

Summary and Conclusions from the Study:

**Heat Waves in Southern Quebec:
Current Adaptation and
Suggestions for Future Adaptation**

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EXECUTIVE SUMMARY

In the context of Canada's obligations under the Kyoto Protocol, Natural Resources Canada is coordinating a national-scale scientific assessment of climate change impacts, which is expected to be finalized shortly. In order to contribute to the health component of this assessment and to set the first milestones for adapting to future climate conditions, as described in the Quebec action plan on climate change, the Direction des risques biologiques, environnementaux et occupationnels of the Institut national de santé publique du Québec (INSPQ) has proposed conducting further research on the ways in which the population of southern Quebec is vulnerable to climate change, and assessing the capacity of this population and certain institutions to mitigate the associated health risks.

In this context, the present report examines ways of adapting to heat waves, which are among the extreme weather phenomena expected to increase in frequency during the coming decades, due to changes in climate averages and variability in Canada. A considerable number of publications have already drawn attention to the health impacts of these changes.

In concrete terms, this document summarizes findings from a telephone survey (n=2,543), conducted in the spring of 2005 among the general population living in southern Quebec, and seeks to answer the following questions:

- Who has access to air conditioning and fans?
- How are these units used during heat waves?
- What are the main characteristics of people who use these units during heat waves?
- What are the preferred places to cool off during hot spells?
- Which indicators differentiate people who prefer to stay home during extreme temperatures from those who go elsewhere?
- What types of drinks are consumed during heat waves?
- Who goes out to run errands or to engage in intense physical activity in spite of the extreme heat?
- What preventive behaviours do they adopt in order to prevent the adverse effects of extreme heat?

In addition, the report suggests various strategies for future adaptation, a number of which are already being recommended nationally and internationally.

Current Adaptation

Access to and Use of Air Conditioners and Fans

Among all of the respondents, 10.2% did not have either an air conditioner or a fan in their home, 53.9% had only fans, 26.2% had both fans and air conditioners, and 9.6% only air conditioners. Nearly half of the participants with air conditioners (35.8%) had access to a central or wall system (known as “fixed,” as opposed to a “removable” system, such as a mobile or window air conditioner).

Respondents who earned \$60,000 or more before tax, from all sources, in the past twelve months (45.5%) were more often equipped with an air conditioner at home than were less wealthy people (<\$15,000: 22.1%; other income brackets: 28.5% to 39.4%) and seniors (41.3%), compared to people aged 35-64 years (36.9%) and 18-34 years (31.0%), and respondents living with other people (38.4%) compared to participants living alone (26.1%). The prevalence of access to air conditioning also varied according to the area of residence, ranging from 5.4% in eastern Quebec to 24.1% in the north of the province (south of the 49th parallel); 24.8% in the Quebec City area; 28.4% in the centre of the province; 40.8% and 41.2% respectively, south and north of Montreal; and 44.6% in Montreal and Laval.

During heat waves, 56.0% of the participants used their air conditioner continually – particularly those who had access to a fixed unit (57.6%; removable: 42.4%) – 20.1% used it only at night and 21.0% just during the day (1.4% never did). Among the respondents whose homes were equipped with an air conditioner, those who were 65 years of age and over and had earned less than \$45,000 in the last twelve months (58.5%) made up the group of people who were least likely to use their air-conditioning system at night during the hottest spells. The second group was made up of participants who were less than 65 years of age and had a similar income to that of the first group (75.5%). The third and fourth groups were made up of the more wealthy people (\geq \$45,000), that is, first those 65 years of age and over (79.7%), then people younger than them (84.8%). Finally, residential air conditioning was the main reason cited by respondents who never opened their windows at night during heat waves, especially if they had a fixed unit.

Four out of five respondents reported owning at least one fan; 42.8% used fans 24 hours a day during periods of oppressive heat, 31.8% exclusively at night, and 17.3% only during the day (8.1% never did). Only residential air conditioning seems to explain the reduced use of fans, which were used more frequently during the hottest spells by participants under 65 years of age (35-64 years of age: 76.8%; 18-34 years of age: 79.6%) than by seniors (55.7%), and by people suffering from chronic neurological illness (during the day and at night: 61.2%; at night: 16.1%; during the day: 16.5%; never: 6.2%), compared to participants with other afflictions (during the day and at night: 43.0%; at night: 24.9%; during the day: 22.5%; never: 9.6%) or who were not sick (during the day and at night: 42.2%; at night: 34.7%; during the day: 15.6%; never: 7.6%). Lastly, respondents who used their fans at night during a heat wave considered that their home insulation provided less effective protection against humidity. They also opened the windows more often, starting at dusk.

Preferred Places to Cool Off During Heat Waves

To keep cool during the hottest weather, 62.3% of respondents preferred to stay home (in the house all the time: 30.7%; on the balcony or in the yard: 31.6%); half of these respondents had access to an outdoor swimming pool at home. The other participants (37.2%) generally went to outdoor public places. In this regard, several locations were named, such as beaches or other places by the water (15.7%), gardens or parks (9.6%), outdoor swimming pools (7.4%), and air-conditioned places (9.5%).

Very briefly, the residents of a house preferred to stay at home to keep cool during hot spells more often (69.9%) than did the other respondents (\geq 5 storeys: 60.5%; <5 storeys: 51.2%); 31.2% remained in the

house all the time; 34.2% took advantage of their private pool. Compared to the other participants, they were more often between 35 and 64 years of age (61.3%; ≥ 5 storeys: 36.8%; < 5 storeys: 44.7%), with minor children (36.2%; ≥ 5 storeys: 12.5%; < 5 storeys: 24.3%) and incomes of \$45,000 or more (≥ 5 storeys: 29.4%; < 5 storeys: 25.4%). They were more likely to live in a dwelling to which home improvements had been made since it was built – either through the addition of insulation (41.6%; ≥ 5 storeys: 12.1%; < 5 storeys: 26.2 %), or the replacement of doors and windows (65.6%; ≥ 5 storeys: 40.7%; < 5 storeys: 55.7%) – and for which the insulation was perceived to be very effective against humidity (40.2%; ≥ 5 storeys: 32.2%; < 5 storeys: 22.4%). Nearly 40% of the residents of a house had access to an air conditioner at home (fixed unit: 23.5%; mobile or window unit: 15.9%; no air conditioner: 60.7%).

Among the residents of a building with at least five storeys, 60.5% stayed home during heat waves, of which half remained solely inside (32.0%); 25.9% had a swimming pool at the residence; 10.2% went out only onto the balcony. They were more often in the age group of 65 years and older (37.7%; house: 14.4%; < 5 storeys: 15.2%) than were the other respondents. One out of two did not have children (50.7%; house: 26.9%; < 5 storeys: 49.4%); one out of two lived alone (50.4%; house: 11.0%; < 5 storeys: 35.0%). Compared to the other participants, they were less likely to live in an apartment that had undergone major repairs, but many had air conditioning (fixed unit: 19.9%; removable unit: 21.6%; no air conditioner: 58.5%).

Participants living in buildings with fewer than five storeys were the most likely to report that they preferred to go to locations other than their home in order to cool off during heat waves; these locations included outdoor sites (17.5%) as well as air-conditioned places (14.7%). However, slightly more than one-quarter (26.6%) remained at home all the time. The residents of a building with fewer than five storeys were more often in the age group of 18 to 34 years (40.1%; house: 24.4%; ≥ 5 storeys: 25.5%) than were the other respondents, with an income less than \$45,000, although two-thirds of them had been gainfully employed during the previous twelve months (< 5 storeys: 65.3%; house: 67.8%; ≥ 5 storeys: 51.7%). These were also the participants who were least likely to describe their home insulation as being very effective against humidity, and were also least likely to have an air conditioner (fixed unit: 4.3%; removable unit: 23.9%; no air conditioner: 71.8%).

In conclusion, it is worth noting that a number of strategies for adapting to the heat have been adopted in similar ways by respondents who prefer to stay home during a heat wave and by those who prefer to go other places, regardless of their type of dwelling. Overall, 68.6% of participants often or always closed the curtains or blinds in order to keep their home cool on sunny days (sometimes: 13.3%; rarely or never: 18.1%). Over one-quarter (27.7%) more frequently sponged water over their faces or bodies with cool water (sometimes: 24.6%; rarely or never: 47.7%) and more than half (56.5%) took showers or baths more often than usual (sometimes: 16.6%; rarely or never: 27.0%). The great majority of participants often or always drank water (always: 60.8%; often: 31.4%; sometimes: 5.5 %, rarely or never: 2.3%); 51.9% consumed other non-alcoholic cold beverages (sometimes: 25.4%, rarely or never: 22.8%); and 7.3% drank alcoholic beverages other than beer (sometimes: 20.9%, rarely or never: 71.9%). In fact, only beer consumption (often or always: 11.4%; sometimes: 30.9%, rarely or never: 57.7%) was more frequently associated with respondents who engaged in outdoor activities during heat waves, compared to participants who preferred to stay indoors.

Going Out to Do Errands or Engaging in Intense Physical Activities Outdoors During Heat Waves

During heat waves, approximately one out of two respondents often went out (20.2%) or always did (28.7%) in order to go shopping (e.g., for groceries); 26.9% occasionally went out, while 15.0% rarely did and 8.0% never went out. A number of participants also reported engaging in intense physical activities outdoors (e.g., running, mowing the lawn): 14.4%, always; 16.4%, often; around 20.0%, sometimes or rarely; and 28.5%, never. Finally, among the respondents who went out to do errands or intense physical

activities, only one out of ten did not take along a drink, and approximately seven out of ten took only water with them.

Workers (80.0%) went out more often to do errands than did the other participants (unemployed people: 74.0%; students: 74.4%; retirees: 68.3%); as well as respondents who considered themselves to be in good health (77.0%) or very good health (80.1%), compared to those who described their health as moderate (69.3%) or poor (54.3%). On the other hand, respondents who always used a cane or a wheelchair outside the house rarely or never left their home during extremely hot spells; this was particularly the case with elderly people.

More men (60.2 %) than women (41.5 %) mentioned going out at least occasionally to do intense physical activities (e.g., running, mowing the lawn), in spite of very hot and humid temperatures. A greater proportion of respondents engaging in these types of activities were in the age group of 18 to 34 years (58.6%; 35-64 years: 49.9%; ≥65 years: 37.2%). In conjunction with these figures, the highest proportion of respondents who went out to do intense physical activities were students (68.0%); the lowest proportion consisted of retirees (40.5%). Finally, respondents who considered heat waves and other extreme climate events to have adverse effects on their health – particularly women– went out less often to do intense physical activities (a lot: 30.5%; a moderate amount: 44.6%; a little: 44.8%) than did those who perceived these events to have no impact on their health (56.9%).

Use of Sunscreen, Sunglasses, and Hats During Heat Waves

Nearly two-thirds (64.7%) of respondents mentioned that they often or always wore sunglasses on sunny days, 11.8% used them occasionally, and 23.4% did so rarely or never. On cloudy days, these statistics were in the order of 48.1%, 15.0% and 36.9%, respectively.

Nearly one out of two respondents reported that they often (17.7%) or always (30.6%) applied sunscreen on bright days, while 35.2% rarely or never did. On overcast days, 34.2% stated that they used sunscreen most of the time, while 50.3% very rarely did.

As for hats, 43.4% of participants said that they wore them often or always on sunny days, while 42.3% rarely or never did. These percentages were respectively 31.0% and 54.3% on cloudy days.

On sunny days, women (76.1%) put on sunscreen more often than men (52.8%); parents of minor children (74.3%) did so more frequently than parents who had only adult children (60.6%) or people with no children (59.9%); the most affluent people used sunscreen more than less well-to-do participants (≥\$60,000: 72.8% ; \$45,000-\$59,999: 67.7%; \$30,000-\$44,999: 62.2%; \$15,000-\$29,999: 61.2%; <\$15,000: 52.7%); and respondents who generally followed (often or always: 70.3%) the prevention advice issued by health professionals during extreme climate events (including heat waves) applied sunscreen more often than those who sometimes complied with this advice (63.9%), or who rarely or never did (49.4%). Gender (women: 80.7%; men: 72.1%) and compliance with health prevention advice (often or always: 81.0%; sometimes: 73.7%; rarely or never: 67.2%) were also associated with the wearing of sunglasses, as well as the use of cars (with air conditioning: 80.8%; without air conditioning: 75.9%; without a car: 64.3%). Regarding hats, it seems that they are worn more by men (men: 66.7%; women: 49.0%) and by people over 65 years of age (61.1%; 35-64 years old: 57.6%; 18-34 years old: 55.7%).

Finally, a number of participants have adopted similar behaviours regardless of whether it is sunny or not, such that habit has remained the main indicator differentiating the respondents on overcast days. It should also be noted that the people who apply sunscreen are frequently the ones who also wear sunglasses and a hat, whether it is sunny out or not.

Suggestions for Future Adaptation

Air Conditioning

It appears that the prevalence of air conditioning in southern Quebec has increased over the past few decades, especially along an east-west trajectory following the rising temperatures observed during the same period, as well as population growth (2026/2001 variation). It would therefore be desirable to monitor the changes in these three upward trends, for these purposes: to obtain more specific information on the air-conditioning statistics gathered (e.g., type of air conditioner); to periodically review temperature patterns in conjunction with the changes in demographic trends; to add the preceding data to an interactive atlas, making it possible to produce maps and graphic representations of the data; and to make this interactive atlas accessible over the Internet in order to provide information for managers and the general population alike.

Economically disadvantaged people are less likely to have residential air conditioning than wealthier people. Since extremely poor or low-income population groups seem to have the poorest state of health, it could be appropriate to consider introducing a grant program for the installation of air conditioning in the homes of the less-privileged (including assessment of the area to be air conditioned, the purchase and installation of the unit, and a maintenance plan), when heat waves pose serious risks to their health.

People aged 65 years and older are among the most vulnerable groups during a heat wave. Even though they seem to have access to an air conditioner at home more often than do people younger than them, it appears that they use air conditioning at night less often than those in younger age groups. Identifying the sociodemographic, physiological, psychosocial and cultural factors that could explain this state of affairs would surely help to guide and assess public health messages and interventions targeting people 65 and older.

Respondents living in apartments were more likely to have access to removable air conditioners rather than fixed air-conditioning systems. The latter are reported to be associated with a decrease in heat-related mortality, in addition to providing a higher comfort level than removable units. The estimated number of hours required for removable air conditioners to produce a comfort level equivalent to that provided by fixed systems would therefore have great significance for public health.

Housing Insulation

A number of respondents who perceived that their home insulation provided inadequate protection against humidity lived in dwellings built before 1983, that is, before the adoption of the *Loi sur l'économie de l'énergie dans le bâtiment* (Act Respecting the Conservation of Energy in Buildings), which aims to ensure a minimum performance of thermal insulation in walls and ceilings. The establishment of a more attractive funding program targeting energy efficiency – as was announced in the recent government action plan on climate change – should help to make strides in this direction. Let us hope, however, that particular attention beyond encouragement will be given, from the outset, to economically disadvantaged people who live in housing already requiring major repairs, whether they are owners or tenants.

On another subject, the perceived effectiveness of housing insulation against humidity has been associated with a number of variables that could be linked in some way to mortality during heat waves. Consequently, this perception could possibly become a useful indicator in the area of public health and climate change.

Other Solutions for Cooling Houses Besides Air Conditioning and Insulation

Respondents who did not have an air conditioner at home, or who only had a removable unit, opened their windows more often at night during heat waves than did participants with access to a fixed air conditioner. From the standpoint of sustainable development, it would be desirable to assess the effectiveness and efficiency of these types of measures (another example: neighbourhood revegetation), in order to recommend a wider range of options for adapting to heat, rather than the use of air conditioning alone.

Neurological Afflictions

People suffering from chronic neurological illness used fans more often at night during heat waves than did the other respondents. This finding is not surprising, since their state of health can deteriorate irreparably during oppressively warm spells. On the other hand, it is surprising to note that they do not have greater access to air conditioning at home. The survey findings shed light on how socioeconomic factors play a role in explaining this state of affairs. Another plausible explanation is that people with neurological illness prefer fans to air conditioners for reasons associated with their health condition. It is most important to gain further knowledge on this subject. This would require identifying the factors that influence the use of fans and air conditioners among this population group, but above all, understanding what makes people with neurological problems so vulnerable to the heat. Such research would support the development of more suitable health care services and would guide the public health measures put into place during periods of extreme heat. Furthermore, it would very likely be an incentive to broaden medical criteria and increase the lump sum allocated by the ministère de la Santé et des Services sociaux for the purchase and installation of an air conditioner, within the framework of its daily and home-living assistance programs.

People Living Alone

Compared to other respondents, people living alone were more often in the age group of 65 years and older, economically disadvantaged, with chronic health problems, and had no residential air conditioning. Given that each of these characteristics (including the lack of air conditioning) has been described as a “risk factor” in the literature on heat waves, “living alone” could be a useful synthetic indicator for population studies focusing on health and climate change, in addition to being easily available through census data.

In order to support front-line workers applying emergency measures, or to implement and assess such measures, it would be desirable to recognize more precisely than was accomplished in this study, the sub-groups of people living alone who are most at risk during heat waves and to identify the services needed by these sub-groups in order to ensure their safety during extreme climate events. In so doing, understanding why “reclusive” or “lonely” people are more difficult to reach would contribute significantly to identifying strategies to remedy this gap in an appropriate, timely manner. However, it would be a good idea to examine separately the respective roles played by social factors (support and integration) and housing characteristics in relation to the health impacts of heat waves. Finally, this approach would be more meaningful overall if it was extended to a variety of cultural communities.

Going Out to Run Errands During Heat Waves

Nearly two-thirds of participants who always used a cane or a wheelchair outside of the home rarely or never went out to do errands (e.g., grocery shopping) during heat waves, particularly in the case of seniors. This worrisome observation brings to mind the potential distress that some people may experience during such climate events, and highlights the need to provide a range of services to assist people who lack adequate social support. From the standpoint of mutual caring and public health, it

would therefore be crucial to take stock of their needs in order to propose a range of services, taking into account their physical limitations as well as their apprehensions (e.g., fear of opening the door to delivery people).

Public Places Frequented During Heat Waves

People living in apartments more often frequented public places during periods of oppressive heat, compared to the occupants of houses. Some of the most meaningful future strategies for adapting to climate change would include providing financial support to municipalities and community organizations for the development and conservation of “free” public environments in urban areas (e.g., parks, gardens), and implementing the assistance program for municipalities and community organizations, set out in the National Water Policy, in order to develop the public access network for the St. Lawrence, as well as other water bodies and rivers in Quebec. At the same time, it will nevertheless be necessary to put in place increased monitoring and vigilance in order to protect both the environment (e.g., erosion and pollution of beaches) and the population (e.g., drowning).

Private Swimming Pools

The penetration rate of private swimming pools province-wide is quite impressive: 31.0% of participants had a swimming pool at their residence, whereas this percentage was 24.0% in 1997. It would be wise to assess their actual use, since filling these pools with water will inevitably become a source of conflict when water consumption restrictions apply. Water use regulations pertaining to the filling of private pools and the creation of mechanisms to ensure that the regulations are enforced would also be adaptation strategies to consider.

Use of Sunscreen, Sunglasses, and Hats During Heat Waves

This study has brought to light a strong correlation between the use of sunscreen, sunglasses or hats on sunny days as well as on cloudy days, and has identified a close linkage between these behaviours, irrespective of the context in which they are applied. At the present time, very little is known in the area of complex interactions between certain preventive behaviours, or about how various behaviours interact (e.g., sequentially, concurrently). Improving knowledge in this field where little research has been done, especially explaining the various types of factors that contribute to compliance with and mutual reinforcement of safety practices associated with sun exposure, would improve the effectiveness of public health interventions.

CONCLUSION

In industrialized countries, the heat waves that have occurred during the past decade, particularly those in Chicago in 1995 and in France in 2003, have been the subject of various publications identifying who is at risk when the weather is oppressively hot. In Canada, this has helped to open the door for research on human health and climate change; in this report, we have embarked on such a study by describing how a number of Quebecers adapt during heat waves. Certain elements of the discussion also make it possible to begin reflecting on why certain members of the population are more at risk than others, which is the question for which answers must continually be found. The suggestions for future adaptation strategies presented in this report, in light of the findings of this study and the literature on climate change, would make it possible to move forward in this direction.