Report to
Rapport au:

Ottawa Board of Health
Conseil de santé d'Ottawa
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Ward: CITY WIDE / À L'ÉCHELLE DE LA VILLE

File Number: ACS2024-OPH-EHI-0004

SUBJECT: Climate Change and Health Vulnerability Assessment

OBJET: Évaluation des changements climatiques et de la vulnérabilité de la santé

REPORT RECOMMENDATIONS

1. That the Board of Health receive information about Ottawa Public Health (OPH)'s Climate Change and Health Vulnerability Assessments (CCHVAs) outlined in this report;

2. And that the Chair of the Ottawa Board of Health share the CCHVA findings with Environment and Climate Change and Emergency Preparedness and Protective Services Council Committees;

3. And that the Board of Health direct the Medical Officer of Health to continue to collaborate with the City of Ottawa's Strategic Initiatives Department's Climate

Change and Resiliency Service Area to inform the Climate Resiliency Strategy and implementation plan.

RECOMMANDATIONS DU RAPPORT

1. **Que le Conseil de santé reçoive de l'information sur les évaluations des changements climatiques et de la vulnérabilité de la santé (ASC) de Santé publique Ottawa (SPO) décrites dans le présent rapport ;**

2. **Et que le président du Conseil de santé d'Ottawa communique les conclusions de l'ACSCR aux comités de l'Environnement et du Changement climatique et du Conseil des mesures d'urgence et des services de protection ;**

3. **Et que le Conseil de santé ordonne au médecin hygiéniste de continuer à collaborer avec le Service des changements climatiques et de la résilience du Service des initiatives stratégiques de la Ville d'Ottawa afin d'éclairer la Stratégie de résilience climatique et le plan de mise en œuvre.**

BACKGROUND

Climate change is the greatest threat to human health of the 21st century, already affecting the health and well-being of many Canadians. [1] Immediate reduction in greenhouse gas emissions is needed to reduce the rate of climate change so that adaptations to improve community resiliency are as effective as possible. [1] The *Healthy Environments and Climate Change Guideline*, [2] under the Ontario Public Health Standards states that health units shall assess the health vulnerability status of their community and address health impacts in key areas related to climate change. To fulfill this requirement, five climate change health hazard priorities were identified from a local perspective as top health risks for Climate Change and Health Vulnerability Assessments (CCHVAs). Local statistics related to the health impacts of the five health hazards were analyzed to better understand the Ottawa specific context. The five identified local hazards include extreme heat (Document 1), vector-borne diseases (VBDs) (Document 2), wildfire smoke (Document 3), food- and waterborne illnesses (Document 4), and ultraviolet radiation (UVR) due to stratospheric ozone depletion (Document 5).

Since 2019, the Board of Health has received one report and two Information Previously Distributed memos, in 2022 and in 2023, on Ottawa Public Health's (OPH)'s climate change work and preliminary findings as the assessment work began.

The City of Ottawa declared a climate emergency in 2019 as climate change poses significant risks to Ottawa's population. Climate change efforts are categorized into two main approaches: mitigation and adaptation. The CCHVAs were primarily focused on informing adaptation measures. OPH's other work on climate change mitigation is ongoing and integrated into work to advance healthy public policy by reducing greenhouse gas emissions through the built environment. This includes OPH's support of healthy, walkable, 15-minute neighbourhoods, as reflected in the new Official Plan and its implementation. OPH continues to support City policies and plans, such as the new Zoning By-law, secondary plans, Master Plans, and design guidelines to mitigate climate change.

At this time, the City of Ottawa's Climate Resiliency Strategy (CRS) is being developed in response to the results of a high-level Climate Vulnerability Risk Assessment that was completed in 2022. [3] OPH is closely collaborating on the development and early implementation of the CRS. The draft CRS (*Climate Ready Ottawa*) focuses on increasing Ottawa's resilience by identifying a series of actions to reduce Ottawa's vulnerability to the effects of climate change. [3] The results of the CCHVAs will be considered in the final CRS and implementation plan, expected in 2025. While climate change adaptation and mitigation strategies are in development, action to limit health risks from climate change have begun and are ongoing through collaborative efforts of OPH, the City of Ottawa, and various partner organizations. Continued success in these initiatives will require sustained and close collaboration.

DISCUSSION

The five climate change health hazard topics for Ottawa were identified through an OPH internal expert working group using Ottawa-specific climate projections data, and the Ontario Climate Change and Health Toolkit. With the effects of climate change, Ottawa is expected to have four times as many hot days over 30°C by 2050 [4] which increases the risk of heat-related illness and death. [5] These warmer conditions are favourable for the migration of new vectors (i.e., insects that can spread disease) and population expansion of existing vectors. Additionally, climate change is impacting food and water safety, leading to an increased risk of food- and waterborne illness due to changes in precipitation, temperature, and extreme weather. [6,7] Increased exposure to wildfire smoke and poor air quality in Ottawa is also expected, due to increased frequency, severity, and distribution of wildfires in North America. [8] Climate change impacts on UVR due to stratospheric ozone depletion (thinning of the ozone layer) are difficult to determine due to the variability of cloud cover, reflective snow and ice, thickness of the ozone layer and sun protective behaviours.[5] With climate projections indicating warmer

seasons in Ottawa, people may spend more time outdoors, increasing their exposure to solar UVR and potentially raising cancer rates.[5]

Frameworks and toolkits from Health Canada and the Ontario Ministry of Health were used to guide the CCHVAs‘ approach. Engagement of approximately 90 external partners was completed through virtual presentations, workshops, interviews, and online surveys, which provided information on who is disproportionately negatively affected by climate change hazards, existing adaptations and their effectiveness, and opportunities to improve community resiliency. These gaps and opportunities where health hazards and impacts could further be addressed set the foundation for proposed priority actions for OPH and partners.

While all residents of Ottawa face risks associated with climate change, we identified through literature reviews and partner engagement, populations that experience disproportionately negative climate change related health impacts for each of the five health hazards (Document 6). Language often uses the term "vulnerable” and “at-risk” when discussing climate change which reinforces stigma and perpetuates bias. [9] Climate vulnerability is not a label for communities or populations. Rather, it occurs when systemic inequity drives differences in exposure, sensitivity, and adaptive capacity to climate hazards. Climate change compounds existing inequities and can increase individual and community stresses to climate hazards. Some people face increased risk due to factors such as age, ethnicity, occupation, income, housing, and health status.[10] These factors also impact the capacity of individuals to cope with the mental health effects of climate change, which is an element of climate change resiliency.[11] Climate change can provoke a range of emotional responses such as fear, anxiety and sadness which are compounded by health inequities.[10,12] Data collected in 2019 reported that 91% of Ottawa adults were concerned about climate change. [13] Therefore, mental health considerations have been included in this report (Document 7).

Overall Findings

Below is a list of findings from each assessment organized by health topic. These findings inform actions for OPH that are listed under the “Actions for Consideration” section.

Extreme Heat

- Extreme heat events are associated with an increase in hospital visits and admissions,[14,15] and Ottawa is expected to have four times more extreme heat days by 2050.[4] Heat related illnesses such as dehydration, heat stroke, heat exhaustion, and deaths are preventable if protection strategies are implemented.

- Some equity denied groups and partners have greater difficulty accessing OPH climate adaptation resources and key messages for extreme heat such as an interactive map of places to cool off and multilingual “Beat the Heat” fact sheets that are currently available online. Identification of populations that disproportionately experience health impacts from extreme heat can be found in Document 6.
- Increasing places to cool off in the community is a priority for strategies and initiatives with partners. This will improve community resilience and protect Ottawa‘s equity-denied populations that are disproportionately impacted by extreme heat. These strategies also include preparedness strategies for concurrent power outages.
- People experiencing homelessness have significant challenges in accessing cool spaces and potable drinking water as a result of stigma, restrictions, and discrimination when attempting to access them. Organizations that represent equity-denied groups identified the need for more shade and space with air conditioning for day programs as they become crowded during extreme heat events (see Document 1 for more findings).

Vector-borne Disease

- Warmer seasons create favourable habitats and increased range for vectors of disease, such as mosquitoes and ticks.[16] In Ottawa, there are three new VBDs due to climate change (anaplasmosis, babesiosis, Powassan virus disease). Warmer seasons and growing human populations in Ottawa, which increase human activity outdoors in vector habitats, can increase exposure and risk of VBD transmission.[16] Groups disproportionately experiencing negative health impacts of VBDs can be found in Document 6.
- OPH has worked with partners on raising awareness about VBDs and promoting preventive measures. OPH has a mosquito surveillance program that includes mosquito trapping and testing, larvicide treatment of storm water ponds and catch basins, and supported the creation of an illustrated booklet on Lyme disease and West Nile virus (WNV) in English, French and Algonquin. OPH collaborates with expert partners at uOttawa regarding tick surveillance and ecology.
- A survey of Ottawa adults found that 88 per cent were aware of WNV in 2019 [13] and 88 per cent were aware of Lyme disease in 2021.[17] But reported protective behaviours against WNV and Lyme diseases that are being used during outdoor activities varies greatly. Behavioral change is crucial for reducing the burden of VBDs, highlighting the need for further focused awareness and promotion of

protective behaviours to day camp operators and organizers of events that take place during dawn and dusk, and improving access for people who cannot afford protective behaviours. For additional findings, see Document 2.

Wildfire Smoke

- Wildfire smoke exposure is associated with respiratory illnesses and infections, adverse prenatal and birth outcomes, adverse mental health, and premature death. [8,18,19] Climate predictions suggest that wildfire frequency, severity and distribution will change as a result of a warming climate. [8] Canada is already experiencing longer wildfire seasons with larger areas burned due to warming temperatures, more extreme weather, and drier conditions.[5]
- Fine particulate matter ($PM_{2.5}$) makes up approximately 90% of wildfire smoke mass [20] and its small size means it can travel great distances geographically in smoke plumes and enter deep into the lungs and even the bloodstream when breathed in.[21] In 2016, there were approximately 4,200 premature deaths attributable to air pollution from $PM_{2.5}$ in Ontario from all sources.[22]
- Populations identified as disproportionately experiencing health impacts from wildfire smoke can be found in Document 6.
- There are significant increases in the use of health care services due to wildfire smoke events. [8,19] Increased promotion of protective behaviours are needed to reduce the health risks from wildfire smoke and to help protect the local health care system from being overwhelmed.
- OPH currently promotes protective behaviours on its website, such as monitoring the air quality and the use of weather apps, to guide decision making to reduce exposure. Through partner engagement, opportunities were identified for an equity-driven approach to address barriers to accessing and actioning this information for residents who are disproportionately experiencing negative health impacts from wildfire smoke to enhance Ottawa's resilience. See Document 3 for more detailed findings.
- Partners identified that addressing barriers to accessing protective health information through improved health education, awareness campaigns, and community engagement is essential. Collaborative efforts between OPH, the City of Ottawa, and local organizations, particularly those who serve equity-denied populations, and the community will be key to improving Ottawa's adaptive capacity and resilience to wildfire smoke.

Food- and Waterborne Illness

- Climate change is impacting food and water safety, leading to an increased risk of food- and waterborne illness due to contamination from changes in precipitation, temperature, and extreme weather.[6,7] For example, with more hot days and increased air conditioning evaporative cooling tower use, favorable conditions are more likely for growth of *Legionella* bacteria, [16] which can infect people through aerosolized water from inadequately maintained equipment. Outdoor food preparation (e.g., summer barbeques) is a classic risk factor for food-borne illness that can be expected to increase with longer summers. [7]
- Populations identified as disproportionately experiencing health impacts from food- and waterborne illness can be found in Document 6.
- OPH plays a key role in preventing food- and waterborne illness through education and by conducting inspections in food premises, risk assessments of small drinking water systems, and by sampling municipal recreational water bodies. Additionally, the City of Ottawa protects the health of Ottawa's residents by providing and maintaining clean drinking water and reporting adverse outcomes to OPH.
- In 2023, the top 2 food-related illnesses in Ottawa were Salmonellosis (135 cases) and Campylobacter enteritis (119 cases). In Ottawa, the most common causes of water-borne illness are those transmitted by pathogens that cause cryptosporidiosis, giardiasis, cyclosporiasis, and amebiasis. [23]
- Opportunities to reduce the risk of consuming contaminated food or water must be explored and promoted such as the promotion of private well water testing. Additionally, partner collaboration is needed to reduce the risks for equity-denied groups, and identified barriers to interventions need to be addressed. For more findings, see Document 4.

Ultraviolet Radiation due to Stratospheric Ozone Depletion

- The health vulnerability from the thinning of the ozone layer was assessed for Ottawa (see Document 5). Climate change impacts on UVR due to stratospheric ozone depletion are difficult to determine due to the variability of cloud cover, reflective snow and ice, thickness of the stratospheric ozone layer and sun protective behaviours.[4,24]
- Populations identified as disproportionately experiencing health impacts from UVR due to stratospheric ozone depletion can be found in Document 6.
- With climate projections indicating warmer seasons in Ottawa, people may spend more time outdoors and wear lighter clothing, increasing exposure to the sun's UVR and potentially raising rates of skin and eye cancers. [5]

- Ottawa's melanoma skin cancer occurrence is 34% higher than the provincial average.[25] It is estimated that a 2°C increase in temperature would lead to a 10% increase of skin cancers annually.[5] Adaptation strategies at the individual and community level are needed to protect the residents of Ottawa.
- OPH currently provides information on its website that promotes best practices such as the use of sun protective gear, the UV index, child sun safety information for parents, and shade policies for childcare settings.[26]
- Opportunities that community partners identified include increased promotion of culturally appropriate individual sun protective behaviors and community level adaptation strategies to increase equitable access to shade to provide maximum protection against UVR. Often, adaptations to address UVR, such as equitable and smart city designs (e.g., 15-minute neighbourhoods) that offer shaded spaces, can provide other health benefits such as protection against extreme heat. [27] These city designs have the added benefit of promoting a healthier lifestyle that can lead to a reduced reliance on fossil fuels and can in turn reduce greenhouse gas emissions.

Report Recommendations

1. That, the Board of Health receive information about OPH's CCHVAs outlined in this report;
2. And That, the Chair of the Ottawa Board of Health share the CCHVA findings with Environment and Climate Change and Emergency Preparedness and Protective Services Council Committees;
3. And That, the Board of Health direct the Medical Officer of Health to continue to collaborate with the City of Ottawa's Strategic Initiatives Department's Climate Change and Resiliency Service Area to inform the Climate Resiliency Strategy and its implementation plan.

Actions for Consideration

Key actions identified from the CCHVAs for OPH, the City of Ottawa, and partners to consider decreasing the health-related risks to the population of Ottawa, notably those that are that are equity-denied, include:

Extreme Heat

- Work with partners to develop strategies, prepare for extreme heat events, and identify leads for initiatives aimed at protecting Ottawa's equity-denied populations disproportionately impacted by building cooler communities.

Vector-Borne Diseases

- Increase the public's awareness of new and existing VBDs and ways to limit the risk of illness.
- Increase focused awareness and promotion of protective behaviours to day camp operators and organizers of events that take place during dawn and dusk and improve access for people who cannot afford protective behaviours.
- Ensure the mosquito control program responds to increasing or new mosquito vectors driven by climate change.

Wildfire Smoke

- Using an equity-driven approach, expand access to resources to improve awareness of air quality knowledge, including use of weather apps and tools (e.g. Air Quality Health Index (AQHI), and protective actions for individuals during poor air quality events.

Food- and Waterborne Illnesses

- Explore and promote initiatives to reduce risk of food- and waterborne illness due to extreme weather events.
- Promote protection of private well water quality from impacts of climate change.
- Prepare and plan for impacts to recreational water quality.
- Promote prevention of *Legionella*-caused disease through appropriate maintenance of potential sources.

Ultraviolet Radiation due to Stratospheric Ozone Depletion

- Promote equitable installation and use of UV protective measures in the community that are sustainable for the long term by influencing upstream built environment policies.

Many initiatives are already underway to help minimize the negative health impacts of climate change. The above findings support the need for OPH and the City of Ottawa to continue to work together, alongside partners and residents to address the actions to make significant change.

This report highlights the expected increased risk of health impacts to Ottawa residents due to climate change. These include more heat-related illness, more VBDs, more respiratory harm due to wildfire smoke, more food- and waterborne illness, and more skin and eye cancers. Adaptive strategies will help improve resilience to climate

hazards and their associated impacts. However, reducing greenhouse gas emissions and our reliance on fossil fuels are crucial to preventing illness and deaths.

These CCHVAs improve understanding of the population health impacts of climate change and underscore the health imperative for action to mitigate greenhouse gas emissions. Greenhouse gas emissions contribute to ongoing climate change. Mitigation measures are actions that are necessary and will determine climate change's ultimate severity and reduce the chance of a state where adaptation cannot keep up. Climate change actions, both adaptation measures and mitigation measures to reduce greenhouse gases, are complementary and necessary to manage the unavoidable and to avoid the unmanageable.

RURAL IMPLICATIONS

OPH activities in support of climate action are intended to improve the resiliency of all Ottawa residents, and rural populations are specifically considered in the findings of the report since they are considered a group that experiences disproportionate health impacts caused or exasperated by climate hazards.

CONSULTATION

Internal OPH departments were consulted throughout the process of the CCHVAs. These City of Ottawa departments were consulted in the development and writing of this report: Strategic Initiatives (Climate Adaptation and Natural Systems programs), Infrastructure & Water Services, Emergency & Protective Services, Recreation, Cultural & Facility Services, and Community and Social Services. The Rideau-Valley Conservation Authority is an external organization consulted in the development and writing of this report. See report for detailed consultation of additional external partners.

LEGAL IMPLICATIONS

There are legal impediments to receiving the information described in recommendation 1 of this report and no legal impediments to approving recommendations 2 and 3 of this report.

RISK MANAGEMENT IMPLICATIONS

Climate change is an urgent and large-scale public health crisis, posing significant health risks for the whole population and health risks that disproportionately negatively impact certain populations. OPH is limited in how it can support the City and community to mitigate and adapt to climate change health effects, including those caused by

extreme heat and air quality issues, without a coordinated response across all sectors and levels of government, as well as sufficient funding.

OPH's strategic plan focuses on climate change mitigation and adaptation and community resiliency. Activities in the strategic plan including the completion of the CCHVA's support the **mitigation** of this risk.

OPH's work to mitigate climate change is integrated into efforts to advance healthy public policy through the built environment. OPH maintains the co-location of employees in the City's Climate Change and Resiliency Service Area within the Strategic Initiatives department and in the Planning, Real Estate and Economic Development department. Through co-location, OPH advances healthy public policies and enhances the City's efforts outlined in the Climate Change Master Plan, the Official Plan, the draft Zoning By-law, secondary plans, and design guidelines. Additionally, the Medical Officer of Health participates in the City's Climate Change Tiger Team to identify opportunities to address climate issues across departments.

ASSET MANAGEMENT IMPLICATIONS

There is no impact on the City of Ottawa's physical assets.

FINANCIAL IMPLICATIONS

There are no financial implications associated with this report.

ACCESSIBILITY IMPACTS

Lack of accessible climate change adaptation measures was considered in the findings of this report, as older adults and people living with visible and/or invisible disabilities are specific groups experiencing disproportionate health impacts caused or exasperated by climate hazards.

ENVIRONMENTAL IMPLICATIONS

As described in the report, OPH will continue to work with partners to implement strategies to reduce the health impacts from climate change. For further information regarding environmental implications, see report.

ALIGNMENT WITH OTTAWA PUBLIC HEALTH STRATEGIC PRIORITIES

Conducting these CCHVAs aligns with OPH's Strategic Goal 2 which is to "Create Conditions to Live Well and Thrive: Influence changes in the built, natural and social environments that promote health and wellbeing, and address the impacts of climate

change. Essential to this is the interconnection between health and nature.” This goal highlights OPH’s commitment to increasing health equity by identifying and addressing systemic barriers and creating conditions for people to live well and thrive.

SUPPORTING DOCUMENTATION

Supporting documentation is included and immediately follows the report.

DISPOSITION

This report is provided for the Board of Health to direct the Medical Officer of Health to continue to work with the City of Ottawa’s Strategic Initiatives Department to action the recommendations.

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Document 1: Climate Change and Health Vulnerability Assessment Summary - Extreme Heat

With climate change, Ottawa is expected to have four times more extreme heat days by 2050. [4] For context, since 2016, Ottawa has had an annual average of 11 days with temperatures over 30°C. [4] Health related illnesses such as dehydration, heat stroke, heat exhaustion and deaths are preventable. Extreme heat days are associated with an overall increase in emergency department visits and admissions. [14,15] The surge in hospital use occurs during extreme heat events and during the days following extreme heat events, with similar trends in Ottawa.[28]

POPULATIONS DISPROPORTIONATELY IMPACTED

For a complete list of populations disproportionately experiencing negative health impacts due to extreme heat, see Document 6.

PROTECTIVE BEHAVIOURS

Ottawa Public Health (OPH) has been actively consulting with partners and working with the City of Ottawa to develop and implement extreme heat strategies. There are many initiatives already underway in Ottawa that help to minimize the negative health impacts of climate change led by OPH and the City of Ottawa. These include sharing resources and key messages on climate adaptation measures for extreme heat such as on the Extreme Heat and Humidity webpage, which includes a map of places to cool off; Beat the Heat fact sheets; a project to enhance preparedness and share heat health messaging with older adults in high-rise buildings; and a fire hydrant drinking water fountain pilot project. The effective strategies that people and organizations in Ottawa are using to stay cool are: installing and using AC or heat-pumps at home, accessing cooled, shaded, or breezier places, staying hydrated, and wearing UV protective clothing. However, many individuals that live in places that lack AC and other mechanical cooling do not use some of the most proven alternative strategies to reduce heat-related health risks such as soaking hands and feet in cold water. Other low-cost heat prevention methods are reportedly underused such as signing up for weather alerts. Community preparedness, including sharing information on places to get cool and planning for extreme heat events is key to supporting the community during extreme heat. Results from partner engagement indicated that people and organizations do not know about OPH's heat resources. Additionally, certain populations face barriers to accessing heat-relief strategies such as temporary foreign agriculture workers and people experiencing homelessness, and there are insufficient nighttime cooling resources for these populations.

OPPORTUNITIES

Through partner engagement, organizations identified adaptation strategies that they would like to consider for future action. This is organized into community features, community preparedness strategies and strategies for concurrent power outages.

Community features to address extreme heat

Organizations reported wanting more ways to cool off to help address extreme heat. These included community features such as misting stations, additional drinking water fountains, places with shade, splash pads, wading and swimming pools, increased beach or river access, and greener neighborhoods. Organizations also identified building features that would be helpful to address extreme heat such rooms with air conditioning or other mechanical cooling, the use of highly reflective building materials, increased insulation for energy efficiency, and changes to the National Building Code of Canada. Investigations following past heat events in other cities and with other organizations concluded that a maximum temperature by-law in rental housing could be an effective way to protect public health and safety in the event of extreme heat. Therefore, OPH and the City of Ottawa could support residents and organizations by enhancing existing strategies such as increasing access to drinking water fountains and pools/splashpads/beaches, providing new strategies such as misting stations, and exploring a maximum temperature by-law in rental housing to build a healthy environment.

Community preparedness strategies

For community preparedness strategies, organizations reported wanting strategies that encourage residents to sign up for weather alerts, disseminate information on places to cool off, remove stigma for priority populations using cooling facilities, and ensure the welfare of isolated individuals and pets. Event organizers indicated some gaps in planning for heat, such as not regularly providing transportation to the finish line when people cannot complete a sporting event due to heat. Additionally, they would like to integrate heat emergency plans into their event applications, have access to an event cancellation or modification algorithm, ensure staff/volunteers are trained on heat-related illness, and ensure access to water and cooling areas during their events. Smaller and non-governmental organization-led event organizers indicated interest in a lending library for resources such as misting stations, shade structures, and water dispensers to make extreme heat strategies more accessible and actionable. Therefore, OPH and the City of Ottawa could support organizations by improving awareness of community and online resources for weather alerts, places to cool off, and trainings,

reducing stigma/discrimination for people using places to cool off, and explore a lending library of equipment to support cooling.

Preparedness for Concurrent Power Outages

Preparing for concurrent power outages is also a key component to adaptability for extreme heat. Preparedness strategies being used by people and organizations in Ottawa during power outages include plans for food delivery, using telephones to access information from 3-1-1 and 2-1-1, and seeking reassurance through telephone calls.

To further support individuals living with disabilities, people experiencing homelessness and temporary foreign agriculture workers during concurrent heat events and power outages, partners reported needing generators and financial support to replace spoiled foods. Additionally, partners indicated that more tree maintenance around power lines to prevent downed lines from fallen trees, social outreach programs, and reliable transportation for people with disabilities are also needed.

There are many opportunities for future action to help build community resiliency to extreme heat. By focusing on community features, community preparedness strategies for extreme heat, and concurrent power outages, Ottawa can become a more resilient community, capable of withstanding extreme heat conditions in the coming decades.

Document 2: Climate Change and Health Vulnerability AssessmentSummary - Vector-borne Diseases

Vector-borne diseases (VBDs) include diseases spread by ticks and mosquitoes, such as West Nile virus and Lyme disease. By 2050, Ottawa will experience shorter, warmer winters (by five weeks) and an earlier spring season (by 2 weeks) due to climate change. [4] This change in temperatures and seasons will create conditions for populations of disease vectors (such as ticks and mosquitoes) to increase and for more vectors to migrate from other countries (e.g., by geographic expansion or by planes, ships). This can lead to an increase in transmissions of VBDs to humans.

The number of people affected by VBDs is expected to increase as climate change creates more favourable habitats and supports range expansion for vectors such as mosquitoes and ticks (e.g., as the winters will be less cold, and spring will be warmer and earlier, mosquito and tick season will be longer). [16] Changes in human activity (e.g., increased access and time spent in vector habitats, and an increase in the human population in Ottawa) are further increasing these impacts.

There are three factors that impact the risk from infectious diseases, and they are expected to be affected by climate change: the presence of VBDs, people’s sensitivity to the pathogen, and protective behaviours by individuals.

Currently the risk level for Zika virus is extremely low, and the risk level is very low for babesiosis, Powassan virus, and Eastern Equine Encephalitis virus (EEEV). The risk level is low for anaplasmosis and West Nile virus (WNV) and rises to medium for Lyme disease. However, for persons spending time in tick or mosquito habitats without adequate protection, individual risk can be considerably higher. These VBDs are being tracked for Ottawa. In 2023, anaplasmosis, babesiosis, and Powassan virus became reportable to public health authorities under Regulation 135/18 under the Health Protection and Promotion Act, 1990. EEEV was recently diagnosed in a person in Ottawa in 2024, though it is important to note that EEEV is not a reportable disease in Ontario. Lyme disease is the most frequently reported VBD. For VBDs not yet detected in Ontario in humans, Health Canada has identified *Borrelia miyamotoi* disease, an illness caused by a bacteria spread by blacklegged ticks, as being an emerging concern due to climate change.

POPULATIONS DISPROPORTIONATELY IMPACTED

For a complete list of populations disproportionately experiencing negative health impacts such as VBDs, see Document 6.

PROTECTIVE BEHAVIOURS

Behavioural change is crucial to reducing the burden of VBDs. There are many protective behaviours, some of which are similar for different VBDs and others that are different.

- Mosquitoes
    - Applying a Health Canada-approved insect repellent containing DEET or icaridin to exposed skin and clothing.
    - Protecting yourself, including with adequate clothing protection, especially between dusk and dawn, when mosquitoes are most active, and any time near shady, bushy, or wooded areas.
    - Having well-fitted screens on windows and doors that are in good condition.
    - Removing standing water around home.
- Ticks
    - Wearing long pants, a long-sleeved shirt, shoes, and socks to cover exposed skin (tuck pants into socks).
    - Staying on the trails when hiking in the woods and other natural areas to avoid brushes against long grasses, etc.
    - Being mindful of the borders adjacent to natural areas that may be suitable tick habitat.
    - Applying a Health Canada-approved insect repellent containing DEET or icaridin to exposed skin, clothing, and gear.
    - Doing full-body tick checks on yourself, children, pets, and gear/clothing, paying careful attention around toes, knees, groin, armpits and scalp, especially if you spend time in wooded or overgrown areas.
    - Removing ticks as soon as possible.
    - If a tick was attached and feeding, seeing a health care provider to see if eligible for Lyme disease prophylaxis.

Public awareness is an indicator of protective behaviours. The Rapid Risk Factor Surveillance System telephone survey of Ottawa adults 18 years and older found that 88% reported they were aware of WNV in 2019 [13] and 88% were aware of Lyme disease in 2021. [17] Reported protective behaviours used during outdoor activities to protect from WNV was using bug spray at least half the time (19%) and wearing long

sleeves at least half of the time (39%). To protect from Lyme disease during outdoor activities the most reported action taken to protect from tick bites included wearing long pants, long sleeves or covering up skin (75%), using insect repellant (34%), wearing socks or closed footwear (19%) and pants tucked in/taped (19%). After visiting grassy fields or wooded areas, 49% of Ottawa adults reported that they checked for ticks every time or most of the time, 29% check sometimes or rarely while 21% never checked for ticks.[29]

OPPORTUNITIES

Ottawa Public Health (OPH) has a robust VBD prevention program to raise awareness about VBDs and preventative measures. As the risk to VBDs is increasing, more can be done. Development of more focused messaging to reach specific risk groups would be beneficial, such as information for day camp operators and organizers of events that take place during dawn and dusk. Protective measures against VBDs could be shared through a program or promotional event that would provide low to no cost DEET or equivalent products for equity denied populations. An identified opportunity was to expand communications to private property owners to offer treatment of catch basins as only a small percentage of property owners currently opt in. Another opportunity is to continue to ensure that the West Nile virus prevention program is responsive to changes as the seasonal period during which mosquitoes are active increases with warming temperatures.

Document 3: Climate Change and Health Vulnerability Assessment Summary - Wildfire Smoke

Air pollution contributes to an estimated 15,300 deaths annually in Canada and has many other non-fatal impacts to health. [8] Climate change related increases in wildfire emissions are one of the most significant risks to air quality in Canada. [8,30] Climate predictions suggest that wildfire frequency, severity, and distribution will change as a result of a warming climate. [8]

At this time, according to the City of Ottawa's interactive mapping tool (geoOttawa), which includes Provincial data of potential hazardous forest types for wildland fires, the risk of wildland fires in the Ottawa region is low in urban settings and ranges from moderate-to-high in the more rural and bordering regions of Ottawa.[31] The City of Ottawa plans to complete a Wildland Fire Risk Assessment and Plan,[32] which will provide more detailed information than the currently available provincial data, and may further inform future public health actions related to the burning of local wildlands.

Several factors are contributing to longer wildfire seasons in Canada and increasing the area burned, including warmer temperatures, more extreme weather events such as lightning, and drier conditions. [5] This has resulted in increased emissions of harmful pollutants, including fine particulate matter ($PM_{2.5}$), which poses significant health risks due to its ability to travel deep into the lungs and bloodstream. $PM_{2.5}$ makes up approximately 90% of wildfire smoke mass [20] and its small size also means it can travel great distances geographically in smoke plumes.

Canada's Air Quality Health Index (AQHI+) helps individuals understand outdoor air quality and make informed decisions to protect their health.[18] However, even low levels of exposure to wildfire or wood smoke pollutants can impact health. [18] Exposure to wildfire smoke can cause a range of health issues, from mild symptoms like headaches and coughs [18] to severe effects such as respiratory and cardiovascular problems.[8,18] Wildfire smoke has been linked to increased hospital admissions, emergency room visits, and premature deaths. [8,19] Health Canada estimated that in 2016, there were 4,200 premature deaths attributable to air pollution from fine particulate matter ($PM_{2.5}$) in Ontario.[33] Nationally, wildfire smoke in particular has contributed to 240 deaths annually due to short-term exposure, and 2,500 deaths annually due to long-term exposure, between the years of 2013 and 2018.[34] Certain populations in Ottawa are at greater risk of experiencing health impacts due to wildfire smoke, including older adults, pregnant individuals, children, people with chronic health conditions, and those of lower socio-

economic status. These groups may experience compounded health risks due to multiple risk factors.

Fortunately, Ottawa's air quality has historically been very good, with very few days of $PM_{2.5}$ levels above 75 µg/m^3 per year.[35] The largest risk to Ottawa's air quality is from transboundary sources from other regions of Ontario, Canada and the United States; sources of $PM_{2.5}$ from the United States contribute to 30-40% of Ontario's annual $PM_{2.5}$ concentration. In June 2023, Ottawa's air quality was directly affected by wildfire smoke from Northern Ontario and Québec which resulted in eight days of $PM_{2.5}$ levels exceeding 75 µg/m^3, including 3 days in the 200-300 µg/m^3 range, and a peak on June 7, 2023, of over 500 µg/m^3. [35]

Reducing the health risks from wildfire smoke by using proven strategies may help lower the strain on local health care systems and reduce long-term deaths linked to air pollution.

POPULATIONS DISPROPORTIONATELY IMPACTED

See Document 6 for a list of populations disproportionately impacted by negative health impacts due to wildfire smoke.

PROTECTIVE BEHAVIOURS

Through partner engagement sessions, Ottawa Public Health (OPH) learned that partners feel that the following evidence-based strategies for individuals are effective and accessible by populations they represent or serve: using weather apps, monitoring the AQHI+, staying informed about air quality advisories, seeking clean air spaces, and cancelling/rescheduling outdoor activities. Community and organizational efforts, including promoting public awareness of weather apps, AQHI+ and protective measures, designating cleaner air spaces, and rescheduling outdoor events, can enhance Ottawa's resilience to wildfire smoke. Some strategies, such as designating cleaner air spaces, are also effective for addressing other climate hazards such as extreme heat; providing combined cool and clean air spaces helps residents better handle both climate hazards.

OPPORTUNITIES

Identified barriers to adopting some of these adaptation strategies include costs, lack of air conditioning, knowledge gaps about the AQHI+ and weather apps, and language barriers. OPH is addressing language barriers in current health promotion and protection work by translating information resources on air quality to languages such as Arabic and simplified Chinese. Some municipalities in Canada have addressed cost

barriers by hosting workshops for build-it-yourself air purifiers using box fans, air filters, and duct tape, and these supplies were sometimes offered for free or at low-cost.[36–38] Although a temporary solution for improving air quality in a room or home, workshops such as this provide an opportunity for health education and gives individuals knowledge and skills that they can use as part of their personal emergency toolkits in the future. An assessment of whether a workshop like this would be feasible and beneficial in Ottawa could be a potential future action.

The results of partner engagement identified that addressing these barriers through improved health education, awareness campaigns, and community engagement is essential. Collaborative efforts between OPH, the City of Ottawa, and local organizations, particularly those who serve equity-denied and populations disproportionately experiencing negative health impacts, and the community will be key to improving Ottawa's adaptive capacity and resilience to wildfire smoke. Organizations are important partners in promotional campaigns. They can help share information about health impacts of wildfire smoke and best practices for Ottawa residents through their communication channels.

Document 4: Climate Change and Health Vulnerability Assessment Summary - Food and Waterborne Illness

Climate change is impacting food and water safety, leading to an increased risk of food- and waterborne illness due to changes in precipitation (e.g. rain), temperature and extreme weather.[6,7]

Climate related food- and water safety concerns include an increased risk of illness-causing germs, such as viruses, bacteria, and parasites, which can thrive in food and water as the main sources of exposure. Though other impacts to food and water due to climate change are significant on a larger scale (e.g., food security, water quantity, saltwater intrusion, etc.), they were outside the scope of this assessment.

POPULATIONS DISPROPORTIONATELY IMPACTED

See Document 6 for a list of populations disproportionately experiencing negative health impacts such as food- and waterborne illnesses.

PROTECTIVE BEHAVIOURS

Ottawa Public Health (OPH) plays a key role in preventing food- and waterborne illness and protecting the health of Ottawa residents. OPH is responsible for several programs under the Ontario Public Health Standards which set out requirements for Public Health Units to reduce the risk of illness due to food and water. This includes inspecting food premises, regulated pools and hot tubs, and small drinking water systems; providing food handler training; promoting testing of private wells; and providing education on the risk of food- and water-related health hazards.

There are many ways individuals can protect themselves and others from food- and waterborne illnesses. Partners consulted said they were confident that the following measures to reduce the risk of foodborne illness are used by clients they represent or serve: cooking foods to a safe internal temperature, washing produce, preventing cross-contamination, cooking and preparing foods according to instructions, hand washing after handling certain foods like eggs or raw meat, cleaning and disinfection of surfaces, storing food at the appropriate temperature, protecting food from contamination, and avoiding unpasteurized milk, dairy products, juices or cider. For reduction of waterborne illness, partners were confident that the following measures are used by clients they represent or serve: only drinking water that is known to be safe, testing well water regularly, and if they are bottle-feeding, ensuring they maintain an adequate supply of safe water for sterilizing and making infant formula. To reduce the risk of waterborne illness due to recreational water, partners were confident this is done by avoiding swimming in bodies of water that appear to have blue-green algae, checking beach

water quality results online, showering after being in recreational water, avoiding accidental ingestion of recreational water, and maintaining residential pool and hot tub water quality.

OPPORTUNITIES

Findings revealed a need for several initiatives that build upon existing OPH, City of Ottawa and partner programs, including a need to explore and promote initiatives to reduce risk of food and waterborne illness due to extreme weather events, promote protection of private well water quality from impacts of climate change, and prepare and plan for impacts to recreational water quality.

The assessment identified barriers for the adoption of measures that can potentially reduce the risk or impact of food- and/or waterborne illness include financial constraints for businesses, lack of awareness of risks, lack of training or education on ways to reduce the risks, being food insecure or housing insecure, and individual income. Supporting adaptations from an equity perspective to address these barriers is key to protecting those who are disproportionately experiencing food- and/or waterborne illness. By focusing on interventions that can help keep food and water safe while considering barriers faced by equity-denied groups and groups disproportionately impacted, OPH can better protect the health of Ottawa residents.

Document 5: Climate Change and Health Vulnerability Assessment Summary - Ultraviolet Radiation due to Stratospheric Ozone Depletion

Stratospheric ozone is found in the upper layers of the atmosphere and acts as Earth's sunscreen, protecting all life from the sun's ultraviolet radiation (UVR).[39,40] The intensity of UVR can vary due to many factors, one of them is the thickness of the stratospheric ozone layer. Climate change may reduce stratospheric ozone, leading to higher levels of UVR. However, the impact of climate change on UVR from reduced stratospheric ozone is difficult to determine due to the variability of cloud cover, reflective snow and ice, as well as thickness of the stratospheric ozone layer and sun protective behaviours.[4,24] In cloud free conditions, climate models project an increase in solar radiation in the southern region of Ontario.[4] Ottawa specific climate projections predict warmer seasons and this change may encourage residents to spend more time outdoors, where they would be exposed to the sun's UVR.[4] Overexposure to UVR can lead to health impacts such as skin and eye cancers.[5] It is estimated that a 2°C increase in temperature would lead to a 10% increase of skin cancers annually. [5] Some examples of those at highest risk are children, people who spend time outdoors, people who intentionally tan for appearance reasons, people with light skin, and people who do not use sun protective behaviors.[5]

POPULATIONS DISPROPORTIONATELY IMPACTED

See Document 6 for a list of populations disproportionately impacted by negative health impacts of UVR due to stratospheric ozone depletion.

PROTECTIVE BEHAVIOURS

Adaptive strategies at the individual and community level are needed to protect Ottawa residents. In Ottawa, individual strategies include wearing SPF 30+ sunscreen, seeking shady areas and wearing UV protective gear such as hats, eyewear, clothing, and swim wear. In addition to these strategies, it is recommended to increase awareness of the UV index and avoid spending time outdoors during peak UV time. In Ottawa, that is when the UV index is 3 or higher, which is typically between 11 am to 3 pm in the summer and a slightly shorter time period in the winter. [26,41] A survey in 2015 found that almost half of Ottawa residents aged 12 and up reported spending 2 or more hours outdoors during peak UV times on their days off. [42] OPH is currently providing information and best practices on the sun safety website. [26]

Community level adaptations to provide maximum protection against UVR are recommended, such as shade structures. The City of Ottawa's Official Plan states the

goal of providing 40% tree canopy coverage across the urban area of Ottawa, and the Parks and Recreation Facilities Master Plan supports this policy with similar goals in their parks. [43,44] The City of Ottawa Park Development Manual states that seating is provided under shade structures where the play areas are in lines of sight, and tree structures are maintained. [45] In 2017, the urban area of Ottawa had 31% tree canopy coverage with variations based on neighbourhood median income. [46] To strengthen shade policies, it is recommended to expand shade coverage to install structures and trees using an equity lens to equity deserving neighborhoods, and where people spend time outdoors such as play areas and commuting routes.[47] These community features have co-benefits of reducing heat exposure.

OPPORTUNITIES

There is a need to increase awareness of sun safe best practices that are culturally appropriate and diverse to achieve equitable health outcomes. Barriers to using best practices for sun safety, such not being able to afford UV protective gear like sunscreen or clothing, should be considered. Collaboration between public health, City planners and other departments is crucial in creating communities that are climate resilient and reducing health disparities with respect to UVR. [48] To ensure equitable protection against UVR, it is recommended to provide increased access to shaded areas using an equity lens. Smart city designs can promote healthier lifestyles and reduce emissions all while improving public health.

Document 6: Populations Disproportionately Impacted by Health Impacts due to Climate Change Health Hazards

Climate Change Health Hazard	Populations Disproportionately Impacted based on Literature Review	Additional Populations Disproportionately Impacted as Identified Through Partner Engagement
Extreme Heat	• Older adults • Pregnant individuals • Infants and young children • Members of racialized groups • First Nations, Inuit, and Métis • People living with chronic illnesses • People living with visible and/or non-visible disabilities • People who use medications that have additional risks in hot weather • People who are socially isolated • People who work in the heat (indoors or outdoors) • People who exercise in the heat (indoors or outdoors) • People living in equity-denied neighbourhoods • People who are unable to keep their living space cool • People experiencing homelessness and/or marginally housed • People with lower incomes	• People with limited access to accessible transportation • People living in overcrowded or unsafe households • People living in upper floors of apartment buildings • People with inconsistent access to places to cool off • People who wear excessive layers of clothing because of age or in response to sexual trauma or psychosis • People who work in greenhouses • People who work in precarious environments (e.g., sex-trade workers) • People with service animals • Postpartum individuals • Athletes • People new to Canada
Vector-borne Diseases (VBDs)	• Older adults • Individuals who are immunocompromised	• N/A

	• People who spend time outdoors, particularly in insect vector habitats • People who live in or near insect vector habitats e.g., urban, suburban and rural)	
Wildfire Smoke	• Older adults • Infants and young children • Pregnant individuals • People who smoke • People living in rural and remote areas • People who work outdoors, including wildland firefighters • People involved in strenuous outdoor exercise • People living with an existing illness or chronic health conditions (e.g., cancer, diabetes, lung or heart condition) • First Nations, Inuit, and Métis • People new to Canada • Members of racialized groups • People living in situations of lower socio-economic status, such as: those with lower income, those with lower education, those experiencing housing insecurity, those experiencing uncertain employment • People living with visible and/or non-visible disabilities	• People who participate in outdoor events and/or festivals • People who are active outdoors but not necessarily involved in strenuous outdoor exercise (e.g., gardeners, walkers, tourists)

	• People living with mental health conditions	
Food- and Waterborne Illnesses	• First Nations, Inuit, and Métis • People living with chronic diseases • People living in rural areas • People that rely on well water • People who are immunosuppressed • People with lower incomes • Older adults • Children • Members of racialized groups • Households headed by single women • Persons living with disabilities	• Pregnant individuals • People experiencing homelessness
Ultraviolet Radiation (UVR) due to Stratospheric Ozone Depletion	• Infants, children, and youth • Men • Older adults (50+) • People with fair skin (e.g., Fitzpatrick Skin Type I) • People living with certain skin conditions (e.g., vitiligo, albinism) • People living in higher-income households • People living in rural areas • People who are employed • Aviation workers • Agriculture workers • Members of the Military • People who work outdoors • People who spend a lot of time outdoors	• N/A

	• People who travel to tropical climates (closer to the equator) • People who deliberately tan their skin through solar or artificial UVR exposure • People who have photosensitive skin due to medication or other reasons • People experiencing homelessness	

Document 7: Climate Change and Mental Health

Why Climate change is a concern

Climate change is a global crisis that causes emotional distress, compounds pre-existing inequities and increases mental health challenges. [49] With the increasing frequency, intensity and duration of climate change events, Canadians' mental health and community resilience is being challenged. For example, 73% of Canadian young people (16 to 25 years) reported thinking that the future is frightening and 78% reported that climate change impacts their overall mental health. [50] Data collected in 2019 reported that 91% of Ottawa adults were concerned about climate change. [13] The stress of climate change may be experienced through a direct hazard, such as floods, extreme heat events, wildfires, droughts, and rising sea levels, or through the indirect consequences of climate change, such as economic insecurity, migration and food and water insecurity. [51] Individual awareness and perception of climate change has also been shown to have adverse effects on mental health and resilience. [11] Consequently, climate change is a growing burden on mental health, health care systems, and on the individual and community's ability to adapt and sustain resilience in times of crisis. Action is needed to identify strategies to promote and protect the mental health of Ottawa residents and build community resilience in a changing climate.

Impacts on Mental Health

Eco-anxiety is the chronic fear or worry of climate change. It includes a diverse and complex range of emotional responses, such as fear, anger, sadness, grief, anxiety, and frustration, [12] as well as positive emotional responses, such as feelings of hope, empowerment, and connection to others.[52] However, climate change can have a more significant impact on mental health, such as depression, anxiety, post-traumatic stress disorder, suicide and substance use challenges. [12] There are factors that influence the mental health outcomes of climate change:

1. The type of climate change event can affect individuals and populations in different ways, such as a drought impacting people living in rural areas whose occupations rely on the land for income which leaves them vulnerable to depression and suicide.[53]
2. Health inequalities, such as age, gender, ethnicity, Indigenous status, pre-existing trauma and mental illness, as well as socio-economic factors, such as homelessness, and poverty.[49]
3. The capacity to adapt to climate change, such as preparing for a climate event, coping skills, social connections in neighbourhoods, and access to resources and services.[51]

Because of these factors, there are certain populations who are more vulnerable to the impacts of climate change:

- **Pregnant people** exposed to extreme weather events, heat, and pollution experience increased maternal distress, which, along with exposure to these events, negatively affects the developing fetus.[12]
- Infancy and young childhood are sensitive times for brain development. Exposure to extreme weather, heat, pollution, displacement, and news about climate can affect brain development and leads to anxiety, sleep challenges, and poor cognitive and emotional development. [12]
- **Children and youth** are impacted by climate change at all stages of their development. It places strain on their social relationships, increases family stress, disrupts opportunities to learn, exacerbates pre-existing childhood adversity, and increases socio-economic challenges, such as insecure housing and racism. [12] In addition, youth and young adults are aware of the injustice of climate change for their future. Seventy-six percent Canadian young people (16 to 25 years) report that people have failed to take care of the planet.[50] In Ottawa specifically, 49% of youth in grades 7 to 12 strongly or somewhat agree that they feel depressed about the future because of climate change, and 47% of youth in Ottawa schools were fairly, very, or extremely worried about climate change.[54]
- **People living with pre-existing mental illness** can experience increased morbidities with climate change; for example heat can affect people living with mood disorders and schizophrenia.[55]
- **Older Adults** are vulnerable to climate change; for example those living with dementia whose cognitive function can be impacted by effects of climate change. [55]
- **Indigenous People** are connected to the land and the natural environment through their culture and traditional practices. Climate change compounds the impacts of colonialism and intergenerational trauma by further threatening the loss of cultural identity, a sense of belonging and community, and a natural source of food and traditional practices.[56,57]
- **Diverse cultural populations** are impacted by climate change due to migration, existing inequities, and racism and discrimination.[51]
- **People with certain occupations,** such as farmers and outdoor workers are impacted by extreme weather events that impact their income and ability to work.[51]

Considerations

While governments and agencies work to mitigate the impacts of climate change, there are adaptation strategies that promote and protect mental health and build community resilience. Consideration should be given to the mental health risks associated with climate change and the ways those risks can be reduced when developing climate change adaptation policies, including the key psychosocial factors that can influence mental health outcomes.[58] For instance, building social connections and networks across neighbourhoods brings communities together in times of crisis and creates social capital. In the context of climate change, social capital is a protective factor that can support and enhance emergency response and recovery. [58] Actively engaging youth in the natural environment and climate change action brings hope, a sense of empowerment and improves mental health outcomes. [50] Health units can play a role in reducing the mental health impacts of climate-related hazards by conducting vulnerability and adaptation assessments, such as the assessments conducted by Ottawa Public Health (OPH) for the purpose of this report, and collaborating with partners to address these mental health impacts. [58]

OPH recognizes that climate change requires a multilevel approach involving the expertise of partners and people with lived and living experience. To successfully include mental health considerations in OPH's climate change planning, the following should be considered:

1. Continue working with the City of Ottawa to build climate resilient communities using a health equity and reconciliation lens.
2. Continue to support and coordinate with partners to ensure access to mental health services and resources in times of crisis.
3. Ensure access to evidence and data through the *Mental Health, Addictions and Substance Use Health in the Community* dashboard.
4. Provide parents and caregivers with information and resources to promote and protect infants, children and youth's mental health and ability to adapt to climate change.
5. Integrate mental health messaging into climate change and emergency preparedness planning.