that new builds maintain trees and/or green space on their properties. Suggested policy actions included lowering water and electricity costs, subsidizing and/or incentivising air conditioning, providing free public transit to pools, and implementing policies to reduce greenhouse gas emissions and the related effects of climate change. Some of these could be implemented quickly, while others would require more time to establish and may necessitate collaboration with other levels of government.

Lastly, the additional comments left in the final question of the survey provided some key reflections on planning for heat in Winnipeg. In particular, one respondent from the North End wrote detailed comments on the challenges related to heat equity in their neighbourhood. These are important issues, like making sure that older

neighbourhoods are prioritized for recreation facilities just as much as newer ones. It is also about making sure that every neighbourhood has access to cooling services close to home, so that transportation is not a barrier (Sanchez, 2019). Services should be as easily accessible as possible – if a registration process is necessary, it should have both online and off-line options. Most importantly, these comments reiterated the importance of planners and other decision-makers listening to community members and responding to their needs.

6.0 Conclusions

This project explored the demographics of those living in four Winnipeg neighbourhoods (River Heights, South St. Vital, Downtown, and the North End) and investigated the strategies they use to cope with heat. The census and survey data shows that higher income neighbourhoods are less vulnerable to heat, regardless of the average surface temperatures in the area. In fact, given the newer average age of construction and higher presence of air conditioning in South St. Vital, residents of that neighbourhood appear in some ways to be less vulnerable than those living in River Heights, despite South St. Vital having higher average surface temperatures. Overall, the census data and surveys showed that the four neighbourhoods share more demographic similarities with each other based on income than based on surface temperature.

The literature on heat vulnerability claims that several demographic groups are more vulnerable to heat, including seniors, BIPOC communities, disabled people, and those with lower incomes. The results of the online survey suggest that, in Winnipeg, more vulnerable groups may include renters, people living in apartment buildings, LGBTQ+ people, and Indigenous people. Other groups facing a moderate level of heat risk among survey respondents included young adults and people who are disabled or chronically ill. The results of the survey did not suggest that seniors or BIPOC people are more vulnerable to heat. However, as discussed above, this

analysis is limited because the individuals who identified with these groups all live in the highest-income study neighbourhood.

The presence or absence of air conditioning played a large role in people's self-perceived heat vulnerability and their need to use other coping strategies. Those with access to central air conditioning relied less on other strategies. Central air conditioning appears to be much more effective in reducing vulnerability than localized window units. Those without any air conditioning had to use several other coping strategies, but even people with access to air conditioning still felt the need to cope in additional ways. Using the framework established by Kemen et al. (2021), body-related and home-protective coping strategies were found to be more common than activity-related coping strategies. Some of the most commonly reported strategies included using fans, using water, and closing curtains or blinds. For those who needed to leave home to avoid the heat, privately-owned places were the most common destination. This could mean that Winnipeg needs more public places for cooling off.

Survey respondents highlighted several ways they would like to see the City of Winnipeg protect people from the impacts of heat. Trees were frequently mentioned, including protecting the existing tree canopy, planting new trees, and replacing ones that have died or been removed. Many people also commented that they would like to see increased numbers of cooling centres, pools, and splash pads, all with longer hours of operation. Additionally, there were broader policy and urban design suggestions like helping people afford air conditioning, adding more shade in public areas, and taking stronger action on climate change. The survey responses reflected the need to ensure that the effects of these decisions are distributed equitably across the city, so that people in all neighbourhoods can find relief from heat close to home. The City of Winnipeg is already pursuing many of these actions, so this research should reinforce the direction that the City has been taking and encourage them to expand on these programs and services that are shown to be in high demand.

The most important takeaway from this research is that heat vulnerability is extremely complex. It cannot and should not be boiled down to just one factor. While income might play the largest role in producing vulnerability in one neighbourhood, the most significant factor in another area could be housing quality, and in another it might be the age of the population. Planners and other researchers must recognize the intersectionality of all the factors explored in this research and understand that there is no silver bullet for solving heat vulnerability. This complexity does not mean that planners and policy makers do not have a role to play in protecting people from rising temperatures. Aside from the imperative need to take action on climate change and reducing emissions, this research has shown that many forms of heat vulnerability stem from systemic inequities. This means that reducing inequality in all forms is the single most important undertaking for making communities more resilient to extreme heat going forward.

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Appendix A: Online Survey

Informed Consent

You can print this screen to keep a copy of the consent form.

Title of Project: Human Heat Vulnerability and Strategies for Coping with Heat in Winnipeg, Manitoba

Principal Investigator: Julia Antonyshyn, Graduate Student, Department of City Planning, antonysj@myumanitoba.ca

Course Instructor: Dr. Orly Linovski, Associate Professor, Department of City Planning, University of Manitoba, Telephone: 204-474-6424, e-mail: orly.linovski@umanitoba.ca

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask using the above contact information. Please take the time to read this carefully and to understand any accompanying information.

Summary of Project: This research will compare the demographics of people living in areas of Winnipeg that are more vulnerable to extreme heat and areas that are less vulnerable to extreme heat. This research will also survey people living in high and low heat vulnerability areas to investigate strategies that individuals use to mitigate the impacts of heat in their lives.

Description of Course Assignment

City Planning graduate students must complete a Capstone Project as part of their Master's degree. The goal of the project is for students to conduct in-depth research on an issue of importance for planning practice. The students' information-gathering projects will be presented in class and will form the basis for a written report at the end of term.

The projects are undertaken under the supervision of the Course Instructor, Dr. Orly Linovski (see contact information below), in accordance with the protocols of the Human Ethics Secretariat of the University of Manitoba for research involving human subjects. This research has been approved by the Research Ethics Board at the University of Manitoba, Fort Garry campus.

Specific Activities to be Completed by Project Participant: Project participants will complete a short survey. All participants must be over the age of 18 and live within

the neighbourhood identified in the survey for more than one “heat season” (i.e. summer). They will be given the opportunity to respond to 19 questions regarding their experience of heat in their neighbourhood and any coping strategies they use to deal with heat.

Participants will also be given the option to enter a draw to win a \$25 gift card to Planet Pantry, a low-waste and refill store located in The Forks Johnston Terminal (25 Forks Market Rd.), which will not be linked to their survey responses. Participants will be able to access the link to enter the draw on the last page of the survey regardless of whether they choose to submit the survey. The draw will be held in March 2023 and the winner will be immediately contacted to arrange the receipt of the gift card.

Time Requirement:

This survey is expected to take about 15 minutes to complete.

Benefits

Direct benefits may include the opportunity for participants to share their perspective on a planning issue or challenge. Indirect benefits are that the final Capstone Projects will contribute to planning knowledge and may result in new strategies or policy directions to address planning issues and challenges. Students will also benefit by learning about conducting ethical research.

Risks

This survey is presented using the U.S website “SurveyMonkey.” Responses are thus subject to U.S. laws. Risks associated with participation are minimal and are similar to those associated with many email and social media websites such as Hotmail and Facebook.

Confidentiality

Information collected from participants will be used as part of the Capstone Project. Direct quotes may be published within the project report, but participants will be referred to anonymously (i.e., “a respondent from the [NEIGHBOURHOOD NAME] survey”). The data collected through this research is anonymous. This means that no personal or identifiable information will be collected or included in presentations or reports arising from the study. Please note that the survey responses/answers are not anonymous if you provide information that could be used to identify you. Any identifying information is discouraged in the response to the open questions.

Conflict of Interest Disclosure

The research team has no real or perceived conflicts of interest arising from this research project.

Use of Data, Secure Storage and Destruction of Research Data

The results from this project, including anonymized details, may be used for conference presentations and/or publication in journals and other academic and professional resources. Students' completed Capstone Projects will be publicly available through the University of Manitoba's website (<https://umanitoba.ca/architecture/department-city-planning>).

All information will be treated as confidential and securely stored in encrypted files and on the University of Manitoba-provided Individual File Storage system OneDrive under the researcher's personal University account, and subsequently destroyed at the end of the course (by the end of June 2023).

Copies of consent forms will be securely kept on file by the Course Instructor for information purposes only for two years and then destroyed, in accordance with University ethics policies.

This survey uses Google Forms. If you prefer not to submit your data through Google Forms, please contact Julia Antonyshyn (antonysj@myumanitoba.ca) so you can participate in an alternative method. The alternate method may decrease anonymity, but confidentiality will be maintained.

Participant Consent

By clicking "yes" below, you indicate that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities.

You are free to withdraw from the study before submitting the survey or refrain from answering any questions you prefer to omit, without prejudice or consequence. If you decide you would like to withdraw while completing the survey, you can exit the online survey at any time before clicking "Submit". Participants cannot withdraw after submitting their survey because the data cannot be linked back to them.

Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way.

An executive summary of the research as well as a copy of the final report will be made available by the end of June 2023 at the following link: <https://umanitoba.ca/architecture/departement-city-planning/student-work> This research has been approved by the Research Ethics Board at the University of Manitoba, Fort Garry campus. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Officer at 204-474-7122 or HumanEthics@umanitoba.ca.

Please note: In addition to completing the survey, you must click “submit” at the end of the survey to finalize your submission. If you do not click “submit” your data will not be recorded. Once you submit the survey, you are not able to edit or withdraw your data.

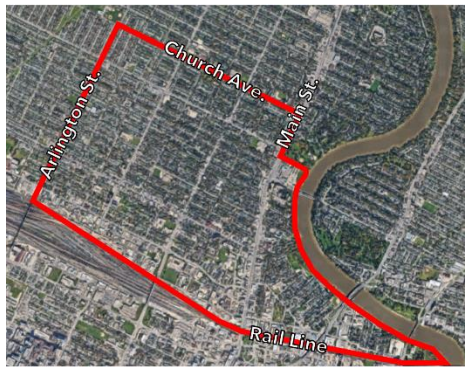
Thank you for your interest in this project. Your cooperation and insights are valuable and are greatly appreciated! Please click the following to be directed to the survey:

INFORMED CONSENT

1. I have understood the details of this consent form.
 - Yes
 - No
2. I confirm that I am 18 years of age or older.
 - Yes
 - No
3. I agree to participate in this study.
 - Yes
 - No

SCREENING QUESTIONS

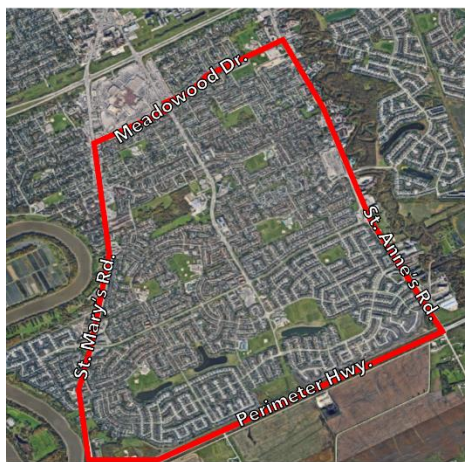
1. Which neighbourhood do you live in? Please view the reference maps to ensure you live within one of the neighbourhoods being studied.
 - Crescentwood/River Heights
 - South St. Vital
 - Downtown
 - North End
 - None of the above



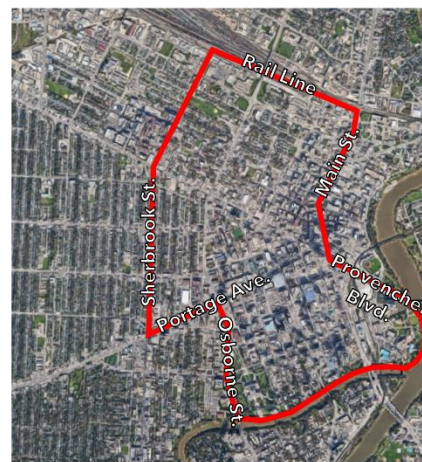
North End



Crescentwood/River Heights



South St. Vital



Downtown

2. Have you lived in your current neighbourhood for more than one "heat season" (i.e. summer)?
 - Yes
 - No

MAIN SURVEY

1. Is your place of residence air conditioned? Please provide any additional details in the space provided under "other".
 - No
 - Yes (window unit)
 - Yes (central air conditioning)
 - Other:

2. In the summers (June to September) of 2021 and 2022, did you ever need to rely on electric or handheld fans to keep cool? Please provide any additional details in the space provided under "other".

- Never
 - Occasionally
 - Sometimes
 - Frequently
 - Other:
3. In the summers (June to September) of 2021 and 2022, did you ever need to rely on water to keep cool (e.g. a cold bath/shower, damp cloths, etc.)? Please provide any additional details in the space provided under "other".
- Never
 - Occasionally
 - Sometimes
 - Frequently
 - Other:
4. In the summers (June to September) of 2021 and 2022, did you ever have trouble sleeping because of heat? Please provide any additional details in the space provided under "other".
- Never
 - Occasionally
 - Sometimes
 - Frequently
 - Other:
5. In the summers (June to September) of 2021 and 2022, did you ever need to leave your home to keep cool? Please provide any additional details in the space provided under "other".
- Never
 - Occasionally
 - Sometimes
 - Frequently
 - Other:
6. If you left your home in the summers (June to September) of 2021 and 2022 to keep cool, where did you go? Please provide any additional details in the space provided under "other".
- Not applicable
 - Go to a friend's/family member's house
 - Go to a public place (park, library, public plaza)
 - Go to a privately-owned place (shopping mall, grocery store)

- Go somewhere else (please describe below)
 - Other:
7. What other strategies, if any, do you use to keep cool during the summer?
8. Have you ever felt that your health or the health of someone in your neighbourhood is at risk because of heat? If so, please describe in the space provided under "other".
- Yes, myself
 - Yes, someone I know
 - No
 - Other:
9. What do you think the City of Winnipeg should do to help people in your neighbourhood keep cool during the summer?
10. Do you have any other comments about how heat impacts you and your neighbourhood that were not covered by this survey?
11. How old are you?
- 18-30
 - 31-50
 - 51-70
 - 71+
12. What is your gender?
- Female
 - Male
 - Non-binary
 - Transgender woman
 - Transgender man
 - Two-Spirit
 - Prefer not to say
 - Other:
13. How long have you lived in your current neighbourhood? If you wish to provide a specific number of years, please do so in the space under "other".
- 1-5 years
 - 5-10 years
 - 10-20 years

- More than 20 years
- Other:

14. Do any of the following identities apply to you? Please select all that apply.

- LGBTQ+
- Indigenous (First Nations, Metis, or Inuit)
- BIPOC (Black, Indigenous, People of Colour)
- Disability/Chronic Illness
- Recent Immigrant to Canada (less than five years)
- None of the above
- Prefer not to say

15. What type of residence do you live in?

- Single-detached house
- Semi-detached house
- Duplex
- Row House
- Apartment building fewer than 5 storeys
- Apartment building with 5 or more storeys
- Other:

16. Do you own or rent your place of residence? Please provide any additional details in the space provided under "other".

- Own
- Rent
- Other (e.g. living with someone else):

Thank you for your interest in this project. Your cooperation and insights are valuable and are greatly appreciated! Please remember that once you click "Submit" you will not be able to edit or withdraw your data.

To be entered in a draw for the \$25 gift card to Planet Pantry, please click on the link below to provide your name and contact information. This page is separate from the survey and will not be linked to your responses.

Please remember to click "Submit" on this survey so that your response is recorded. If you are entering in the gift card draw, you must click "Submit" in both tabs of your browser.

<https://forms.gle/qaMCZM7nHWcTaVnMA>

Appendix B: Neighbourhood Census Data

		River Heights					
	Winnipeg (CSD)	6020010.00	6020008.00	6020009.00	6020005.00	6020004.01	
Population 2021	749,607	5,356	2,850	2,999	5,511	4,554	
Pop % change (2016-2021)	6.30%	-0.30%	-4.20%	-2.70%	-4.40%	-4.00%	
Pop density (per km2)	1,623.3	3,064.9	2,539.20	3,033.30	2,323.60	4,124.60	
Men +	369,205	2,600	1,405	1,420	2,570	2,145	
Women +	380,400	2,755	1,440	1,580	2,945	2,410	
Age 0-14 (%)	16.6%	12.60%	15.40%	16.80%	15.30%	11.70%	
Age 15-64 (%)	66.4%	69.30%	66.80%	65.30%	57.30%	68.80%	
Age 65+ (%)	17.0%	18.20%	17.70%	17.70%	27.50%	19.40%	
Average age	40.3	42.6	42.5	41.6	46.6	43.2	
Median age	38.8	42.0	45.6	44.0	48.4	42.0	
Total occupied private dwellings	300,430	2,430	1,135	1,210	2,025	2,265	
Single-detached house	172,765	1,205	1,065	1,205	1,855	1,240	
Semi-detached house	12,015	30	5	0	15	35	
Row house	11,700	10	0	0	5	0	
Apartment or flat in a duplex	5,515	190	25	10	10	45	
Apartment building fewer than 5 stories	56,430	735	35	0	35	195	
Apartment building 5 or more stories	41,055	250	0	0	95	755	
Other single-attached house	285	0	0	0	0	0	
Movable dwelling	665	0	0	0	0	0	
Average household size	2.5	2.2	2.5	2.5	2.6	2.0	
Multi-generational households	1,755	20	10	10	25	25	

Median total income in 2020	\$39,600	\$52,400	60,400	60,800	55,200	42,400
Median after-tax income in 2020	\$35,200	\$44,400	48,800	50,400	46,800	37,200

Number of COVID-19 benefits recipients	160,780	1,085	475	465	860	900
Prevalence of low income (age 0-17) based on Low-income cut-offs, after tax (LICO-AT)	9.6%	5.00%	5.20%	4.00%	1.60%	8.00%
Prevalence of low income (age 18-64) based on Low-income cut-offs, after tax (LICO-AT)	9.1%	7.60%	5.00%	3.50%	2.40%	7.60%
Prevalence of low income (age 65+) based on Low-income cut-offs, after tax (LICO-AT)	4.1%	2.60%	2.00%	2.40%	2.00%	4.00%
Indigenous identity	90,995	520	150	100	190	330
First Nations	40,290	180	25	0	35	100
Metis	47,915	330	120	70	155	215
Inuit	455	0	0	0	0	0
Multiple Indigenous responses	1,600	0	0	0	0	0
Household tenure (owner)	189,575	1,605	980	1,165	1,875	1,240
Household tenure (renter)	110,855	820	155	70	150	1,030
Average # of rooms per dwelling	5.7	6.6	8.2	7.6	7.5	5.2
Period of construction (1960 or before)	94,010	1,835	1,015	1,170	1,465	1,370
Period of construction (1961 to 1980)	92,410	330	35	35	380	595

Period of construction (1981 to 1990)	36,600	80	10	10	85	130
Period of construction (1991 to 2000)	19,030	55	0	0	60	90
Period of construction (2001 to 2005)	9,695	50	0	0	0	25

Period of construction (2006 to 2010)	12,055	10	30	0	0	10
Period of construction (2011 to 2015)	15,490	35	0	10	20	0
Period of construction (2016 to 2021)	21,140	25	45	0	15	40
Dwelling condition (maintenance and minor repairs needed)	280,850	2,150	1,050	1,100	1,880	2,115
Dwelling condition (major repairs needed)	19,580	275	85	125	150	155
Households 'spending 30% or more of income on shelter costs' or 'not suitable' or 'major repairs needed'	94,430	770	220	225	325	800
Spending 30% or more of income on shelter costs only	52,455	435	125	80	150	505
Not suitable only	18,635	55	0	10	25	120
Major repairs needed only	13,810	220	75	115	130	125
Acceptable housing	206,000	1,655	915	1,005	1,705	1,470
In core housing need	34,425	180	75	35	85	285
Not in core housing need	258,120	2,190	1,050	1,180	1,930	1,955
Canadian citizens	634,515	5,155	2,740	2,950	5,025	3,895
Not Canadian citizens	102,145	305	145	55	150	535

Non-immigrant	505,525	4,715	2,475	2,680	4,465	3,250
Immigrant before 1980	29,080	200	145	160	320	205
Immigrant 1980 to 1990	17,290	80	20	40	90	75
Immigrant 1991 to 2000	17,060	80	40	35	95	100
Immigrant 2001 to 2010	48,280	105	65	55	105	190
Immigrant 2011 to 2021	89,330	200	85	20	100	445

Racialized population	253,630	585	195	200	400	980
South Asian	62,460	120	55	60	75	205
Chinese	22,745	70	30	45	75	55
Black	40,085	85	40	15	40	85
Filipino	83,305	30	0	35	80	330
Arab	7,035	50	0	0	10	35
Latin American	8,910	30	40	0	15	105
Southeast Asian	10,285	20	10	15	20	55
West Asian	3,280	60	0	0	0	50
Korean	3,825	15	0	0	0	0
Japanese	1,520	40	0	0	15	30
Other racialized population (visible minority n.i.e.)	2,800	10	0	10	35	35
Rest of the population	483,030	4,870	2,690	2,805	4,775	3,450
No certificate, diploma, or degree	89,430	445	205	160	430	415
High school diploma or equivalency certificate	182,910	1,000	535	475	955	1,110
Postsecondary certificate or diploma below bachelor level	161,460	675	365	380	870	950
Bachelor's degree or higher	178,745	2,630	1,370	1,460	2,085	1,460
Employed (in the labour force)	366,595	3,010	1,595	1,655	2,655	2,460

Unemployed (in the labour force)	35,770	295	165	115	150	180
Not in the labour force	210,185	1,445	715	715	1,530	1,285
Participation rate	65.7%	69.6%	71.30%	71.30%	64.90%	67.30%
Employment rate	59.8%	63.4%	64.60%	66.90%	61.20%	62.60%
Unemployment rate	8.9%	8.9%	9.40%	6.50%	5.30%	6.80%
Vehicle as driver (main mode of commuting)	217,750	1,390	740	880	1,425	1,305
Vehicle as passenger (main mode of commuting)	27,305	140	80	80	175	165

Public transit (main mode of commuting)	27,710	185	35	50	70	195
Walked (main mode of commuting)	14,090	220	55	45	90	190
Bicycle (main mode of commuting)	3,880	75	75	65	75	45
Other (main mode of commuting)	6,050	65	50	55	25	40

		River Park South					
	Winnipeg (CSD)	6020100.01	6020100.10	6020100.09	6020100.05	6020100.07	
Population 2021	749,607	7,133	5,749	3,721	4,381	5,151	
Pop % change (2016-2021)	6.30%	1.70%	-2.70%	23.80%	-1.70%	0.60%	
Pop density (per km2)	1,623.3	3,047.60	3,719.40	1,261.40	3,126.80	3,710.80	
Men +	369,205	3,515	2,760	1,850	2,120	2,365	
Women +	380,400	3,615	2,990	1,870	2,260	2,780	
Age 0-14 (%)	16.6%	20.40%	12.80%	21.00%	15.40%	11.80%	
Age 15-64 (%)	66.4%	67.30%	64.20%	67.60%	63.8%	58.60%	
Age 65+ (%)	17.0%	12.10%	23.10%	11.30%	20.80%	29.60%	
Average age	40.3	37.9	45.9	37.2	42.6	48.3	
Median age	38.8	39.2	49.2	38.4	42.8	50.8	
Total occupied private dwellings	300,430	2,380	2,205	1,235	1,775	2,180	
Single-detached house	172,765	2,160	1,395	955	1,060	1,145	
Semi-detached house	12,015	25	90	0	180	60	
Row house	11,700	50	35	60	130	15	
Apartment or flat in a duplex	5,515	0	0	0	0	0	
Apartment building fewer than 5 stories	56,430	145	605	0	400	625	
Apartment building 5 or more stories	41,055	0	80	220	0	0	
Other single-attached house	285	0	0	0	0	0	
Movable dwelling	665	0	0	0	0	330	
Average household size	2.5	3.0	2.5	3.0	2.4	2.2	
Multi-generational households	1,755	85	45	35	50	40	
Median total income in 2020	\$39,600	50,800	46,800	52,800	45,200	41,600	
Median after-tax income in 2020	\$35,200	43,200	40,400	44,400	39,200	36,400	
Number of COVID-19 benefits recipients	160,780	1,215	1,020	600	825	870	

Prevalence of low income (age 0-17) based on Low-income cut-offs, after tax (LICO-AT)	9.6%	3.40%	5.40%	2.20%	4.00%	5.80%
Prevalence of low income (age 18-64) based on Low-income cut-offs, after tax (LICO-AT)	9.1%	2.70%	3.50%	2.20%	4.00%	4.50%
Prevalence of low income (age 65+) based on Low-income cut offs, after tax (LICO-AT)	4.1%	1.80%	1.60%	**	1.80%	2.20%
Indigenous identity	90,995	485	340	270	505	505
First Nations	40,290	95	50	40	75	115
Metis	47,915	370	275	220	420	380
Inuit	455	0	0	10	0	0
Multiple Indigenous responses	1,600	15	10	0	0	0
Household tenure (owner)	189,575	2,240	1,950	1,185	1,475	1,775
Household tenure (renter)	110,855	165	260	55	285	405
Average # of rooms per dwelling	5.7	7.3	6.4	6.9	6.2	5.9
Period of construction (1960 or before)	94,010	15	10	10	20	30
Period of construction (1961 to 1980)	92,410	75	20	0	620	545
Period of construction (1981 to 1990)	36,600	1,140	290	115	940	1,075
Period of construction (1991 to 2000)	19,030	235	960	75	80	360
Period of construction (2001 to 2005)	9,695	90	370	315	10	45
Period of construction (2006 to 2010)	12,055	420	250	140	0	20

Period of construction (2011 to 2015)	15,490	325	205	340	60	70
Period of construction (2016 to 2021)	21,140	105	105	230	25	35
Dwelling condition (maintenance and minor repairs needed)	280,850	2,380	2,180	1,205	1,690	2,115
Dwelling condition (major repairs needed)	19,580	25	30	30	70	70
Households 'spending 30% or more of income on shelter costs' or 'not suitable' or 'major repairs needed'	94,430	350	340	180	355	435
Spending 30% or more of income on shelter costs only	52,455	250	240	120	200	305
Not suitable only	18,635	70	60	30	75	55
Major repairs needed only	13,810	15	15	20	65	50
Acceptable housing	206,000	2,055	1,865	1,055	1,405	1,745
In core housing need	34,425	95	115	25	85	145
Not in core housing need	258,120	2,270	2,075	1,200	1,660	2,010
Canadian citizens	634,515	6,515	5,140	3,425	3,910	4,510
Not Canadian citizens	102,145	655	380	320	325	385
Non-immigrant	505,525	5,235	4,290	2,790	3,250	3,765
Immigrant before 1980	29,080	170	205	110	205	155
Immigrant 1980 to 1990	17,290	150	135	75	70	135
Immigrant 1991 to 2000	17,060	140	90	125	75	75
Immigrant 2001 to 2010	48,280	515	300	220	185	260
Immigrant 2011 to 2021	89,330	825	445	375	365	390
Racialized population	253,630	2,325	1,380	1,235	1,075	1,295
South Asian	62,460	540	255	330	395	390
Chinese	22,745	460	255	230	115	175

Black	40,085	440	345	265	230	240
Filipino	83,305	445	135	200	125	185
Arab	7,035	50	170	0	35	45
Latin American	8,910	60	90	10	50	45
Southeast Asian	10,285	55	35	50	20	65
West Asian	3,280	55	0	0	0	50
Korean	3,825	75	20	40	0	30
Japanese	1,520	20	20	25	0	10
Other racialized population (visible minority n.i.e.)	2,800	50	15	30	40	0
Rest of the population	483,030	4,845	4,140	2,520	3,165	3,605
No certificate, diploma, or degree	89,430	525	515	315	470	555
High school diploma or equivalency certificate	182,910	1,455	1,355	640	1,185	1,320
Postsecondary certificate or diploma below bachelor level	161,460	1,590	1,485	745	940	1,335
Bachelor's degree or higher	178,745	2,095	1,525	1,180	1,005	1,085
Employed (in the labour force)	366,595	3,665	2,870	1,920	2,130	2,265
Unemployed (in the labour force)	35,770	225	270	140	155	170
Not in the labour force	210,185	1,765	1,740	825	1,310	1,855
Participation rate	65.7%	68.80%	64.40%	71.50%	63.60%	57.00%
Employment rate	59.8%	64.80%	58.90%	66.70%	59.20%	52.80%
Unemployment rate	8.9%	5.80%	8.60%	6.80%	6.80%	7.00%
Vehicle as driver (main mode of commuting)	217,750	2,345	1,860	1,220	1,335	1,460
Vehicle as passenger (main mode of commuting)	27,305	205	160	125	110	150
Public transit (main mode of commuting)	27,710	195	85	45	95	135
Walked (main mode of commuting)	14,090	45	45	35	55	80

Bicycle (main mode of commuting)	3,880	15	10	0	15	10
Other (main mode of commuting)	6,050	50	55	25	60	25

		Downtown					
	Winnipeg (CSD)	6020023.00	6020025.00	6020022.00	6020026.00	6020014.00	6020013.00
Population 2021	749,607	5,204	4,122	4,378	2,140	6,582	2,326
Pop % change (2016-2021)	6.30%	-2.40%	8.70%	-6.70%	3.80%	11.20%	39%
Pop density (per km2)	1,623.3	12,207.40	3,937.30	7,710.50	3,697.90	9,615.80	2,352.80
Men +	369,205	2,625	2,120	2,345	1,120	3,510	1,325
Women +	380,400	2,580	2,005	2,035	1,020	3,070	995
Age 0-14 (%)	16.6%	13.80%	25.00%	18.00%	23.40%	7.10%	7.50%
Age 15-64 (%)	66.4%	68.40%	64.70%	73.20%	65.90%	78.60%	85.40%
Age 65+ (%)	17.0%	17.80%	10.50%	8.80%	10.70%	14.20%	7.10%
Average age	40.3	41.5	34.2	35.2	35.5	40.1	37.1
Median age	38.8	39.6	32.0	33.2	34.0	35.6	33.2
Total occupied private dwellings	300,430	2,815	1,635	1,875	825	4,215	1,290
Single-detached house	172,765	10	240	345	210	5	5
Semi-detached house	12,015	5	45	20	35	0	0
Row house	11,700	0	30	25	50	0	0
Apartment or flat in a duplex	5,515	5	60	135	60	0	0
Apartment building fewer than 5 stories	56,430	335	310	1,010	270	1,035	215
Apartment building 5 or more stories	41,055	2,445	950	335	190	3,170	1,070
Other single-attached house	285	0	0	10	5	0	0
Movable dwelling	665	0	0	0	0	0	0
Average household size	2.5	1.8	2.4	2.2	2.5	1.5	1.6
Multi-generational households	1,755	30	35	35	30	10	0
Median total income in 2020	\$39,600	28,800	27,800	25,400	25,800	34,400	38,000
Median after-tax income in 2020	\$35,200	26,600	26,000	24,200	24,800	31,400	33,600

Number of COVID-19 benefits recipients	160,780	1,475	1,000	1,320	585	1,875	590
Prevalence of low income (age 0-17) based on Low-income cut-offs, after tax (LICO-AT)	9.6%	28.40%	31.60%	34.00%	27.80%	25.20%	17.00%
Prevalence of low income (age 18-64) based on Low-income cut-offs, after tax (LICO-AT)	9.1%	26.90%	24.80%	31.50%	27.20%	20.20%	19.00%
Prevalence of low income (age 65+) based on Low-income cut-offs, after tax (LICO-AT)	4.1%	18.00%	21.00%	17.00%	20.00%	11.00%	6.00%
Indigenous identity	90,995	835	925	1,130	425	830	185
First Nations	40,290	550	645	950	320	425	70
Metis	47,915	255	240	135	100	375	105
Inuit	455	0	0	0	0	0	0
Multiple Indigenous responses	1,600	10	15	25	0	10	0
Household tenure (owner)	189,575	295	250	295	225	285	35
Household tenure (renter)	110,855	2,600	1,450	1,500	520	4,025	1,160
Average # of rooms per dwelling	5.7	3.0	3.7	4.0	4.4	3.2	2.8
Period of construction (1960 or before)	94,010	815	750	955	370	1,105	240
Period of construction (1961 to 1980)	92,410	1,200	330	355	135	1,470	480
Period of construction (1981 to 1990)	36,600	510	160	145	45	1,045	115
Period of construction (1991 to 2000)	19,030	170	150	110	40	220	70
Period of construction (2001 to 2005)	9,695	25	30	25	10	60	30

Period of construction (2006 to 2010)	12,055	25	75	55	40	65	55
Period of construction (2011 to 2015)	15,490	65	90	55	65	65	55
Period of construction (2016 to 2021)	21,140	70	110	95	20	275	155
Dwelling condition (maintenance and minor repairs needed)	280,850	2,640	1,610	1,570	650	4,040	1,120
Dwelling condition (major repairs needed)	19,580	255	90	220	90	270	70
Households 'spending 30% or more of income on shelter costs' or 'not suitable' or 'major repairs needed'	94,430	1,575	720	980	345	2,060	560
Spending 30% or more of income on shelter costs only	52,455	780	375	485	135	1,385	345
Not suitable only	18,635	465	210	200	110	320	120
Major repairs needed only	13,810	130	35	120	55	140	35
Acceptable housing	206,000	1,320	975	810	400	2,255	630
In core housing need	34,425	885	450	540	180	925	170
Not in core housing need	258,120	1,910	1,210	1,155	555	3,175	925
Canadian citizens	634,515	3,560	2,975	2,990	1,395	4,940	1,015
Not Canadian citizens	102,145	1,585	1,280	910	500	1,575	875
Non-immigrant	505,525	2,495	2,215	2,220	875	4,060	790
Immigrant before 1980	29,080	190	40	135	85	195	30
Immigrant 1980 to 1990	17,290	130	165	165	105	130	25
Immigrant 1991 to 2000	17,060	155	135	115	70	115	20
Immigrant 2001 to 2010	48,280	470	285	330	185	345	65
Immigrant 2011 to 2021	89,330	1,300	1,275	585	495	915	490

Racialized population	253,630	3,060	2,425	1,930	1,130	2,640	1,060
South Asian	62,460	260	45	270	45	580	355
Chinese	22,745	115	290	95	20	125	95
Black	40,085	1,655	1,065	680	400	875	205
Filipino	83,305	690	440	470	470	335	150
Arab	7,035	45	320	0	110	170	20
Latin American	8,910	30	50	35	0	275	130
Southeast Asian	10,285	125	70	265	55	75	35
West Asian	3,280	30	55	30	0	20	0
Korean	3,825	40	0	15	0	50	0
Japanese	1,520	0	0	0	0	15	0
Other racialized population (visible minority n.i.e.)	2,800	30	0	0	0	10	10
Rest of the population	483,030	2,080	1,830	1,975	760	3,875	825
No certificate, diploma, or degree	89,430	1,090	1,050	910	515	600	160
High school diploma or equivalency certificate	182,910	1,315	820	1,100	555	1,710	370
Postsecondary certificate or diploma below bachelor level	161,460	985	535	685	270	1,665	400
Bachelor's degree or higher	178,745	965	645	510	195	2,015	830
Employed (in the labour force)	366,595	2,065	1,445	1,540	695	3,845	1,230
Unemployed (in the labour force)	35,770	350	235	275	125	410	160
Not in the labour force	210,185	1,950	1,375	1,380	710	1,740	370
Participation rate	65.7%	55.30%	54.90%	56.80%	53.70%	71.00%	79.00%
Employment rate	59.8%	47.40%	47.40%	48.20%	45.30%	64.10%	69.90%
Unemployment rate	8.9%	14.50%	14.00%	15.20%	15.20%	9.60%	11.50%
Vehicle as driver (main mode of commuting)	217,750	635	550	580	350	1,320	255
Vehicle as passenger (main mode of commuting)	27,305	180	140	120	75	190	35

Public transit (main mode of commuting)	27,710	605	195	430	155	630	250
Walked (main mode of commuting)	14,090	285	255	170	60	660	255
Bicycle (main mode of commuting)	3,880	10	20	15	0	70	10
Other (main mode of commuting)	6,050	50	50	15	0	75	25

		North End					
	Winnipeg (CSD)	6020043.00	6020034.00	6020035.00	6020036.00	6020042.00	6020045.00
Population 2021	749,607	4,551	2,693	1,859	811	2,650	6,438
Pop % change (2016-2021)	6.30%	10.50%	-3.20%	2.80%	9.60%	-1.80%	2.60%
Pop density (per km2)	1,623.3	3,553.80	3,483.40	3,753.30	1,511.60	5,526.60	6,169.60
Men +	369,205	2,305	1,395	890	430	1,370	3,250
Women +	380,400	2,250	1,300	970	385	1,285	3,190
Age 0-14 (%)	16.6%	23.30%	28.60%	18.00%	17.80%	21.10%	21.30%
Age 15-64 (%)	66.4%	65.50%	60.50%	56.70%	68.70%	69.80%	67.50%
Age 65+ (%)	17.0%	11.20%	10.90%	25.00%	12.90%	9.10%	11.30%
Average age	40.3	35.7	34.6	44.7	39.8	35.5	36.5
Median age	38.8	34.0	32.8	42.0	40.8	34.0	35.2
Total occupied private dwellings	300,430	1,715	1,015	675	390	1,035	2,325
Single-detached house	172,765	770	260	310	160	425	1,525
Semi-detached house	12,015	105	40	55	20	55	120
Row house	11,700	105	170	15	5	0	5
Apartment or flat in a duplex	5,515	170	90	80	20	215	255
Apartment building fewer than 5 stories	56,430	310	175	170	80	335	320
Apartment building 5 or more stories	41,055	245	260	45	95	5	75
Other single-attached house	285	5	5	5	5	5	25
Movable dwelling	665	0	0	0	0	0	0
Average household size	2.5	2.6	2.5	2.3	2.0	2.6	2.8
Multi-generational households	1,755	80	40	20	10	50	115
Median total income in 2020	\$39,600	27,200	25,000	29,800	26,600	29,200	32,400
Median after-tax income in 2020	\$35,200	25,800	24,000	27,800	25,600	26,800	29,400

Number of COVID-19 benefits recipients	160,780	1,455	700	435	255	875	1,925
Prevalence of low income (age 0-17) based on Low-income cut-offs, after tax (LICO-AT)	9.6%	24.00%	23.40%	20.40%	25.00%	25.20%	15.80%
Prevalence of low income (age 18-64) based on Low-income cut-offs, after tax (LICO-AT)	9.1%	20.20%	27.00%	21.80%	28.00%	19.20%	11.20%
Prevalence of low income (age 65+) based on Low-income cut-offs, after tax (LICO-AT)	4.1%	14.80%	21.00%	8.00%	20.00%	13.00%	10.40%
Indigenous identity	90,995	1,940	1,235	765	335	1,075	2,070
First Nations	40,290	1,365	815	455	260	735	1,300
Metis	47,915	545	370	260	80	290	715
Inuit	455	0	0	0	0	0	0
Multiple Indigenous responses	1,600	20	20	50	0	30	40
Household tenure (owner)	189,575	580	205	255	150	390	1,260
Household tenure (renter)	110,855	1,115	780	470	235	555	1,040
Average # of rooms per dwelling	5.7	4.7	4.5	5.5	4.6	5.4	5.3
Period of construction (1960 or before)	94,010	945	405	435	230	700	1,665
Period of construction (1961 to 1980)	92,410	345	385	105	70	105	370
Period of construction (1981 to 1990)	36,600	120	35	65	20	30	85
Period of construction (1991 to 2000)	19,030	75	55	50	20	35	65
Period of construction (2001 to 2005)	9,695	25	30	15	0	0	10

Period of construction (2006 to 2010)	12,055	40	20	20	10	35	60
Period of construction (2011 to 2015)	15,490	45	30	15	10	20	45
Period of construction (2016 to 2021)	21,140	100	20	15	20	20	10
Dwelling condition (maintenance and minor repairs needed)	280,850	1,450	820	625	335	770	1,995
Dwelling condition (major repairs needed)	19,580	245	165	100	50	175	310
Households 'spending 30% or more of income on shelter costs' or 'not suitable' or 'major repairs needed'	94,430	870	445	345	160	470	980
Spending 30% or more of income on shelter costs only	52,455	385	200	185	90	195	355
Not suitable only	18,635	220	800	30	20	75	290
Major repairs needed only	13,810	165	130	60	20	120	235
Acceptable housing	206,000	820	535	380	230	475	1,325
In core housing need	34,425	480	295	200	95	260	450
Not in core housing need	258,120	1,120	655	500	275	655	1,800
Canadian citizens	634,515	3,970	2,155	1,610	735	2,165	5,645
Not Canadian citizens	102,145	470	285	95	65	235	725
Non-immigrant	505,525	3,110	1,855	1,445	655	1,880	4,265
Immigrant before 1980	29,080	125	35	80	20	80	135
Immigrant 1980 to 1990	17,290	115	115	45	0	65	195
Immigrant 1991 to 2000	17,060	110	55	25	20	25	225
Immigrant 2001 to 2010	48,280	420	90	40	55	105	660
Immigrant 2011 to 2021	89,330	510	285	70	35	200	785

Racialized population	253,630	1,485	695	205	155	560	2,550
South Asian	62,460	55	0	0	0	35	60
Chinese	22,745	10	25	20	20	0	15
Black	40,085	245	380	110	55	110	175
Filipino	83,305	920	145	35	55	260	1,955
Arab	7,035	0	0	0	0	0	0
Latin American	8,910	65	45	0	0	50	95
Southeast Asian	10,285	95	50	15	0	85	150
West Asian	3,280	0	0	0	0	0	0
Korean	3,825	15	0	0	0	0	0
Japanese	1,520	0	0	0	0	0	0
Other racialized population (visible minority n.i.e.)	2,800	0	10	0	0	0	0
Rest of the population	483,030	2,950	1,745	1,500	640	1,845	3,825
No certificate, diploma, or degree	89,430	1,345	785	365	225	695	1,390
High school diploma or equivalency certificate	182,910	1,050	485	455	240	620	1,715
Postsecondary certificate or diploma below bachelor level	161,460	695	310	295	165	445	1,190
Bachelor's degree or higher	178,745	300	135	165	55	190	760
Employed (in the labour force)	366,595	1,210	485	530	315	785	2,685
Unemployed (in the labour force)	35,770	330	165	100	40	200	375
Not in the labour force	210,185	1,855	1,070	650	325	965	2,000
Participation rate	65.7%	45.40%	38.10%	49.40%	52.60%	50.50%	60.50%
Employment rate	59.8%	35.60%	28.20%	41.20%	46.00%	40.30%	53.10%
Unemployment rate	8.9%	21.40%	25.20%	15.70%	11.10%	20.30%	12.30%
Vehicle as driver (main mode of commuting)	217,750	640	280	210	160	410	1,570

Vehicle as passenger (main mode of commuting)	27,305	155	30	25	55	70	455
Public transit (main mode of commuting)	27,710	180	90	95	40	155	340
Walked (main mode of commuting)	14,090	65	40	35	15	50	65
Bicycle (main mode of commuting)	3,880	30	10	15	0	0	20
Other (main mode of commuting)	6,050	60	10	0	0	0	35