Enabling local public health adaptation to climate change

Supplementary Materials

Appendix A

Current and Projected Health Impacts of Climate Change and Example Adaptation Measures

Health Impact Categories	Potential Changes	Projected/Possible Health Effects	Example Adaptation Measures
Temperature extremes	• More frequent, severe and longer heat waves • Increase in number of hot days • Possible colder conditions in some areas	• Increase in heat-related morbidity (e.g. heat stress, respiratory and cardiovascular disorders) and mortality, particularly in elderly populations • Possible change in patterns of morbidity and mortality due to cold	• Heat alert and response systems • Expand public access to drinking water • Development of cool refuges • Urban heat island controlling measures
Extreme weather events and natural hazards	• Increase in extreme weather events (e.g. extreme heat events, storms, hail, heavy rainfall, avalanches, landslides, drought, floods) • Rising sea levels and coastal instability	• Increase in disease, injury and mortality • Psychological health impacts (e.g. stress, anxiety, depression) • Illnesses associated with drinking contaminated water • Health effects due to displacement of populations and crowding in emergency shelters	• Flood warning forecasting • Flood risk mapping • Bolster existing emergency management plans to consider climate change
Air quality	• Increase in the concentrations of ozone and particulate matter in the air, including from wildfires • Earlier and longer pollen season, increased production of pollen and spores by plants • Migration of plants such as ragweed (Ambrosia artemisiifolia)	• Irritation of mucous membranes, respiratory reactions such as reduced lung functions, cardiovascular diseases, impaired physical performance • Exacerbation of respiratory conditions, asthma and hay fever symptoms • Increased frequency of allergy symptoms	• Air quality and health warnings

Contamination of food and water	• Increased contamination of drinking and recreational water from increased rainfall, flooding and drought	• Increased number of cases of food- and water-borne infectious diseases • Skin irritation	• Research (e.g. Evaluation of the impacts of climate change on food and water safety and public health outcomes) • Drinking water supply analyses
Vector-borne infectious diseases	• Changes in the biology and ecology of various disease-carrying insects, ticks and rodents (including geographical distribution) • Faster maturation for pathogens within insect and tick vectors • Longer disease transmission season	• Increased incidence of native vector-borne infectious diseases • Emergence or re-emergence of vector-borne infectious diseases previously not found or rarely found	• Improved monitoring of infectious diseases • Training public health professionals • Alert and response systems to infectious diseases • Raise public awareness of Lyme disease
Stratospheric ozone depletion	• Depletion of stratospheric ozone • Temperature-related changes to stratospheric ozone chemistry, delaying recovery of the ozone hole	• Increased number of cases of skin cancer, sunburns, and corneal and conjunctival inflammation	• Development or modification of shade policy guidelines • Increase green canopy

Adapted from Augustin et al. (2017); Berry et al. (2014); Umweltbundesamt (2013, 2015)

Appendix B

List of interviewees by jurisdiction

Level	Canada	Germany
Federal	- Health Canada - Public Health Agency of Canada - Environment and Climate Change Canada	- German Environment Agency - German Meteorological Office - Robert Koch Institute
Regional	**Quebec** - Quebec National Institute for Public Health - Ministry for Health and Social Services - Ministry of Sustainable Development, Environment and the Fight Against Climate Change	**Baden-Württemberg** - State Public Health Office - Ministry of the Environment, Climate Protection and the Energy Sector
Local Case Study #1	**Montreal** - Montreal Public Health Directorate - City of Montreal	**Stuttgart** - Stuttgart Public Health Office - City of Stuttgart
Local Case Study #2	**Estrie/Sherbrooke** - Estrie Public Health Directorate - CIUSSS de l'Estrie – CHUS - City of Sherbrooke	**Karlsruhe** - Karlsruhe Public Health Office - City of Karlsruhe
Non-Governmental Key Informants	- Conseil-Régional Environnement Montréal - Ouranos	- University of Stuttgart - Climate Alliance - South German Climate Office
Non-Canadian and Non-German Key Informants	- American Centers for Disease Control and Prevention (CDC) - American university researcher (university withheld by request for confidentiality)	

Appendix C

Interview Guide Key Themes and Example Questions

Theme	Example Guiding Questions
General Information	• What is your role at [department/agency]? How long have you been working with [department/agency]?
Administrative Structure (General)	• How is your [department/agency] organized? (e.g. how are decisions made, where does funding come from) • How does your [department/agency] work with the [regional] and federal governments on public health issues?
Adaptation Progress	• Can you describe health adaptation activities and planning in your jurisdiction? (e.g. vulnerability assessment, adaptation plan, policies) • How does health adaptation planning differ from other public health issues?
Adaptive Capacity	• Within your [department/agency], how would you describe the level of priority given to climate change adaptation relative to other health issues in your region? a. Currently and future • How would you describe your level of knowledge on climate change impacts and how to adapt to these impacts? a. Similar throughout [department/agency]? b. Sufficient knowledge to make decisions on climate change adaptation? • Does your [department/agency] have the capacity to implement adaptation initiatives? (e.g. knowledge, resources and skills)
Top-Down Influence	• How do the federal and regional governments influence your [department/agency] adaptation activities and decision-making? • Overall, do you think your [department/agency] receives adequate support from the regional and/or federal government for adaptation? • In your opinion, how could the regional and/or federal government best support your [department/agency]'s health adaptation activities?
Bottom-Up Influence	• Are you or your [department/agency] able to influence health adaptation decisions taken at the regional or federal level? If so, how?
Roles and Responsibilities	• How are the roles and responsibilities for climate change adaptation shared between levels of government in the health sector? • How should these roles and responsibilities be reconfigured to better support local health adaptation?
Other Actors	• Do you receive support (e.g. information, guidance, financing) for climate change adaptation from other sources? • Are any other actors are involved in local health adaptation planning and activities?
Closing Questions	• Does your [department/agency] have plans for further health adaptation activities in the future?

References

Augustin, J., Sauerborn, R., Burkart, K., Endlicher, W., Jochner, S., Koppe, C., . . . Herrmann, A. (2017). Gesundheit. In G. P. Brasseur, D. Jacob, & S. Schuck-Zöller (Eds.), Klimawandel in Deutschland: Entwicklung, Folgen, Risiken und Perspektiven (pp. 137-149). Berlin, Heidelberg: Springer Berlin Heidelberg.

Berry, P., Clarke, K., Fleury, M. D., & Parker, S. (2014). Human Health. In F. J. Warren & D. S. Lemmen (Eds.), Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (pp. 191-232). Ottawa, ON: Government of Canada.

Umweltbundesamt. (2013). Climate Impacts: Field of Action Human Health Retrieved April 13 2017, from https://www.umweltbundesamt.de/en/topics/climate-energy/climate-change-adaptation/impacts-of-climate-change/climate-impacts-germany/climate-impacts-field-of-action-human-health#textpart-1

Umweltbundesamt. (2015). Germany's Vulnerability to Climate Change: Summary.