

**COMMUNITIES ADAPTING TO CLIMATE CHANGE:
EMERGING PUBLIC HEALTH STRATEGIES**

by

Hannah Moffatt
B.Sc. McGill University, 2006

MASTERS PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF PUBLIC HEALTH

In the
Faculty of Health Sciences

© Moffatt, Hannah 2009

SIMON FRASER UNIVERSITY

Summer 2009

All rights reserved. This work may not be
reproduced in whole or in part, by photocopy
or other means, without permission of the author.

APPROVAL

Name: Hannah Moffatt
Degree: Master of Public Health
Title of Thesis: Communities Adapting to Climate Change:
Emerging Public Health Strategies

Examining Committee:

Chair: **Dr. Ryan Allen**
Assistant Professor
Faculty of Health Sciences

Dr. Tim Takaro
Senior Supervisor
Associate Professor
Faculty of Health Sciences

Dr. Kate Bassil
Supervisor
Assistant Professor
Faculty of Health Sciences

Dr. Michel Joffres
External Examiner
Professor
Faculty of Health Sciences

Date Defended/Approved: May 14, 2009



SIMON FRASER UNIVERSITY
LIBRARY

Declaration of Partial Copyright Licence

The author, whose copyright is declared on the title page of this work, has granted to Simon Fraser University the right to lend this thesis, project or extended essay to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users.

The author has further granted permission to Simon Fraser University to keep or make a digital copy for use in its circulating collection (currently available to the public at the Branches & Collections' "Institutional Repository" link of the SFU Library website www.lib.sfu.ca), and, without changing the content, to translate the thesis/project or extended essays, if technically possible, to any medium or format for the purpose of preservation of the digital work.

The author has further agreed that permission for multiple copying of this work for scholarly purposes may be granted by either the author or the Dean of Graduate Studies.

It is understood that copying or publication of this work for financial gain shall not be allowed without the author's written permission.

Permission for public performance, or limited permission for private scholarly use, of any multimedia materials forming part of this work, may have been granted by the author. This information may be found on the separately catalogued multimedia material and in the signed Partial Copyright Licence.

While licensing SFU to permit the above uses, the author retains copyright in the thesis, project or extended essays, including the right to change the work for subsequent purposes, including editing and publishing the work in whole or in part, and licensing other parties, as the author may desire.

The original Partial Copyright Licence attesting to these terms, and signed by this author, may be found in the original bound copy of this work, retained in the Simon Fraser University Archive.

Simon Fraser University Library
Burnaby, BC, Canada

ABSTRACT

Local governments throughout North American are mitigating greenhouse gases (GHGs) and adapting to the impacts of climate change. This project utilizes a case-based approach to address the question, “How does health promotion and public health practice influence municipal climate change adaptation?” The project reviewed resource materials and interviewed staff members from ten selected Canadian and American local government ‘leaders’ in adaptation. To provide a public health perspective, staff members from Toronto Public Health and Vancouver Coastal Health were also interviewed. Results demonstrate that there is a disconnect between many local health authorities and their respective municipality. The case studies illustrate the need to employ community-based strategies, recognize leaders in local governments and utilize strategic partnerships while adapting to climate change. Further research is required to understand how local governments can be proactive in preventing and mitigating the negative health and wellbeing consequences of climate change.

Keywords: climate change; adaptation; public health; health promotion; local governments

Subject Terms: climatic changes – health aspects; public policy; environmental health; local government – Canada; public health – Canada

EXECUTIVE SUMMARY

The increase of atmospheric concentrations of greenhouse gases (GHGs) and resulting changes in climate will have health and quality of life impacts on communities across Canada (Lemmen et al, 2008). Municipal organizations have become the fundamental units for climate change mitigation and adaptation strategies as input from provincial and federal levels of government has been limited. Many Canadian municipalities are currently not preparing for the consequences of climate change; however leaders in mitigation and adaptation strategies have emerged. Given that the inclusion of the health field is a potential strategy to protect the health of community members while adapting to climate change, this project seeks to address the question, “How do health promotion and public health practice influence the municipal climate change adaptation?”

Methods

This project utilizes a case-based approach to review local government leaders in climate change adaptation. Materials from eight Canadian and two American local governments were reviewed and open-ended structured telephone interviews were conducted with the staff members working on municipal climate change adaptation projects. The primary aim of these interviews was to verify the information available in community materials and to gain insight on adaptation from a municipal staff member perspective. Upon completion of the initial municipal adaptation project, two health authorities were

selected to provide a health field perspective on climate change adaptation. Interview data was analyzed using an iterative process that included multiple reviews of the data for content and themes.

Findings & Discussion

The case studies demonstrate a range of unique local government approaches, public engagement strategies, comprehensive plans and sector specific strategies. Climate change adaptation is described by staff members as an emerging inter-disciplinary practice that lacks a common framework. To increase the number of communities engaged in climate change health adaptations and to overcome obstacles to adaptation, a potential long term strategy is prioritizing health and wellbeing among communities with community organizing, communication and partnership approaches.

The community-based health adaptation framework provided by Ebi and Semenza (2008) is a community organization approach that may improve local climate strategies. In addition, these case studies demonstrate the importance of recognizing local governments as leaders in climate adaptation, utilizing strategic partnerships and exploring how communities can be proactive. However, the disconnection between health authorities and municipalities was evident in this case study.

Recommendations & Conclusions

Health promotion and public health practice influence municipal climate change adaptation in a number of ways. Specifically, public health is involved

through the provision of research and expertise to identify community adaptation priorities. There is also the potential for health promotion involvement in community partnerships, mobilization and messaging strategies. Further research is required to understand how local governments can be proactive in preventing and mitigating the negative health and wellbeing consequences of climate change. Recommendations include:

- Utilizing a community-based adaptation framework when developing local governments' climate policies
- Appointing a person or organization to be the leader of community adaptation strategies
- Ensuring partners share a goal, vision and objectives and are clear on their role and contribution to the adaptation process
- Increasing dialogue between municipalities and local health authorities to define the impacts local climate change will have on individual and on community health
- Prioritizing climate change adaptation at the federal government level in Canada
- Facilitating learning between local governments currently adapting to climate change

ACKNOWLEDGEMENTS

I would like to extend a sincere thank you to my senior supervisor Dr. Tim Takaro. I am grateful for Tim's continued support on this project and guidance throughout my MPH degree. I would also like to thank Dr. Kate Bassil who provided particular insight on this project and who has been continually helpful throughout the capstone process. An additional thank you is extended to the staff members from municipalities and health authorities who participated in this project. I am thankful for their time and expertise, their insight contributed greatly to this work. Finally, I must also acknowledge my friends and family for their continued support. Thank you.

TABLE OF CONTENTS

Approval	ii
Abstract	iii
Executive Summary	iv
Acknowledgements	vii
Table of Contents	viii
List of Figures	x
List of Tables	xi
Glossary	xii
1: Introduction	1
2: Climate Change: Health, Policy & Practice	3
2.1 Health & Climate Change.....	3
2.2 Climate Change Strategies, Roles & Responsibilities	5
2.2.1 Roles & Responsibilities of Government.....	6
2.2.2 Division of Health Responsibility	6
2.3 Climate Change Adaptation Practice.....	7
2.3.1 Current Municipal Mitigation & Adaptation Strategies	10
3: Methods	12
4: Findings	18
4.1 Municipal Climate Change Adaptation	18
4.2 Health Authority Climate Change Programs & Strategies	26
5: Discussion	30
5.1 Implications	33
5.2 Limitations	37
5.3 Research Gaps	38
5.4 Recommendations	40
Appendices	43
Appendix A: Concepts of Climate Change Adaptation	44
Appendix B: Adaptation Resources Available to Local Governments	46
Appendix C: Selection Plan for Reviewed Communities	49
Appendix D: Demographics of Local Governments Interviewed	50
Appendix E: Local Government Interview Guide	51
Appendix F: Interview Participants	53
Appendix G: Health Authority Interview Guide	54

Appendix H: Coding Definitions & Examples.....	56
Appendix I: Code Relationships	63
Reference List.....	65

LIST OF FIGURES

Figure 1: Framework for Community-Based Adaptation.....	34
---	----

LIST OF TABLES

Table 1: Climate Change Health Concerns in Canada	4
Table 2: Local Governments Reviewed	16
Table 3: Adaptation Progress of Local Governments Reviewed.....	19
Table 4: Summary of Recommendations	42
Table 5: Milestones of the ICEIL Guidebook	47

GLOSSARY

Adaptive capacity	The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (Séguin, 2008 citing IPCC, 2007).
Climate change adaptation	“Any action that reduces the negative impact of climate or takes advantage of potential new opportunities” (Mehdi, 2006).
Federation of Canadian Municipalities (FCM)	Is an organization that “represents the interests of municipalities on policy and program matters that fall within federal jurisdiction.” FCM has more than 1,775 members; which include Canada's cities, small urban and rural communities, and 18 provincial and territorial municipal associations. (For more information visit www.fcm.ca)
Greenhouse gas (GHG) mitigation	“A human intervention to reduce the sources or enhance the sinks of GHGs” (Mehdi, 2006).
Health promotion	“The process of enabling people to increase control over and to improve their health” (World Health Organization, 1986).
ICLEI – Local Governments for Sustainability	ICLEI is an association of more than 1000 local governments in 67 countries committed to sustainable development. (For more information visit www.iclei.org).
Partners for Climate Protection (PCP)	The Partners for Climate Protection (PCP) program is a program that connects Canadian municipal governments who have committed to reducing greenhouse gases and acting on climate change. PCP is a partnership between the Federation of Canadian Municipalities (FCM) and ICLEI - Local Governments for Sustainability.
Population Health	A population health approach utilizes the social determinants of health to address health inequalities at the societal or group level (Frank, 1995).

Public health	“One of the efforts organized by society to project, promote, and restore people’s health” (Last, 2001).
Risk assessment	Estimating the consequence, probability and resulting risk of specific climate change impacts on systems of interest (Snover et al, 2007).
Vulnerability	Vulnerability is susceptibility to harm. Vulnerability to climate change is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability to climate change is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity (Séguin, 2008 citing IPCC, 2007).
Vulnerability assessment	An iterative process that includes a sensitivity analysis, evaluation of adaptive capacity and assessment of vulnerability to the effects of climate change on built, human and natural systems (Snover et al, 2007). Vulnerability assessments utilize input from community stakeholders, historical data and experience, climate scenarios as well as future social and economic conditions (Mehdi, 2006).

1: INTRODUCTION

The increase of atmospheric concentrations of greenhouse gases (GHGs) and resulting changes in climate will have health and quality of life impacts on communities across Canada (Lemmen et al, 2008). An individual's health is considered a result of the complex interaction of the 'determinants of health,' which include social and economic factors, physical environments and individual traits and behaviour (PHAC, 2001). Health is also influenced by one's capacity to adapt to, respond to or control the challenges and changes of one's life (Frankish et al, 1996). The impacts of climate change on individual and community health have become increasingly evident as "Our economic, social and general wellbeing are all linked, both directly and indirectly to climate" (Lemmen et al, 2008, p23).

Mitigating GHG emissions is essential to reduce the long term impacts of climate change. However, regardless of the success of mitigation efforts the impact of climate change will continue into the future (Lemmen et al, 2008). The harmful human health effects of climate change require the process of climate change adaptation at the national, regional and community level (Ebi & Semenza, 2008).

Climate change adaptation must be realized through the use of local and regional level strategies to reduce the negative consequences of climate change. In Canada, municipal organizations have become the fundamental units for

climate change mitigation and adaptation strategies. Within this relatively new field there is a range of ongoing research and a lack of agreement on best practices. Many Canadian municipalities are currently not preparing for climate change; however leaders in mitigation and adaptation strategies have emerged.

Due to the interdisciplinary nature of climate change policy, local governments include a range of stakeholders while strategizing to prevent and prepare for the impacts of climate change. The inclusion of the health field is a potential strategy to protect the health of community members while adapting to climate change. Inter-related health disciplines in Canada include population health, health promotion and public health protection (Tricco et al, 2008).

Population health aims to change the health of the population through addressing the determinants of health and reducing population health inequalities. Health promotion seeks to utilize community-based partnerships to enable individuals and communities to gain control of their environment and overall health. Public health practice focuses on the governments' responsibility for health protection and includes disease surveillance and communicable disease control (Tricco et al, 2008).

This project utilizes a case-based approach to better understand various aspects of municipal climate change adaptation and mitigation policy. It provides perceptions from municipal and health authority staff members that will be useful for other communities adapting and preparing to adapt to climate change. This project seeks to address the question, "How do health promotion and public health practice influence municipal climate change adaptation?"

2: CLIMATE CHANGE: HEALTH, POLICY & PRACTICE

2.1 Health & Climate Change

The health effects of climate change occur through a range of pathways which differ in directness, scale and complexity (Séguin, 2008). Health impacts result from direct exposures (e.g. extreme heat events), indirect exposures (e.g. favourable conditions for infectious diseases) and as a result of social and economic disruption (e.g. stress resulting from a natural disaster). Table 1 describes typical risks and health effects associated with climate change in Canada.

Recently, Natural Resources Canada (Lemmen et al, 2008) and Health Canada (Séguin, 2008) released complementary reports about the impacts of climate change and required responses in Canada. In these reports, Canada's population is described as vulnerable to climate change. Populations most at risk to the health impacts of climate change include infants and children, seniors, pregnant women and their developing fetuses, people in poor health, and people whose livelihood is tied to the resource economy (Séguin, 2008).

Populations will also experience climate change differently based on the geographical variation of impacts across Canada. For example, coastal areas are at risk of sea level rise and rapid changes in Canada's Arctic have already been observed. Climate change is altering the way of life and wellbeing of Northern Canadians and particularly disrupting Canadian Aboriginal groups. As well, urban

areas may experience warmer temperatures and smog episodes whereas rural areas may be at greater risk of water quality and quantity issues as a result of drought and floods (Health Canada, 2005).

Table 1: Climate Change Health Concerns in Canada

Health Concerns	Examples of Health Vulnerabilities
Temperature-related morbidity and mortality	<ul style="list-style-type: none"> • Cold- and heat-related illness • Respiratory and cardiovascular illness • Increased occupational health risks
Health effects of extreme weather events	<ul style="list-style-type: none"> • Damaged public health infrastructure • Injury and illness • Social and mental stress due to disaster • Occupational health hazards • Population displacement
Air pollution-related health effects	<ul style="list-style-type: none"> • Changed exposure to outdoor and indoor air pollutants and allergens • Asthma and other respiratory disease • Heart attacks, strokes and other cardiovascular disease • Cancer
Health effects of water- and food-borne contamination	<ul style="list-style-type: none"> • Diarrhoea and intoxication caused by chemical and biological contaminants
Vector-borne and zoonotic disease	<ul style="list-style-type: none"> • Changed patterns of disease caused by bacteria, viruses and other pathogens carried by mosquitoes, ticks and other vectors
Health effects of exposure to ultraviolet rays	<ul style="list-style-type: none"> • Skin damage and skin cancer • Cataracts
Population vulnerabilities in rural and urban communities	<ul style="list-style-type: none"> • Older people • Children • People with compromised health status • People with lower incomes • People without shelter • Northern residents and Aboriginal people • People with disabilities • People living off the land
Socioeconomic impacts on community health and wellbeing	<ul style="list-style-type: none"> • Loss of income and productivity • Social disruption • Diminished quality of life • Increased costs to health care • Health effects of mitigation technologies

Source: Health Canada, 2005, p17.

2.2 Climate Change Strategies, Roles & Responsibilities

To diminish the harmful consequences of climate change, mitigation of GHGs and adaptation to climate change impacts are proposed as complementary strategies. Mitigation strategies are interventions that reduce the sources or enhance the sinks of GHG emissions (Mehdi, 2006). Climate change adaptation refers to “any action that reduces the negative impact of climate or takes advantage of potential new opportunities” (Mehdi, 2006, p8). Adaptation is often divided into reactive and anticipatory actions. Anticipatory adaptation is implementation of actions in advance of a climate event; reactive adaptation is implementation in response to a climate incident (Mehdi, 2006).

Sustainable development is a potential framework for the integration of climate change strategies directly into policy (Robinson et al, 2006). Sustainable development “implies meeting the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987). Shifting the frame of climate change policy to a sustainable development framework suggests engaging public and stakeholders to thinking in alternative development paths and places an emphasis on collective choices and decision making rather than individual behaviour change. This strategy also recognizes that climate change is not the only challenge municipalities face (Robinson et al, 2006). The Intergovernmental Panel on Climate Change (IPCC, 2007) Working Group II emphasize the importance of sustainable development for reducing climate vulnerability as strategies enhance adaptive capacity and increase resilience.

2.2.1 Roles & Responsibilities of Government

Defining roles and responsibilities is an important aspect of climate change policies. The recent federal publications define a role of Natural Resources Canada (Lemmen et al, 2008) and Health Canada (Séguin, 2008) in describing the evident and future climate change impacts as well as trends at the national and regional levels. In Canada, municipalities are considered organizational bodies of the provincial/territorial levels of governments. Regional government actions are various and differ from one province/territory to another. Despite regional government ambiguity, local municipal government levels play a key role in climate change adaptation and mitigation.

At the federal government level in Canada, there has been a lack of leadership in mitigating climate change through GHG reduction strategies. As a result, municipal level mitigation strategies have become a priority (for example see FCM, n.d. A). In terms of adaptation, local governments will experience climate change impacts in different degrees and in different ways, and thus local, specific strategies will be required. International and national levels of government may provide funding and support but the ultimate responsibility will be at the local and regional levels to tailor preparedness and plans proactively (Snover et al, 2007; Ebi & Semenza, 2008).

2.2.2 Division of Health Responsibility

Research results often describe health adaptation options yet fail to investigate key decision-making processes (Séguin, 2008). In Canada, federal, provincial, territorial and municipal authorities share the responsibility for the

delivery of public health, health care and emergency social services.

Responsibility for specific issues is allocated differently from one province/territory to another (Séguin, 2008). For example, Ontario currently has 36 public health units and British Columbia has six regional health authorities.

A central role in reducing climate-related health risks extends to municipal-level governments, given their roles in providing police services, fire and ambulance services, local public health and social services, and community emergency preparedness and planning (Séguin, 2008). Furthermore, at the local level, demographic and population specific information is available and knowledge of capacities and services can be utilized. Local emergencies are currently managed by municipalities with aid from provincial/territorial levels of government. Many municipalities are currently expanding their role in emergency services and require financial, information and technical support from higher levels government (Séguin, 2008).

2.3 Climate Change Adaptation Practice

Climate change adaptation is often considered an ongoing process rather than one assessment and responsive action (Ebi & Semenza, 2008). The process includes a number of iterative stages, including public participation, situational assessments, strategizing and prioritizing interventions, and implementation and evaluation of programs and policies (Ebi & Semenza, 2008; Mehdi, 2006; Snover et al, 2007; See Appendix A). A great deal of climate change conceptualization and research is ongoing on the local, regional, national

and international organizational level, yet coordination between these levels is generally poor.

The Canadian Climate Impacts and Adaptation Research Network (C-CIARN) (Mehdi, 2006, p8) states “In most cases, anticipatory adaptation is the most cost-effective and efficient plan of action.” However, anticipating and acting based upon projected future scenarios is difficult within a municipal organization. Planning for climate change requires taking preventative actions and working with evolving and imperfect information. When addressing uncertainty it is important to understand and record the certainty of the information that is available. Waiting for more certainty can potentially increase financial and social costs of not adapting to climate change (Snover et al, 2007). There is also acknowledgement that there is enough information available now to determine vulnerable populations and develop suitable adaptation options (Health Canada, 2005).

A challenge of climate change adaptation is that the actions required are specific to context and locale. Each community must choose adaptation measures that reflect their own circumstances (Mehdi, 2006). To integrate decision making at the local level, public participation approaches include local goal selection, utilization of local knowledge, building capacity, and creating institutional partnerships between local authorities, citizens’ groups, the private sector and scientists (Bizikova et al, 2007). Municipal adaptation to climate change is not a rapid process and requires continuous learning and flexible responses. Furthermore, taking incremental steps rather than large actions has

been suggested as a means of building institutional and public support. This also reduces the risk of unknown impacts and keeps options open to adapt in the future (Parzen, 2008).

One way to promote adaptation is to use 'win-win' approaches that reduce vulnerability to climate change while reducing costs or producing co-benefits (Parzen, 2008). Generally, measures aim to increase the resiliency of a municipality to deal with the impacts of climate change. 'No-regrets' strategies are actions taken that provide benefit regardless of future climate changes (Mehdi, 2006). The strategies ensure prudent risk management and are not necessarily considered 'climate change' adaptation but reduce a population's vulnerability to current climatic risks. However, this strategy may have tradeoffs and additional considerations; "The challenge for public health decision makers will be to balance efforts to alleviate today's stresses with the need to prepare for the unexpected" (Health Canada, 2005, p15).

There are numerous climate change adaptation and mitigation strategies available within multiple sectors of a community preparing for climate change. As a result there are often synergies but also tradeoffs between strategies. There are actions that integrate climate change mitigation and adaptation. For example, green roof strategies increase a building's resiliency and decrease energy requirements during extreme heat events. However, there are also strategies that are adaptive but increase GHG emissions. For example, air conditioning during an extreme heat event decreases health risks but also increases energy consumption and GHG emissions.

2.3.1 Current Municipal Mitigation & Adaptation Strategies

The Federation of Canadian Municipalities (FCM) has a 'Partners for Climate Protection' (PCP) program to help municipalities reduce GHGs emissions within their community and corporate structure. As of February 2009, a total of 178 of municipalities have participated in the five milestone program (FCM, n.d. A). Municipalities range in levels of engagement; some municipalities have recently joined the PCP, other members have been involved successfully for a number of years. For example, the City of Edmonton, Alberta joined in 1995 and has completed all 5 community and corporate milestones. Yet still others have been involved with limited success; Chelsea, Quebec, for instance, joined in 1997 and has not completed any milestones. In general, large municipalities participating in the PCP program have achieved a greater number of milestones in comparison to smaller communities. As well, a majority of Canadian municipalities are not members of the PCP program; municipalities may or may not be involved in other mitigation strategies.

The FCM supports a Centre for Sustainable Community Development and distributes funding to municipalities through the 'Green Municipal Fund' (FCM, n.d. B). In contrast to mitigation efforts, there is no FCM program specifically supporting municipal climate adaptation measures. However, the mission statement of the Centre for Sustainable Community Development is aligned with strategies that promote holistic decision making and planning; considerations which are imperative for climate change adaptation.

In comparison to the ongoing work within European nations and at the level of the European Union (European Union, 2008), adaptation strategies have been implemented relatively slowly in Canada. However, leaders in municipal climate change adaptation have recently emerged. For example, the City of Toronto has a division devoted to climate change adaptation within the Environmental Office (City of Toronto, 2009). As well, the Corporation of Delta has a specific plan for flood management as a result of sea level rise in the area (Corporation of Delta, 2009). There are a number of resources available to municipalities preparing for the effects of climate change (See Appendix B), however, the majority of Canadian municipalities are not adapting to climate change.

To protect health and promote the wellbeing among Canadians, climate change adaptation has recently emerged as an important local government practice. Given the uncertainty of local roles and responsibilities, this project seeks to address the question, “How do health promotion and public health practice influence the municipal climate change adaptation?”

3: METHODS

The “Communities Adapting to Climate Change” project began as a Directed Studies Project (HSCI 893) to review the climate change adaptation literature including peer reviewed scientific journals and non-published resources available to municipalities. Additionally, municipalities currently adapting to climate change were selected for review using a case-based approach. The work was limited to the climate change adaptation strategies employed by local governments in North America.

A selection plan to review a limited number of Canadian and American community adaptation plans was determined. The criteria for selection included leadership in climate change adaptation, geographical location and population size (for details see Appendix C). The selection of communities was constrained by finding communities with available climate change adaptation information through interpersonal communication channels and accessible Internet websites. As previously noted, many municipalities across Canada are neither planning nor taking action to adapt to climate change. The group of municipalities selected are ‘leaders’ in climate change adaptation.

Table 2 lists the communities selected, their climate change actions to date and materials produced. The eight Canadian municipalities reviewed were from seven different provinces/territories. The City of Keene, New Hampshire was selected because it was the first ICLEI – Local Governments for

Sustainability adaptation pilot city. A representative from King County, Washington was interviewed because of the local government's leadership in developing the ICLEI guidebook (Snover et al, 2007). King County is not a municipality but a local government which provides regional services. Appendix D describes the various geographical and population sizes of the local governments interviewed.

Materials from the selected local governments were reviewed and open-ended structured telephone interviews were conducted with available staff members working on municipal climate change adaptation projects. Local government materials reviewed included formal climate change adaptation plans, City Administrative Reports, summaries of initiatives on municipal websites and documents summarizing the results of pilot projects. The materials were examined to review the ongoing municipal climate policies, strategies and partnerships. The review particularly focused on adaptation strategies that related to the health field and described health issues and perspectives.

Staff members from each of the selected communities participated in the telephone interview between 20 and 35 minutes in length. The primary aim of these interviews was to verify the information available in community materials and to gain insight on adaptation strategies and planning processes from a municipal staff member perspective. The interview guide is available in Appendix E. The municipal staff interviewed included Managers, Senior Environmental Officers, and Project Coordinators who responded to emails and phone calls directed towards the department responsible for the climate change initiatives.

The City of Dawson interview was with a project manager from the Northern Climate ExChange working in partnership with the municipality. The title and association of all participants is available in Appendix F. These interviews were retroactively approved by the Simon Fraser University Research Ethics Board and all interview participants signed a consent form to release their responses for this research.

Upon completion of the initial project of municipal adaptation, two health authorities were selected for more in-depth case studies. These health authorities were selected as they each have jurisdiction over a large Canadian municipality who is recognized as a leader in climate change adaptation (the City of Toronto and the City of Vancouver). The primary aim of these interviews was to provide a health field perspective on climate change adaptation. Ethics approval for these supplemental interviews was obtained from the Simon Fraser University Research Ethics Board. Open-ended telephone interviews were conducted with a Toronto Public Health Research Consultant and the Regional Director of Health Protection at Vancouver Coastal Health. The supplemental interview guide is available in Appendix F.

Interview data included notes taken during the interview and direct quotations of interviewees. Prior to analysis, the main points of interview notes and direct quotations were cross-verified by the interview participants. Data analyzed included restatements and additional information, background and context from the participants. As previously noted, the information collected in the

interviews was analyzed in conjunction with the municipal climate change resources available to the public.

Emergent codes were utilized to analyze the interview data for content and themes. As described by Neuman (2006), *open coding* of the interview data assigned initial themes and subsequent *axial coding* assigned code labels to the themes; finally *selective coding* examined the data for conceptual coding categories. Sections from interview notes were coded, using an iterative process that included multiple reviews of the data. Codes were assigned to the interview text; when appropriate, multiple codes were assigned to the same section of text or sections of the text were not coded. The emergent codes included both ideas previously discussed in the climate change literature and new themes that became apparent throughout the interview process. The list of codes, definitions and examples is available in Appendix H. The conceptual relationships between the codes, assessed in the *selective coding* process, are portrayed in Appendix I.

Table 2: Local Governments Reviewed

Local Government	Title of Interviewee Participant(s)	Greenhouse Gas Mitigation	Climate Change Adaptation Progress/Materials
City of St. John's	Manager, Environmental Initiatives, Waste Management Division	PCP Milestone 3 (Development of a local action plan)	ICLEI Adaptation Pilot Project participant
City of Yellowknife	Energy Coordinator	PCP Milestone 4 (Implementation of a local action plan)	Partnered with the Pembina Institute to develop planning document (Pryor & Cobb, 2007)
City of Edmonton	Environmental Engineer, Office of the Environment, Deputy City Manager's Office	PCP Milestone 5 (Monitoring progress and reporting results)	Future participant of a Canadian Council of Engineering Pilot Project on municipal infrastructure adaptation
Halifax Regional Municipality	Manager Infrastructure Planning, Acting Manager, Sustainable Environmental Management Office	PCP Milestone 4 (Implementation of a local action plan)	Produced "Climate SMART: An integrated strategy for climate change mitigation and impact & adaptation preparedness and planning" (HRM, 2007A; 2007B)
Corporation of Delta	Senior Environmental Officer	PCP Milestone 1 (GHG inventory & forecast)	Developed nine climate change initiatives (Delta, 2009); participated in the ICLEI Adaptation Pilot Project & UBC Community Visioning Project
City of Toronto	Senior Environment Specialist, Toronto Environment Office	PCP Milestone 2 (Emissions reductions target set)	Produced "Ahead of the Storm: Preparing Toronto for Climate Change" (Toronto Environment Office, 2008)
City of Vancouver	Project Manager, Sustainability Group	PCP Milestone 4 (Implementation of local action plan)	Working internally to develop adaptation strategies, reporting to Council (City of Vancouver, 2008)
City of Dawson	Dawson Adaptation Coordinator, Northern Climate ExChange	Not a member of the PCP program	Working with the Northern Climate ExChange to develop an adaptation plan

Local Government	Title of Interviewee Participant(s)	Greenhouse Gas Mitigation	Climate Change Adaptation Progress/Materials
Keene, USA	Planning Director & City Planner	Clean Air, Cool Planet partner city	Produced climate change adaptation plan (City of Keene, 2007) & completed a community visioning process
King County, USA	Climate Change Policy Advisor, King County Executive Office	King County Executive Ron Sims has called on the region to cut GHGs by 80 percent below current levels by 2050	Published "How to Prepare for Climate Change: A Guidebook" (Snover et al, 2007) in association with by ICLEI, produced an adaptation plan & annual report (King County 2007; 2009)

4: FINDINGS

4.1 Municipal Climate Change Adaptation

A range of Canadian and American leaders in climate change adaptation were reviewed using this case-based approach. The communities were classified into categories as explored in Rogers' (2003) *Diffusion of Innovations*. This theory classifies members of a system based on their degree of innovativeness; "the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system" (p280). The five adopter categories, beginning with the earliest adopters, are: (1) innovators, (2) early adopters, (3) early majority, (4) later majority, (5) laggards. This assessment divided the communities selected as leaders into adaptation 'innovators' and 'early adopters' categories. 'Innovators' in climate change adaptation include communities who have current plans and 'early adopters' are those who have begun the planning process but have not yet established formal strategies or plans. Table 3 describes the stages and assesses the current progress of the participating local governments.

Table 3: Adaptation Progress of Local Governments Reviewed

Local Government	Stage	Progress to Date
King County, WA	Adaptation innovator – comprehensive plan	Partnered to produce the local governments guide.
City of Keene, NH	Adaptation innovator – comprehensive plan	Adaptation has been incorporated in the community visioning process. Strategies have not yet been implemented.
City of Toronto, ON	Adaptation innovator – comprehensive plan	Implementation of the plan has been gradual on multiple fronts. Many strategies ongoing prior to adaptation.
Corporation of Delta, BC	Adaptation innovator – sea level rise & flood management planning	Flood Management Plan underway (dikes upgraded; modeling storm surge and monitoring water levels); Sustainable Development Plan underway (review of bylaws by the Pembina Institute).
Halifax Regional Municipality, NS	Adaptation innovator – emergency response planning	Implementation of developer guidelines, ground water regulations, underground wiring has occurred. Integration into existing practice has been a work in progress.
City of Vancouver, BC	Adaptation innovator – internal planning	Currently assessing vulnerability and reporting to council on specific initiatives.
City of Dawson, YK	Early adopter – partnership to develop comprehensive adaptation plan	Project coordinator is seeking community input on vulnerabilities and potential adaptation strategies.
City of Edmonton, AB	Early adopter – ongoing thought about internal planning process	Staffs have taken internal initiative to begin adaptation strategizing and planning.
City of Yellowknife, NWT	Early adopter – partnership to develop adaptation strategy	The strategy is currently delayed as climate change threats were not identified during the assessment process.
City of St. John's, NL	Early adopter – pilot project participant	Lack of human/financial resources & political commitment has delayed progress.

Municipal Strategies: Planning & Problem Identification

At the time of the interviews, three municipalities - City of St. John's, City of Edmonton, and City of Dawson - had not yet produced any type of adaptation plan. The City of Yellowknife had produced a decision making strategy for potential climate adaptation (Pryor & Cobb, 2007). Two municipalities (Toronto

Environment Office, 2008; City of Keene, 2007) and a regional government (King County, 2007) had produced comprehensive planning documents.

The City of Keene representatives noted their comprehensive plan did raise awareness of climate change adaptation within the health industry. However, the difficulty of translating a plan into community action and implementation was discussed. A report published by the Clean Air Partnership (Penney, 2008) describes the process of adaptation planning for the City of Toronto as prolonged yet worthwhile due to increased ownership of the document and a wide range of engagement throughout the process. Two municipalities (Corporation of Delta, 2009; HRM, 2007A) had sector specific plans and one municipality (City of Vancouver, 2008) had produced internal documents and a report to council. The participant from the Corporation of Delta noted they chose purposefully not to do one extensive document because “staff are pressed for time and action. The large documents typically created for these projects are rarely thoroughly read and are usually underutilized.” The City of Vancouver participant noted they also intentionally did not publish a plan and instead aimed to plan within existing frameworks.

A number of strategies were utilized to define the climate threats and to prioritize adaptation responses. Municipalities often focused upon physical impacts of climate change. The Halifax Regional Municipality has compiled a Risk Management Strategy (HRM, 2007B). The strategy does not include social impacts in the assessment process yet the participant interviewed acknowledged that segments of the population were more vulnerable to extreme events. The

City of Dawson is completing focus groups with community members; to identify possible strategies the municipality asked, “What can we do to make ourselves more resilient [to climate change]?” To identify sensitive areas, the City of Vancouver is completing a vulnerability assessment. The King County representative focused on obtaining specific “actionable and practical” information, specifically, projected climate data, to identify the climate threats. The City of Yellowknife representative noted that the high uncertainty of climate projections did not provide enough information to justify investments into prevention activities. The City of Keene participants noted a lack of climate projection data at the local level and that social vulnerabilities were often “more anecdotal” in description. The range of municipal planning and problem identification strategies demonstrates there is no common best practice framework available while preparing for the impacts of climate change.

Decision Making & Public Engagement Strategies

Municipal staff members described the importance of input and approval by members of council and the municipal mayor. The lack of support from current and past council members was only specifically mentioned by participant from the City of St. John’s. Public participation was also defined as valuable for the decision making process. The City of Toronto adaptation strategy included an extensive public engagement process (Penney, 2008). The City of Dawson had been working closely with the community throughout the situational assessment and development priority adaptation actions. The City of Keene representatives described a strategic consultation process that did not include public input until

adaptation strategies were incorporated into the master community plan. The City of Vancouver representative noted the adaptation process has intentionally been kept flexible to allow for internal and external stakeholder engagement, however noted the current lack of public engagement due to the difficulty of climate change attribution and the desire to avoid climate change debates within the public. The City of St. John's participant noted public consultation was not ongoing because of lack of resources.

A number of municipal initiatives began with a priority on infrastructure adaptation. The City of Yellowknife participant extensively described the importance of identifying a "threat" to which an adaptation strategy could be based upon. In their external assessment no climate threat was identified, resources could not be mobilized, thus the respondent asked "How do you become proactive?" Responding to unique and local climate change threats was identified by a number of 'innovator' municipalities. The City of Vancouver noted that adaptation is often 'niche oriented.' These municipal perspectives demonstrate that decision making and public engagement strategies are specific to the locale and context of communities. To prepare for climate change and take preventative action a number of stakeholders must be engaged in the process.

Municipal Implementation: Partnerships & Mainstreaming Adaptation

A number of the 'innovator' municipalities have collaborated with government, non-governmental organizations (NGOs), academics and industry partners during the adaptation process. The City of Toronto partnered with two external organizations for the development of strategy and is the only Canadian

member of the Urban Leaders Adaptation Initiative (Penney, 2008; CCAP, 2008). The participants from ‘innovator’ governments noted partnerships with academia and scientific research. The Halifax Regional Municipality’s strategy was developed through a partnership between the municipality, province, federal government and private companies (HRM, 2007A). The benefit of learning from other governments and integrating existing guidebooks and frameworks was discussed by both ‘innovators’ and ‘early adopters.’

Participants also noted the requirement to coordinate multiple sectors due to the range of climate change issues and response strategies within a municipality. The King County participant noted that integration of climate change adaptation into practice has increased interdepartmental communication. Two of the four participants from ‘early adaptor’ governments strongly described the need to balance climate initiatives with other municipal issues. Adaptation was discussed as an emerging practice among municipalities by three of the six ‘innovators’ governments. Six of the ten local governments reviewed had or will participate in an adaptation pilot project.

‘Innovators’ of adaptation working with comprehensive plans described the process of implementation as gradual. The King County participant noted that adaptation is about mainstreaming climate change considerations into everyday planning processes. The City of Toronto participant also noted that the current actions were activities the municipality was already working on. The City of Vancouver and the City of Yellowknife participants noted that existing flexible municipal processes facilitated adaptation. The City of Toronto mentioned that

no-regrets activities have been the first actions implemented. The City of Keene participants noted that framing climate change policies in terms of long term cost saving strategies is crucial within local government. The importance of practicality at the municipal level was described by the City of Keene participants and two of the four participants from 'early adopter' governments.

Two of six 'innovators' of adaptation practice specifically noted that adaptation and mitigation strategies have the potential to be synergistic. However, the City of Yellowknife participant described a tradeoff between adaptation and mitigation strategies; adaptation efforts would reduce the community's focus on mitigation. The City of St. John's participant noted that framing climate change as sustainable development was potentially useful for future funding and practice. The Halifax Regional Municipality's climate change strategy is considered part of a long term plan for sustainability (HRM, 2007A). The Corporation of Delta climate change initiative includes a Sustainable Development Plan. The municipal perspectives demonstrate that partnerships and other strategies are useful for integrating adaptation into everyday planning and decision making.

Municipal Perceptions of Health Adaptations

'Early adopters' of initiatives implied that citizen health as not a municipal issue; the City of Yellowknife participant described health as the territory's jurisdiction and the City of St. John's participant mentioned health was not normally a concern of municipalities. The City of Edmonton participant noted that health was not explicitly linked to municipal initiatives but that mitigation and

adaptation efforts often have tangential health benefits; the initiatives have the potential to affect health yet have been implemented for other reasons.

The City of Toronto participant noted a number of health concerns associated with the municipality's changing climate. The City of Delta participant noted that their focus on sea level rise and flood management in the community had no direct health threats. The City of Keene participants noted that the health field was included in the social environment aspects of the planning process. The Halifax Regional Plan (HRM, 2006) included input from health professionals and prioritized a healthy, safe and walk-able community. The City of Vancouver participant described the major snow fall event during December 2008 as impacting citizens socially and physically. The City of Vancouver participant described the event saying "That is a health issue." Following this discussion, the participant asked; how do municipalities protect their citizens? As well as, what criteria should be used for evaluating the delivery of municipal services?

The association between climate change and health was described as topical to community members; the King County participant stated that health was an important topic, "this is what matters to people." The City of Delta noted that health is often included as part of their communication strategy. Given the public's pre-existing air quality concerns, air quality improvements are a rationale for mitigation and adaptation strategies.

'Innovator' governments with comprehensive plans described partnering with their local health authority while planning adaptation strategies. The City of Toronto participant noted, "Toronto Public Health continues to play a key part of

the climate change adaptation committee.” The King County participant described public health input in prioritizing initiatives given limited resources. Of the six ‘innovator’ governments, the three governments with sector-specific planning processes have not yet partnered with a health authority for climate change adaptation planning. The City of Vancouver noted that the municipality has previously partnered with the health authority on other initiatives, for example to monitor the noise by-law. The various partnership strategies with health authorities as well as the range of municipal staff perspectives on associations between health and climate change reveal the potential for strategizing health and adaptation strategies in a more comprehensive and complementary fashion.

4.2 Health Authority Climate Change Programs & Strategies

The two health authorities, Toronto Public Health (TPH) and Vancouver Coastal Health (VCH) were selected for comparison. The objective of these case studies was to better understand interactions between health authorities and municipal governments. Both cities are considered ‘innovators’ in this discussion yet the municipalities are in different stages of adaptation. The City of Toronto has been involved in adaptation for a long period of time and is utilizing a comprehensive planning strategy whereas the City of Vancouver has recently made their internal planning adaptation strategies public. TPH has two projects directly related to extreme heat event adaptation; heat adaptations were an obvious start as the programs existed prior to adaptation planning. The hot weather response program is working with academia to describe social vulnerabilities within the community and Health Canada is partnering to evaluate

the project. TPH was involved in the core steering group working on the City of Toronto adaptation plan. Currently TPH is interviewing divisions from the health units to understand what work is ongoing and who might be interested and involved in future climate change programs. The interviews serve to instigate reflection about climate change adaptation among staff and may result in re-framing initiatives. As the VCH participant said, “While programs are not actually framed as climate change they potentially will be adaptation strategies.” In contrast, the interview with VCH participant described historical and current GHG mitigation strategies.

The health authorities have different organizational structures. TPH is within the city governance structure. The health authority in Vancouver has been reorganized a number of times; presently VCH is a regional health authority that comprises a number of municipalities. The VCH participant feels not being part of the municipal structure is one reason adaptation is not a priority; various stages in the regionalization and the urgency to address treatment has left little resources for prevention strategies. The TPH participant noted the importance of partnerships and the available funding within a large municipal organization. The VCH participant noted the health authority did not have the same level of commitment as TPH; the Toronto Atmospheric Fund provided resources that were not available for mitigation in Vancouver.

When asked, the health authorities noted very similar potential health threats of climate change. The TPH participant linked the potential health threats to ongoing strategies. For example, TPH has an emergency response team that

reacts to health emergencies. Attributing the emergencies as climate change related does not alter the response strategy. The VCH participant noted that the health authority has a specific regulatory role in water quality regulation.

Potential Climate Strategies

The VCH participant was optimistic about the potential for climate change adaptation strategies with the City of Vancouver and noted that strategies have the potential to be included under a number of different health authority departments. Furthermore, the VCH participant said “under the new BC Public Health Act there are ways to collaborate for a healthier community.” The potential to use health in climate change messaging was described; in the words of the participant, “we can use the health angle, not to sell that climate change is coming, but to say climate change is important.” The participant also noted the previous lack of commitment for GHG mitigation strategies by staff, though the province of British Columbia now has a mandate to reduce emissions and Chief Medical Health Officer is the chair of VCH working group.

Challenges of Climate Adaptation

The TPH participant described adaptation as an emerging theme among health professionals. The participant explained that special considerations were required while partnering with academia on new fields of research and practice. The participant described the difficulty of creating health messages that are not contradictory. For example, contradictory messaging may occur when aiming to prevent West Nile Virus (e.g. ‘wear long sleeves and stay inside in the evenings’), reduce risk from extreme heat (e.g. ‘wear light clothing and stay

inside during the day’) but also promote physically activity. When describing this concern, the participant stated “Aligning health messages will be difficult for other health authorities as well.” This statement expresses the need to partner and share resources to best address challenges in the emerging field of climate change adaptation. Finally, the TPH participant noted that there were a great deal of resources for extreme weather and infrastructure adaptation but gradual long term changes will also require planning and preparation.

5: DISCUSSION

Climate change adaptation and mitigation strategies have human health, social and quality of life impacts. Municipal organizations have become the fundamental drivers of climate change mitigation and adaptation strategies. However, most municipal mandates do not include roles and responsibilities for community health and wellbeing. Thus their strategies are often not evaluated through a health lens. Health authorities often focus on hospital and acute care; secondary and increasing roles of health authorities are health promotion and prevention strategies. Together, municipalities and health authorities greatly influence the health and wellbeing of the community and its individual members. Collaboration on health and wellbeing strategies requires a partnership and stakeholder engagement process.

Many municipalities are currently struggling to become proactive in the face of climate change. The use of legislation, such as the BC Public Health Act was described as a potential local government mobilization strategy. Legislation potentially authorizes action and designates roles and responsibilities. However, there is a perception among municipal staff members that the public is reluctant to take climate change action. At the local government level, municipal participants described the importance of being practical and framing strategies as beneficial in terms of cost-benefits when possible.

The range of unique municipal approaches, public engagement strategies, comprehensive plans and sector specific strategies demonstrate climate change adaptation is an emerging field in which there is no common best practice framework. There is a great need for locally specific climate data and vulnerability assessments. Furthermore, the organizational structure of local governments, both the municipality's structure and the relationship with health authority, changes a community's climate change adaptation strategy. The municipal case studies demonstrate climate change strategies and priorities often occur in context of local, provincial and national jurisdictions. The various agendas of the jurisdictions influence municipal approaches to climate change.

Climate change adaptation is an emerging inter-disciplinary practice that involves a number of roles and responsibilities. Many of the leaders in adaptation noted the need for practical health information and research. Partnerships between health authorities, academics and NGOs were described as one tool for overcoming this obstacle. However, the disconnection between health authorities and municipalities was evident throughout this case study. A health promotion, population and public health perspective and knowledge of health infrastructure was often absent in discussions with municipal staff members. For example, when assessing the impacts of climate change social vulnerability information was often incomplete. As well, the co-benefits of municipal climate strategies were described as unintended. Exploiting co-benefits is a promising strategy to further the climate change policy agenda. Climate change health concerns considered by municipal staff members also demonstrated a lack of

communication with health professionals. For example, flooding has local health impacts but often municipal staff members considered the relationship to be indirect and not a priority.

This study demonstrates that clearly defining roles within partnerships is a major challenge. For example, what does a health authority contribute to a municipal planning process? Climate change health concerns require a specialized expertise that may not be available in small health authorities. Health authorities may, however, provide a population health inequality approach in vulnerability assessments. The field of health promotion may be involved in offering resources and ongoing programs that increase a community's adaptive capacity and address health inequalities.

There is potential for a municipality to partner with health authorities or NGOs to provide credible climate change messages. Health is considered a topical issue for community members and thus is a potential social mobilization tool for both public health practitioners and municipal organizations. Risk communication and health messaging within a municipality was often described as informal. Municipal staff members described using or potentially using health messages yet did not describe coordinating the messages with local health authorities. Health authorities are potential reputable partners for the provision of messages that convey specific population risk.

5.1 Implications

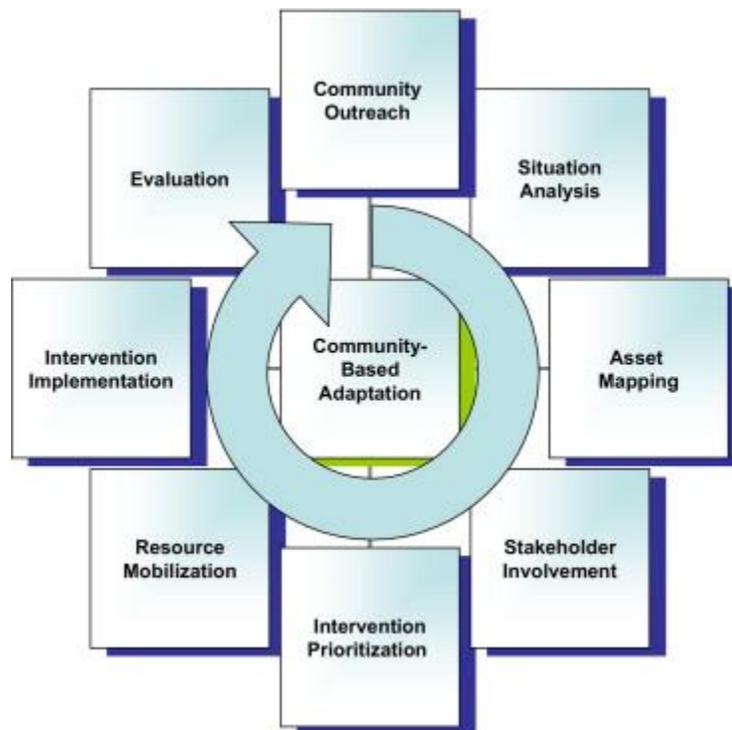
Health promotion and public health practice influence municipal climate change adaptation in a number of ways. Specifically, public health is involved through the provision of research and expertise to identify community adaptation priorities. There is also the potential for health promotion involvement in community partnerships, mobilization and messaging strategies. However, many municipalities compared in this case study are not part of the organizational structure and are not currently partnering with their local health authority. The potential for working collaboratively between health authorities and municipal organizations was often discussed; however there are a number of obstacles to overcome. Obstacles include the need for governments to be proactive and the climate change specificity and expertise required at the local level. To increase the number of communities engaged in climate change health adaptations and to overcome obstacles to adaptation, a potential long term strategy is prioritizing health and wellbeing among communities with community organization, partnership and communication strategies.

Community-Based Adaptation to Climate Change

Ebi and Semenza (2008) provide a framework for community-based health adaptations to climate change (Figure 1). The framework is a community organization approach to be implemented in specific local contexts and is designed to reach vulnerable populations through stakeholder engagement. The framework focuses on strategies that empower community members and strengthen social capital. The link of climate adaptation with social capital is

noted to be particularly important to connect community members at different levels of power as well as to engage various levels of expertise require in adaptation strategies. Community engagement is described as a way to enhance community resilience to climate stressors and also aid in the community's ability to cope with other societal issues (Ebi & Semenza, 2008).

Figure 1: Framework for Community-Based Adaptation



Source: Ebi & Semenza, 2008, p503.

This framework could be employed to overcome the barriers to adaptation evident in the case studies. However, the framework does not describe the importance of defining leadership and partnerships in adaptation strategies and

requires additional exploration of how communities can be proactive while strategizing actions.

Successful social mobilization approaches appoint a strategic form of leadership; an individual, a group or organization, or steering committee (Patel, 2005). Municipal organizations have become the fundamental units for climate change mitigation and adaptation in Canada. They have partnered with local NGOs, academic institutions, other levels of government and even businesses to adapt locally to climate change. To successfully apply this framework the role of Canadian municipalities in the adaptation process must be emphasized. Local governments will experience climate change and be required to respond with local capacities. Thus local governments require adequate resources to develop strategic climate policies.

Social mobilization approaches utilize the synergistic benefit of partnerships (Patel, 2005). Partnerships are required among public service sectors to develop healthy public policies (Naidoo & Wills, 2005). Partnerships in climate change adaptation provide particular knowledge, skills and expertise. As well, strategic partnerships can be created to communicate credible messages to various stakeholders.

Partnerships have a number of benefits including (1) a mix of skills and knowledge; (2) sharing common concerns and information; (3) the ability to influence decision making; (4) avoiding duplication or gaps in services; (5) expand budgets and utilize resources effectively; and (6) approach problems comprehensively and holistically. However, partnerships require that members of

a group relinquish control and the inclination to prioritize self-interests. Further, when group members are not clear about their role or contribution conflict may arise. Steps to overcome barriers in the establishment of partnerships include (1) find a shared goal; (2) build trust gradually; (3) find a common currency; (4) clarify vision and objectives; (5) include a wide range of stakeholders; (6) have good communication, visibility and transparency of working; and (7) develop human resources (Naidoo & Wills, 2005).

Part of community outreach is utilizing communication strategies which frame the issue of climate change adaptation for decision makers and the public. In communication strategies framing is used to present a problem in a context which ultimately shapes its meaning and attribution of responsibility (Wallack et al, 1993). Ryan (1991) notes “every frame defines that issue, explains who is responsible, and suggests potential solutions” (p59). In community communication and advocacy approaches, framing is often paired with audience segmentation and the implementation of multilevel interventions.

To make policies easier to accept Maibach, Roser-Renouf and Leiserowitz (2008) suggest choosing message frames that are consistent with target audience values. There is potential for risk perception to have a role in behavior messaging related to climate change. However, the use of fear appeals in climate messaging requires further research (Maibach, Rose-Renouf & Leiserowitz, 2008). As health is topical to community members, framing community-based adaptation as improving community health and wellbeing is one potential strategy to reach decision makers and the public. This requires that

decision makers understand the concept of community health and wellbeing and understand the direct and indirect health consequences of climate change.

One mobilization approach explored by Ebi and Semenza (2008) includes the use of storylines to describe the possible local health risk of climate change in compelling narratives. These narratives may describe a range of vulnerabilities and allow stakeholders to visualize and identify responses to potential risks (Ebi & Semenza, 2008) and make modeling and statistics more real-life.

5.2 Limitations

This case approach of local government climate change adaptation comprised a small purposeful sample of interviews. The review focused on adaptation 'leaders' and does not reflect wider perspectives from governments, particularly those not preparing for climate change. There was also a bias for ICLEI adaptation programs because planning information was available on websites and through communication networks. This selection bias is likely natural as many of the early leaders in adaptation emerged from the ICLEI program. Adaptation strategies external to the ICLEI were sought and included in this case study.

Interviews were conducted with various staff members with different roles and responsibilities. Their own personal role and participation in the adaptation and mitigation strategies influences their responses to the interview questions. The interviews are a 'snap shot' of one perspective from each of the organizations contacted. One perspective does not reflect opinions of other staff

or decision makers within the municipality. Nonetheless, the range and number of cases reviewed provide a useful description of ongoing adaptation strategies and perspectives in Canadian communities.

A number of possible biases during the interview process include interviewer bias and social desirability bias. The researcher's interest in connecting adaptation strategies to community health may have influenced participant responses. As well, participants may have felt it was socially desirable to respond with information that reflected their adaptation strategy as positive. The researcher was previously employed by the City of St. John's interview participant. This project was related to the past employment, yet the interviews described perceptions of adaptation and community health strategies honestly and, additionally, clarified ongoing and recent municipal strategies in several other communities.

5.3 Research Gaps

Further research is required to understand the role of communication and framing in community climate change adaptation. Exploring how to best increase awareness and understanding of climate change at the local level will improve climate change and health policies. Assessing risk communication and framing strategies to promote resilient and healthy communities could be assessed with in-depth qualitative research. Engaging a variety of community members and stakeholders within communities currently adapting as well as communities not yet preparing for climate change is required for this assessment.

Given the recent emergence of climate change adaptation in the field of public health there are a great number of other potential research directions. For example, it would be interesting to review where adaptation is taking place in other sectors and geographic areas in Canada. Most of the communities reviewed were large urban centers; however a number of smaller community pilot projects are currently ongoing. Further, increasing understanding of where adaptation is taking place in relation to community vulnerability may be particularly insightful.

The crucial relationship between academia and local governments was described by a number of interview participants. Knowledge translation may be especially important for new and innovative climate change adaptation practices. Research in cross-community learning has the potential to impact climate change policy and practice through diffusion of innovation processes.

Finally, integrating climate change decision making within a sustainable development framework may have particular importance for health promotion and public health. Health promotion and prevention strategies, including increasing adaptive capacity and local decision making, have health impacts at the community and individual level. There is an increasing need to evaluate municipal development policies and practices to ensure community health and wellbeing are being promoted along with controlled growth. Utilizing a sustainable development framework may aid exploiting the co-benefits of climate policy. However, more research is required to inform the cost-benefit frame of reference used in most climate policy debates.

5.4 Recommendations

A number of initial and long term approaches are required to prioritize community health and wellbeing throughout the process of climate change adaptation. For communities currently preparing to and adapting to climate change, utilization of the general community-based adaptation framework (Ebi & Semenza, 2008) has the potential to engage a variety of stakeholders within the local community context. Relating climate policies to this framework has the potential to provide greater understanding of the stages and strategies of adaptation. For example, communities can refer to the framework when considering what type of planning strategy and document will be suitable for their adaptation process.

Communities preparing for climate change should appoint a person or organization as a leader and decide on the shared values of the partnerships. To collaborate successfully, partners should share a goal, vision and objectives and clarify roles and contributions. Increasing dialogue between municipalities and local health authorities is a strategy to develop adaptation strategies and prioritizes that contribute to the wellbeing of community members.

To increase the number of communities adapting to climate change over the long term, prioritization of climate change adaptation at the federal government level would place adaptation on the agenda of provincial and territorial governments and thus influence decision making within municipal organizations. As well, highlighting adaptation within the Federation of Canadian Municipalities (FCM) would increase the number of municipalities involved in

adaptation and facilitate learning between local governments. NGOs, such as the Alliance for Resilient Cities are currently employing learning facilitation strategies for Canadian cities adapting to climate change (for details see Appendix B). Improved tactics are required to expand learning to rural communities.

Framing climate change adaptation as promoting community health has the potential to engage various stakeholders with a shared value. Further, defining roles and responsibilities for risk communication, health messaging and community mobilization in climate change policy is important for partners; including health authorities, municipal organizations, NGOs and other levels of government. To resist political apathy and motivate citizen engagement, communication messages must balance the needs of various stakeholders, the fear of climate change and hope for a healthy future within a community.

Regardless of the framework approach, it is important for health authorities and municipalities to have increased dialogue while strategizing climate change policies. Defining the local impacts climate change will have on individual and on community health is an important part of this process. The partnerships and dialogue have the potential to increase understanding of community health at the local decision making level. Increased understanding of local government's influence and role in community health is an important step in improving community adaptive capacity. There must be a focus among communities to promote adaptive capacity, health and wellbeing.

Climate change adaptation requires citizens and political decision makers to act utilizing prevention strategies. Given the current economic climate,

environmental strategies may not be a priority for many local governments, though economic crisis can also enable dramatic shifts in policy. For example, to achieve rational climate policies, framing adaptation and mitigation strategies as cost-effective is beneficial for local governments.

Table 4: Summary of Recommendations

<p>Short Term Actions</p> <ul style="list-style-type: none">• Utilize a community-based adaptation framework when developing local governments' climate policies• Appoint a person or organization to be the leader of community adaptation strategies• Ensure partners share a goal, vision and objectives and are clear on their role and contribution to the adaptation process• Increase dialogue between municipalities and local health authorities to define the impacts local climate change will have on individual and on community health
<p>Long Term Actions</p> <ul style="list-style-type: none">• Prioritize climate change adaptation at the federal government level in Canada• Facilitate learning between local governments currently adapting to climate change

APPENDICES

Appendix A: Concepts of Climate Change Adaptation

Vulnerability to climate change is defined as “the degree to which a system is susceptible to and unable to cope with, the adverse effects of climate change” (Lemmen et al, 2008 citing IPCC, 2001, p30). Vulnerability is characterised by the integration of “exposure of individuals or populations to the impacts of climate; sensitivity to the impacts; and adaptive capacity of individuals, populations and institutions” (Séguin et al, 2008, p11). This includes the main stressors (climatic and non-climatic) in a system and the socioeconomic adaptive capacity of a population (Lemmen et al, 2008).

Adaptive capacity is the ability, capability or potential of a system to adapt to climate change impacts (Lemmen et al, 2008 citing IPCC, 2001). Adaptive capacity includes a population's perception of risks and how equipped they are to deal with the impact of climate change (Séguin et al, 2008). Adaptive capacity is influenced by interrelated social factors, including economic resources, technology, information and skills, infrastructure, institutions, equity and population health status (Grambsch & Menne, 2003). A population's sensitivity and adaptive capacity to climatic events are influenced by the ‘determinants of health’ (Health Canada, 2005). Generally, adaptive capacity is described as high in Canada; however it is unevenly distributed within regions and populations (Lemmen et al, 2008).

Scenarios are coherent, consistent and plausible descriptions of possible world future states (Lemmen et al, 2008 citing Parry & Carter, 1998). Scenarios are not predictions, as they represent one of many possible futures. Scenarios

are either climatic or socioeconomic. Climatic scenarios represent climate information for a future time periods based upon climate model outputs (usually Atmosphere-Ocean General Circulation Models). Socioeconomic scenarios describe future social and economic conditions. These conditions are important for vulnerability assessments and for describing adaptive capacity. However, socioeconomic scenarios are best forecasted at the national and regional scale and local level downscaling may not be meaningful. Scenarios facilitate considerations of climate change uncertainty as well as provide a foundation to guide and explore the implications of climate change. Despite direct links between the types of scenarios, climatic scenarios have been greatly explored where as socioeconomic scenarios are currently underdeveloped (Lemmen et al, 2008).

Appendix B: Adaptation Resources Available to Local Governments

A number of climate change adaptation resources are available to local governments. As climate change adaptation is an emerging practice the resources available are continually evolving. In 2007, the Heinz Center in Washington, DC released a report (Perkins, Ojima & Corell, 2007) surveying ongoing adaptation planning and tools, including guidebooks and frameworks, available to communities. The report does not claim to be representative of all ongoing practices but was produced to generate discussion and share lessons learned. The reports reviewed are primarily from Western developed countries and most of the reviewed planning initiatives occur in urban areas. The report notes this bias reflects the need to develop strategies in less developed and rural areas of the world.

Eight guidebooks and frameworks are reviewed, including three from North America; the guidebook developed in partnership by the Climate Impacts Group, King County, Washington, and ICLEI – Local Governments for Sustainability (Snover et al, 2007); the Clean Air Partnership’s review of six urban leaders in adaptation (Penney & Wieditz, 2007); and the C-CIARN document (Mehdi, 2006) introducing climate change adaptation to Canadian municipalities. Additional North American resources have become available since the publication of the Heinz Center review. For example, the Chicago Climate Task Force recently released a quick adaptation guide for municipalities and other organizations (Parzen, 2008).

The guidebook developed in partnership by the Climate Impacts Group, King County and ICLEI – Local Governments for Sustainability (Snover et al, 2007) is a widely used document that outlines a process for community climate change adaptation. The guidebook describes five adaptation milestones, each of which is explained in detail (Table 5). It provides an explanation of climate change adaptation in plain terms, discusses credible sources of information, and describes how to use risk assessments and climate projections for future planning. The guidebook may be considering inadequate in terms of utilizing health and inequalities lenses. However, the document does provide clear, easy steps and uses political champions to follow through the intended plans.

Table 5: Milestones of the ICEIL Guidebook

<p>MILESTONE 1: Initiate your climate resiliency effort</p> <ul style="list-style-type: none"> Scope the climate change impacts to your major sectors Pass a resolution or administrative order directing your government to prepare for climate change Build and maintain support to prepare for climate change Build your climate change preparedness team Identify your planning areas relevant to climate change impacts <p>MILESTONE 2: Conduct a climate resiliency study</p> <ul style="list-style-type: none"> Conduct a climate change vulnerability assessment Conduct a climate change risk assessment Prioritize planning areas for action <p>MILESTONE 3: Set preparedness goals and develop your preparedness plan</p> <ul style="list-style-type: none"> Establish a vision and guiding principles for a climate resilient community Set your preparedness goals <p>MILESTONE 4: Implement your preparedness plan</p> <ul style="list-style-type: none"> Ensure that you have the right implementation tools <p>MILESTONE 5: Measure your progress and update your plan</p> <ul style="list-style-type: none"> Develop and track measures of resilience Update your plan

In Canada, the Alliance for Resilient Cities (ARC) is a network of decision makers supporting urban adaptation initiatives. ARC conducts bimonthly web-based seminar meetings with the goal of supporting local governments identify climate change impacts, analyze adaptation options and act to protect communities. The alliance is supported by Toronto's Clean Air Partnership (CAP) (CAP, 2007). Additionally, the City of Toronto is the only Canadian member of the Urban Leaders Adaptation Initiative, a partnership of resources to empower local governments launched by the Center of Clean Air Policy (CCAP) in the United States (CCAP, 2008).

Appendix C: Selection Plan for Reviewed Communities

Communities selected to offer a range of:

- Geographical locations across Canada
- Population sizes
- Stages in climate change adaptation policy / practice:
 - “Innovators” – have current adaptation plan(s)
 - Either comprehensive or sector specific plan(s)
 - “Early Adopters” – have begun the planning process but not yet established formal strategies or plans

Other selection criteria:

- Participation in recent climate change pilot projects
- Recognized as a ‘leader’ in climate change adaptation through personal communication and/or documents reviewed

Appendix D: Demographics of Local Governments Interviewed

Local Governments	Population Size (CDN: 2006 census)	Geographical Area (square kilometres)
King County, WA	1,859,284 (2007 estimate)	315
City of Keene, NH	23,040 (2005 estimate)	97.3
City of Toronto, ON	2,503,281	630
Corporation of Delta, BC	98,723	364
Halifax Regional Municipality, NS	372,858	5,850
City of Vancouver, BC	578,041	106.7
City of Dawson, YK	1,327	32.45
City of Edmonton, AB	752,412	700
City of Yellowknife, NWT	18,695	136
City of St. John's, NL	100,646	480

Appendix E: Local Government Interview Guide

Key Informant Introduction:

Hello,

Thank you for speaking with me today. My name is Hannah Moffatt. Before we get started, I would like to tell you a bit about myself and my program. I'm a graduate student from Simon Fraser University, located in Vancouver. I'm in my second year of a Masters of Public Health program.

I am currently doing a directed studies project about how communities are adapting to climate change. Municipal adaptation is about how communities are taking action to reduce the negatives impacts of climate change (for example a more variable and intense weather patterns). The project is about the process communities undertake to adapt to climate change, the plans produced, engagement with the public and how the plans can be implemented. As a student in population health, I'm especially interested in reviewing the plans and process with a 'health lens'.

This interview will be used to contribute to a report I am producing about the municipal adaptation process. It will help my understanding of municipal adaptation as I have previously reviewed your municipal plan but wanted to ask about the process and certain details. This interview should take about 30 minutes; there are no wrong answers and you can stop anytime or skip any questions. I would like to link your responses to the interview questions with your municipality and your job title. Is that ok with you? Would you like to continue with the interview?

Key Informant Questions:

1. (if not already explained in the document) How did your community climate change adaptation plan come about?
 - a. Was there someone in your community specifically interested in the project? Or connection with an organization or institution working on adaptation? (a champion, internal or external?)
 - b. Where any frameworks or step-by-step processes used for the development of the plan? Why were these frameworks chosen?
2. How do you feel community health and well-being has been incorporated into your community's climate change adaptation plan? And/or community strategic plan?
 - a. Was anyone from the 'health field' part of your adaptation planning process? If so, what was their title? Role?

- b. Where there any community health concerns or 'threats' brought up as issues that needed to be addressed or that influenced your plan during its development?
- 3. (If not already explained in the document) Has the public been engaged in the climate change planning and implementation process?
 - a. No – why not? Is their public interest?
 - b. Yes – How did the planning process incorporate members of the public?
- 4. Has there been any action taken to implement the climate change plan produced?
 - a. Yes - which actions? How has the implementation process going so far? How easy or difficult do you think it will be to implement other actions of your plan?
 - b. No - why? How easy or difficult do you think it will be to implement specific actions of the plan? Examples?
- 5. During the planning process, how were community social and biophysical vulnerabilities included when deciding on priority actions?

(Biophysical vulnerabilities which include physical climate impacts, for example rise in sea level, heat concerns, change in permafrost etc. / Social vulnerabilities are pre-existing social conditions, for example poverty, institutional structures and inequality within a community.)

- a. (If not already explained in the document) Where any climate project models were used during the planning process? Which ones?
 - b. How was the process of working with the climate models? (Did the group use expert information or Gov Canada information/website)
- 6. Do you have anything you would like to add about your experience planning for climate change?

Appendix F: Interview Participants

Association (Local Government or Health Authority)	Title of Participant(s)
City of Edmonton, AB	Environmental Engineer, Office of the Environment, Deputy City Manager's Office
City of Keene, NH	Planning Director & City Planner
City of St. John's, NL	Manager, Environmental Initiatives, Waste Management Division
City of Toronto, ON	Senior Environment Specialist, Toronto Environment Office
City of Vancouver, BC	Project Manager, Sustainability Group
City of Yellowknife, NWT	Energy Coordinator
Corporation of Delta, BC	Senior Environmental Officer
Halifax Regional Municipality, NS	Manager Infrastructure Planning; Acting Manager, Sustainable Environment Management Office (SEMO)
King County, WA	Climate Change Policy Advisor, King County Executive Office
Northern Climate ExChange	Dawson Adaptation Coordinator
Toronto Public Health	Research Consultant, Environmental Protection Office
Vancouver Coastal Health	Regional Director, Health Protection

Appendix G: Health Authority Interview Guide

Key Informant Introduction:

Hello,

Thank you for speaking with me today. My name is Hannah Moffatt. Before we get started, I would like to tell you a bit about myself and my program. I'm a graduate student from Simon Fraser University, located in Vancouver. I'm in my second year of a Masters of Public Health program.

I previously did a project interviewing municipal staff about their climate change adaptation strategy. The project is about the process communities undertake to adapt to climate change, the plans produced, engagement with the public and how the plans can be implemented. I am particularly interested in the role and relationship of public health to these plans and programs. I've decided to interview two case studies, Vancouver and Toronto, to compare the approaches of the Health Authority.

This interview will be used to contribute to final project for my masters in public health. I would like to eventually publish the document. This interview will help my understanding of municipal and health adaptations to climate change and the role of the health authority. All members who participate in the study will receive a copy of my final report you can contact me (hcm5@sfu.ca or 604-312-0619) to receive a copy of this report.

This interview should take about 30 minutes; there are no wrong answers and you can stop anytime or skip any questions. I did not seek approval of the health authority (or your supervisor) to request your participation in this project.

After the interview is complete I will send it to you via email to verify I have all the information correct. Finally, I would like to link your responses to the interview questions with your health authority and your job title. There is no anonymity in the responses, your interview responses will be linked to your job title and municipality. Your name will be undisclosed, however the public may deduce your identify based on upon your job title. Is that ok with you?

For more information about this project or if you have any questions, concerns you can contact the Director, Office of Research Ethics, Simon Fraser University at hal_weinberg@sfu.ca or call 778-782-6593). This information was presented in a prior email – do you have it? May I continue with the interview?

Key Informant Questions:

1. What type of work (project, programs, research involvement) is the Health Authority doing with regards to climate change and health?
 - a. At what stage are you in the planning/implementation process?
 - b. What kinds of health concerns does the municipality face?
2. What kinds of relationship does the Health Authority have with the climate change adaptation planning with your municipality?
3. Has the Health Authority conducted any vulnerability or risk assessments with regards to climate change and health?
4. Do you have anything you would like to add about your experience planning for climate change?

Appendix H: Coding Definitions & Examples

Code #	Code ID	Code definition	Examples of the code
1	Identifying the problem	Description of process for identification or stating current/future climate change concerns	Currently TPH is trying to think of less obvious, indirect, relationships between climate change and health.
2	Assessing risk	Description of the risk assessment process	An independent assessment of emergency response and risk assessment was recently completed by the City. Natural, seasonal, climatic; forest fires and flooding all had a low probability of occurring in Yellowknife because of the geography and proximity to large lake
3	Assessing vulnerability	Description of the vulnerability assessment process	Phase 1: methods development to spatially map vulnerability ... note that we are focusing mainly on social vulnerability coupled with exposure to heat.
4	Predicting	Describing the process of prediction and/or predictions that exist for the community/region	The modelling available for YK has precipitation changes all over the map which affects the accuracy of predicting its impact on the community ... Presently the information going into the scenarios are not accurate enough to generate an appropriate level of confidence to justify any investment as a result of them
5	Potential for action	Describing the potential for municipality / health authority to act – adaptation, mitigation and/or health community	There is opportunity; “under the new BC Public Health Act there are ways to collaborate for a healthier community”
6	Using scientific information	Describing how scientific information is used to aid adaptation process	Current projects include the LIDAR - actual mapping of coastal cities. This project will help HRM better map of coastal areas that are used heavily to manage and watch over them

Code #	Code ID	Code definition	Examples of the code
7	Working with academia	Describing the process of working with academia and/or naming academic partners in projects	Most important engagement is currently with science, academia – so they know they are getting the right science to help us
8	Working with external partners	Describing the process or naming partners (other than government or academic)	The Climate SMART project was a collaboration with industry and government.
9	Describing the decision making process	WHO and HOW decision making is accomplished in municipality / health authority	This plan has significant support from council at the moment.
10	Framing as climate change	Participant describes framing current/new initiatives as climate change adaptation	<p>“While programs are not actually framed as climate change they potentially will be adaptation strategies”</p> <p>We have implemented many initiatives that address adaptation, but not for the purpose of addressing adaptation itself. The adaptation benefit would be a spin off benefit as mentioned in the various examples previously written up in this note.</p>
11	Framing as sustainable development	Participant describes framing current/new initiatives as sustainable development	The initiatives could be “packaged” as sustainable development
12	Strategizing responses	Description of why and how initiatives are initiated / planned	Purposefully chose not doing one huge document (<i>extensive plan</i>) because “staff are pressed for time and action; the large documents typically created for these projects are rarely thoroughly read and are usually underutilized,” they take a lot of time to implement and sift through

Code #	Code ID	Code definition	Examples of the code
13	Prioritizing actions	Describing what actions are a priority to the municipality / HA and why/how they became a priority	The City will may never has a glossy plan but use vulnerability assessment to set priorities and identify sensitive areas leading to possible actions
14	Existing strategies framed as adaptation	Participant describes how previous strategies fit as climate change adaptation planning (similar to #10)	There has been action on the Adaptation Plan; mostly what departments were already working on.
15	Existing practices are flexible for climate change	Describing how existing practices are flexible and fit within a climate change adaptation framework	The committee feels comfortable with existing development models to project infrastructure. The building codes include a fluid document that is reactive to change. For example if the snow levels increase codes are changed.
16	Coordinating multiple sectors	Describing the need and/or process for coordinating multiple sectors	There is a Environmental Risk Management Committee that represents 14 different departments - climate change will remain the top priority.
17	Practicing public engagement	Describing the need and/or practice of engaging the public	Prior to implementation of the plan community consultation and consensus on priorities will take place
17 B	Lacking public engagement	Describing current/past practice as lacking public engagement	Public engagement has not occurred for climate change initiatives because of lack of resources
18	Defining responsibility	Describing who is responsible for what	Narrowed the focus to infrastructure because of municipal responsibility. Health is not part of municipal scope (not directly involved), but the responsibility of the Territorial level - Territorial gov. is doing work on climate change adaptation.
19	The need for practicality	Describing the need for practicality at the local level	We have to think really practically at municipal levels – best ideas are actually getting things done - that’s why money is important.

Code #	Code ID	Code definition	Examples of the code
20	Responding in a unique / local way	Describing the adaptation response as unique to the municipality	It is important to make sure this is a plan unique to Dawson
21	Considering other municipal concerns	Describing the need to consider other municipal responsibilities (and balance them with climate change adaptation)	There are many issues a municipality must address. Climate change is one, growth is one, catering to the citizenship is another, maintaining services....etc.
22	Gaining support for initiatives	Describing how and the importance of having support for climate change initiatives	Good and reliable information can be a source of confidence for the public and decision makers.
23	General barriers to adaptation	Describing general barriers to the climate change adaptation process	We didn't have the climate projections specifically about health at the local level
24	Lacking public support	Describing the lack of public support	Thus far, there has not been enough drivers from the community
25	Climate change characteristics influencing strategies	Climate change science is uncertain; climate change will result in variability	Climate change is difficult to respond to because of the unknowns For every discipline, not just public health, the use of climate science requires a shift in thinking"
26	Lacking resources	A barrier to climate change initiatives is lack of financial and/or staff resources	The process has been delayed because of lack of staff
26 B	Available resources	Resources are currently available for climate change adaptation	TPH also has greater resources than likely a small municipality would; greater manpower (there are staff who are currently working on the climate change and health portfolio)
27	Dealing with conflicting viewpoints	Describing the occurrence of conflicting viewpoints during the planning process	However, the timing of this project was at the same time as conflicting views from council about climate change were made public

Code #	Code ID	Code definition	Examples of the code
28	Experiencing climate change	Climate change has been experienced in the community.	The community has not experienced direct threats ... although they have seen a change in climate that is confirmed by statistics
29	General facilitators to adaptation	Generally describing the elements adaptation that facilitate / make the process easier	Other actions taken are “not big tickets items”; they are implemented because they are ‘win-win’ no regrets actions and have additional benefits (i.e. save money and energy)
30	Learning from others	Describing the potential and/or process of learning from others in the field of adaptation	Framework used is similar to King County’s published guidelines. Vancouver isn’t reinventing but using synergies and modifying it to fit with current plans/strategies
31	Providing leadership	Describing leadership in the field of climate change adaptation	Generally, Toronto is one of the leaders in policy development for climate change adaptation in North America, as benchmarked by the Boston Consulting Group as part of a New York City sponsored study.
32	Involving the health field	Describing the process of involving the health field	Public health was asked to help with social environment system... There hasn’t been action on the health adaptation initiatives. The document is available for health professionals to “keep in mind” the initiatives and concerns
33	Health is ‘topical’ to the community	Health is described as topical to the community	Public health is an important topic – “this is what matters to people”
34	Health is a ‘tangential’ benefit	Health is described as a ‘tangential’ benefit to adaptation / mitigation policies / practices	For example clean air and idling have the potential to affect health, yet the initiatives were more driven by greenhouse gas emissions reduction initiatives

Code #	Code ID	Code definition	Examples of the code
35	GHG mitigation	Present or historical focus on GHG mitigation strategies	The Regional Director of Health Protection sat as a member of the “Cool Vancouver Task Force”; working with the city to reduce GHG gases within the corporate and the greater community
35 B	GHG mitigation as synergistic with adaptation	GHG mitigation is described as synergistic with adaptation measures	Many of energy reduction – green roofs and development standards will reduce GHGs and improve reliance to climate change (i.e. heat waves, extreme waves)
36	Working with other levels of government	Describing the process of working with other levels of government	The planning process has included meetings with the City of Toronto Environment Office and Health Canada
37	Implementing strategies gradually	Describing how adaptation strategies are gradually implemented	Action (is occurring) on so many fronts the City of Toronto is making gradual process in lots of area
38	Strategies are internally driven by staff	Describing the initial process for adaptation as internally driven by staff members of the municipality / health authority	Two staff members had an interest in climate change science and were in the position to take mitigation and adaptive action
39	Mainstreaming climate change policy/practice	Describing the importance or and the process for mainstreaming climate change policy into existing practice	<p>“Integration has been a work in progress” climate change planning has not yet been integrated into all departments</p> <p>“Adaptation strategies will want to be mainstreamed within existing practices”</p>
40	Multiple fronts of climate change	Describing how climate change influences and initiates responses on multiple fronts	It is amazing the number of opportunities [present to municipalities] because of the broad range of strategies [available]

Code #	Code ID	Code definition	Examples of the code
41	Adaptation is an emerging practice	Describing adaptation planning, processes as an emerging practice among municipalities or health authorities	Public health is working through this for the first time and “learning as we are going”
42	Municipality influence health	Describing ways in which the municipality influences the health of citizens/community	Working not only with City of Vancouver, but City of Richmond, North Shore – on a healthy built environment project. This project is trying to influence local government decision making (healthy communities concept)
43	Adaptation benefits	Generally describing the benefits of undertaking adaptation efforts	The process of integration has increased interdepartmental communication and collaboration
44	Relationship between the Health Authority and municipality	Describing the relationship between the health authority and municipality (roles, responsibilities, previous and current collaborations)	The Toronto Environment Office is currently taking the lead on projects (like adaptation and LiveGreen); TPH has been providing advice and input.
45	Learning resources available	Mention/description of learning resources available to municipalities for adaptation	City of Toronto has a website of urban climate change resource collection

Appendix I: Code Relationships

Situational Assessment:

- 1-Identifying the problem
- 2-Assessing risk
- 3-Assessing vulnerability
- 4-Predicting
- 6-Using scientific information
- 28-Experiencing climate change

Strategizing:

- 5-Potential for action
- 10-Framing as climate change
- 11-Framing as sustainable development
- 12-Strategizing responses
- 13-Prioritizing actions
- 14-Existing strategies framed as adaptation

Implementation:

- 15-Existing practices are flexible for climate change
- 16-Coordinating multiple sectors
- 20-Responding in a unique / local way
- 19-The need for practicality
- 21-Considering other municipal concerns
- 37-Implementing strategies gradually
- 40 -Multiple fronts of climate change
- 39-Mainstreaming climate change policy/practice
- 43-Adaptation benefits

General:

Decision Making:

- 9-Describing the decision making process
- 18-Defining responsibility
- 22-Gaining support for initiatives
- 38-Strategies are internally driven by staff

Partnerships:

- 7-Working with academia
- 8-Working with external partners
- 36-Working with other levels of government

Public Engagement:

- 17-Practicing public engagement
- 17 B-Lacking public engagement
- 24-Lacking public support

Health Topics:

- 32-Involving the health field
- 33-Health is 'topical' to the community
- 34-Health is a 'tangential' benefit
- 42-Municipality influence health
- 44-Relationship between the health authority and municipality

Adaptation Topics:

- 23-General barriers to adaptation
- 29-General facilitators to adaptation
- 27-Dealing with conflicting viewpoints
- 25-Climate change characteristics influencing strategies
- 30-Learning from others
- 31-Providing leadership
- 41-Adaptation is an emerging practice

Relationship with GHG strategies

- 35-GHG mitigation
- 35 B-GHG mitigation as synergistic with adaptation

Resources

- 26-Lacking resources
- 26 B-Available resources
- 45-Learning resources available

REFERENCE LIST

- Bizikova, L., Robinson, J., & Cohen, S., (2007). Linking climate change and sustainable development at the local level. *Climate Policy*, 7(4), 271-277.
- CAP (Clean Air Partnership). (2007). Alliance for resilient cities (ARC). Retrieved February 23, 2009 from <http://www.cleanairpartnership.org/arc.php>.
- CCAP (Centre for Clean Air Policy). (2008). Urban leaders adaptation initiatives. Retrieved February 23, 2009 from <http://www.ccap.org/index.php?component=programs&id=6>.
- City of Keene. (2007). Adapting to climate change: Planning a climate resilient community. Retrieved on March 16, 2009 from http://www.ci.keene.nh.us/planning/Keene%20Report_ICLEI_FINAL_v2.pdf.
- City of Toronto. (2009). Climate change adaptation. Retrieved on February 27, 2009 from <http://www.toronto.ca/teo/adaptation.htm>.
- City of Vancouver. (2008). Climate change adaptation report. Retrieved on March 17, 2008 from <http://vancouver.ca/sustainability/documents/7193ClimateAdaptationReport27May2008.pdf>.
- Corporation of Delta. (2009). What is Delta doing? Retrieved on February 27, 2009 from http://www.corp.delta.bc.ca/EN/main/residents/771/50845/what_delta_is_doing.html.
- Ebi, K. L., & Semenza, J. C. (2008). Community-based adaptation to the health impacts of climate change. *American Journal of Preventive Medicine*, 35(5), 501-507.
- European Union. (2008). Living with climate change in Europe. Retrieved on April 16, 2008 from http://ec.europa.eu/environment/climat/adaptation/index_en.htm.
- FCM (Federation of Canadian Municipalities). (n.d., A). Partners for climate protection. Retrieved February 28, 2008 from <http://www.sustainablecommunities.fcm.ca/partners-for-climate-protection>.
- FCM. (n.d.,B). Welcome to the federation of Canadian municipalities. Retrieved October 6, 2008 from <http://www.fcm.ca/english/view.asp?x=1>.

- Frank, J.W. (1995). Why "population health"? *Canadian Journal of Public Health*, 86(3), 162-164.
- Frankish, C.J., Green, L.W., Ratner, P.A., Chomik, T., & Larsen, C. (1996). *Health impact assessment as a tool for health promotion and public policy*. A report submitted to the Health Promotion Development Division of Health Canada, Ottawa.
- Grambsch, A., & Menne, B. (2003). Adaptation and adaptive capacity in the public health context. In McMichael A.J., et al. (Eds.), *Climate change and health: Risks and responses* (pp. 220-236). Geneva: World Health Organization.
- Health Canada. (2005). Climate change: Preparing for the health impacts. Health Policy Research, (11). Retrieved October 2008 from <http://www.hc-sc.gc.ca/sr-sr/pubs/hpr-rpms/bull/2005-climat/index-eng.php>.
- HRM (Halifax Regional Municipality). (2006). Regional municipal planning strategy. Retrieved on March 17, 2008 from http://www.halifax.ca/regionalplanning/documents/Regional_MPS.pdf.
- HRM. (2007A). Climate SMART: Be cool - reduce global warming & climate risks. Retrieved on November 26, 2008 from <http://www.halifax.ca/Climate/index.html>.
- HRM. (2007B). Climate SMART: Risk management strategy for the Halifax Regional Municipality. Retrieved on November 26, 2008 from <http://www.halifax.ca/Climate/documents/ClimateChangeRiskManagementStrategyforHRMDecember2007.pdf>.
- IPCC. (2007). Summary for policymakers. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved on February 27, 2008 from <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>.
- King County. (2007). 2007 King County climate plan. Retrieved March 24, 2009 from <http://your.kingcounty.gov/exec/news/2007/pdf/climateplan.pdf>.
- King County. (2009). 2008 King County climate report. Retrieved April 27, 2009 from http://www.kingcounty.gov/exec/sims/Legacy/~media/exec/news/documents/2009/2008_Annual_Climate_Report_February_2009.ashx.
- Last, L. M. (2001). *A dictionary of epidemiology* (4th ed.). Toronto, ON: Oxford University Press.
- Lemmen, D.S., Warren, F.J., Lacroix, J., & Bush, E. (ed.). (2008). From impacts to adaptation: Canada in a changing climate 2007. 448 pgs. Natural Resource Canada, Ottawa. Retrieved October 7, 2008 from http://adaptation.nrcan.gc.ca/assess/2007/index_e.php.

- Maibach, E. W., Roser-Renouf, C., & Leiserowitz, A. (2008). Communication and marketing as climate change–intervention assets: A public health perspective. *American Journal of Preventive Medicine*, 35(5), 488-500.
- Mehdi, B. (ed). (2006). Adapting to climate change – An introduction for Canadian municipalities. Canadian Climate Impacts and Adaptation Research Network. Retrieved October 14, 2008 from www.c-ciarn.ca/adapting_e.html.
- Naidoo, J., & Wills, J. (2005). Partnership working. *Public health and health promotion: Developing practice* (2nd ed., pp. 133-150). US: Elsevier Ltd.
- Neuman, W. L. (2006). *Social research methods: Qualitative and quantitative approaches* (6th ed.). US: Pearson Education, Inc.
- Parzen, J. (ed). (2008). Chicago area climate change quick guide: Adapting to the physical impacts of climate change. For municipalities and other organizations. Chicago Climate Change Action Plan, City of Chicago. Retrieve on November 25, 2008 from: http://www.chicagoclimateaction.org/filebin/pdf/Chicago_Quick_Guide_to_Climate_Change_Preparation_June_2008.pdf.
- Patel, D.S. (2005). Social mobilization as a tool for outreach programs in the HIV/AIDS crisis. In M. Haider (Ed.), *Global public health communication: Challenges, perspectives, and strategies* (1st ed., pp. 91-102). Sudbury, Massachusetts: Jones and Bartlett Publishers.
- Penney, J. (2008). Climate change adaptation in the City of Toronto: Lessons for great lakes communities. Clean Air Partnership. Toronto, Ontario.
- Penney, J., & Wieditz, I. (2007). Cities preparing for climate change: A study of six urban regions. Toronto: Clean Air Partnership. Retrieved October 15, 2008 from http://adaptation.nrcan.gc.ca/projdb/pdf/171e_e.pdf.
- Perkins, B., Ojima, D. & Corell, R. (2007). A survey of climate change adaptation planning. The H. John Heinz III Center for Science, Economics and the Environment. Retrieved February 23, 2009 from http://www.heinzctr.org/publications/PDF/Adaptation_Report_October_10_2007.pdf.
- PHAC (Public Health Agency of Canada). (2003). What determines health? Retrieved on March 24, 2009 from <http://www.phac-aspc.gc.ca/ph-sp/determinants/index-eng.php#determinants>.
- Pryor & Cobb. (2007). Creating a more resilient Yellowknife: Climate change impacts & municipal decision making. The Pembina Institute.
- Robinson, J., Bradley, M., Busby, P., Connor, D., Murray, A., Sampson, B., et al. (2006). Climate change and sustainable development: Realizing the opportunity. *Ambio*, 35(1), 2-8.

- Rogers, E. M. (1995). *Diffusion of innovations* (5th ed.). New York, NY: The Free Press, A Division of Simon & Schuster, Inc.
- Ryan, C. (1991). *Prime time activism*. Boston: South End Press.
- Séguin, J. (ed.). (2008). Human health in a changing climate: A Canadian assessment of vulnerabilities and adaptive capacities. 524 pgs. Health Canada, Ottawa. Available from Health Canada.
- Snover, A.K., Whitely Binder, L.C., Lopez, J., Willmott, E., Kay, J., Howell, D., et al. (2007). Preparing for climate change: A guidebook for local, regional, and state governments. In association and published by ICLEI – Local Governments for Sustainability, Oakland, CA. Retrieved September 2008 from <http://www.cses.washington.edu/db/pdf/snoveretalgb574.pdf>.
- Toronto Environment Office. (2008). Ahead of the storm: Preparing Toronto for climate change. Toronto Environment Office, City of Toronto Climate Adaptation Steering Group & Clean Air Partnership. Retrieved October 2008 from http://www.toronto.ca/teo/pdf/ahead_of_the_storm.pdf.
- Tricco, A.C., Runnels, V., Sampson, M., & Bouchard, L. (2008). Shifts in the use of population health, health promotion, and public health: A bibliometric analysis. *Canadian Journal of Public Health*, 99(6), 466-71.
- United Nations. (1987). General Assembly Resolution 42/187, 11 December 1987. Report of the World Commission on Environment and Development. Retrieved on February 27, 2009 from <http://www.un.org/documents/ga/res/42/ares42-187.htm>.
- Wallack, L., Dorfman, L., Jernigan, D., & Themba, M. (1993). *Media advocacy and public health*. Sage.
- World Health Organization. (21 November 1986). Ottawa charter for health promotion. *First International Conference on Health Promotion*, Ottawa. WHO/HPR/HRP/95.