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**THESIS**

**A 21st CENTURY  
NATIONAL PUBLIC HEALTH SYSTEM**

by

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September 2008

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**A 21st CENTURY  
NATIONAL PUBLIC HEALTH SYSTEM**

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## **ABSTRACT**

The attention that SARS created in 2003 has influenced public and political perceptions about the risks associated with infectious diseases and the role the public health system should play in national security. This comparative case study was conducted to examine the Canadian public health's system response to SARS in order to formulate recommendations for the U.S. public health system. This analysis demonstrated that the governmental organizational structure of the U.S. public health system does not support its current mission or its new responsibilities for public health security.

A national public health system is needed to support dual missions: the traditional mission of tailoring public health programs specific to the social and demographic needs of the citizens; and the new mission of public health security. In order to transform the current U.S. public health system into a national public health system two critical components must be addressed at the federal, state, and local level: 1) organizational capacity and 2) service delivery. Recommendations are provided regarding the way forward at the federal level and work needing to be done at the state and local level towards building a national system capable of meeting the public health threats of the 21st century.

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# I. INTRODUCTION

## A. BACKGROUND

Emerging and reemerging infectious diseases have plagued human populations throughout history.<sup>1</sup> From some of the earliest recorded epidemics of bubonic plague and smallpox to the deadly 1918 Spanish Flu pandemic, infectious diseases have shaped a significant part of public health practice. The terrorist attacks on the United States in 2001 and subsequent anthrax-laden letters sent through the U.S. Postal Service propelled public health into the rank and file of the “first responder community.”<sup>2</sup> Likewise, the Severe Acute Respiratory Syndrome (SARS) epidemic in 2003 confirmed the need to ensure the nation’s public health system has the capacity to prevent, detect, respond to, and manage outbreaks of infectious disease.

In the first few years of the twenty-first century, the anthrax attacks, SARS, and the threat of another pandemic demonstrate how the world is changing in terms of vulnerability to health threats. Concerns about the U.S. public health system’s preparedness for epidemics and disasters have been elevated. According to a World Health Organization (WHO) 2007 report, SARS confirmed fears generated by the bioterrorism threat that a new or unfamiliar pathogen would have profound national and international implications for global public health security. SARS provides proof that infectious diseases are a national and international public health threat. In order to address these threats, the public health system must have adequate capacity and capability to reduce morbidity and mortality from infectious diseases either naturally occurring or intentionally introduced. The attention that SARS prompted has influenced public and political perceptions about the risks associated with infectious diseases and the

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<sup>1</sup> Donald F. Thompson et al., “The Bug Stops Here: Force Protection and Emerging Infectious Diseases,” (Washington, DC, National Defense University, 2005), [http://www.ndu.edu/CTNSP/Def\\_Tech/DTP%2021%20Bug%20Stops%20Here.pdf](http://www.ndu.edu/CTNSP/Def_Tech/DTP%2021%20Bug%20Stops%20Here.pdf) (accessed July 20, 2007).

<sup>2</sup> For the purpose of this thesis, the “first responder community” refers to law enforcement, hazardous materials (HAZMAT) teams, firefighters, emergency medical services and emergency management.

role the public health system should play in homeland security. SARS highlights the fact that emerging infectious diseases know no boundaries; thus, the threat is global.

Challenges faced by Canada's public health system during the SARS response and the threat of pandemic influenza have raised questions about the ability of the U.S. public health system to lead efforts in ensuring national public health security. According to a 2004 fact sheet from the U.S. Department of Health and Human Services (DHHS), public health systems are better prepared for terrorism and natural disasters. States have mass vaccination plans in place, reportable disease detection systems, and plans for receiving assets from the Strategic National Stockpile.<sup>3</sup> Substantial investments have been made since 2002, in excess of \$7 billion, to increase America's ability to prepare for and respond to public health emergencies.<sup>4</sup> Despite these investments, efforts thus far may be yielding less progress than anticipated, and it continues to be unclear whether the U.S. public health system is prepared for natural occurring epidemics or bioterrorism.<sup>5</sup> Its capacity and capability to provide national public health security is being called into question.

Governmental public health is intrinsically a network of local, state, and federal agencies that are collectively responsible for disease prevention, response, and control in America. Governmental roles and responsibilities for these agencies have evolved throughout history. These agencies emerged several decades ago to provide basic community services, including collecting vital statistics, prevention services (e.g., well-child care), and the promotion of health education and healthy life styles. In addition, these services included ensuring clean drinking water, sanitation, and prevention and control of diseases. The focus of traditional public health practice is at the community

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<sup>3</sup> U.S. Department of Health and Human Services (DHHS), "HHS Fact Sheet: Biodefense Preparedness – Record of Accomplishments," <http://www.hhs.gov/news/press/2004pres/20040428.html> (accessed August 9, 2007).

<sup>4</sup> DHHS, "HHS Announces \$896.7 Million in Funding to States for Public Health Preparedness and Emergency Response," news release, July 17, 2007, <http://www.hhs.gov/news/press/2007pres/07/pr20070717c.html> (accessed, September 6, 2007).

<sup>5</sup> Nicole Lurie et al., "Conceptualizing and Defining Public Health Emergency Preparedness," *American Journal of Public Health* 97, no. 1 (2007): S9.

level and aimed at the population. The practice must be flexible in order to deal with specific community health needs which may be different from jurisdiction to jurisdiction. According to the Institute of Medicine (IOM) 2003:

The concept of a “public health system”—a complex network of individuals and organizations that, when working together, can represent “what we as a society do collectively to assure the conditions in which people can be healthy.”<sup>6</sup>

Thousands of local, state, and federal agencies participate in public health practice and are governed independently by varying degrees of authority. This nation’s public health agencies are products of federalism—a system of government in which power is distributed between a central authority and the constituent units—and act on the orders of boards at the local level, governors at the state level, and primarily secretaries at the federal level.<sup>7</sup> Public health is primarily the responsibility of the state. The Tenth Amendment enunciates plenary power retained by the states: “The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or the people.”<sup>8</sup>

Public health practice is governed by administrative and bureaucratic realities, meaning that programs are influenced and shaped by their political context. The translation of plans into action requires a great deal of perseverance and negotiating skill and, if successful, comes with varying degrees of support in terms of funding and infrastructure. As political alliances rise and fall so does public health. In essence, public health is not defined by what the profession is capable of doing; instead, it is driven by decisions made by a political system within a jurisdiction.<sup>9</sup>

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<sup>6</sup> Institute of Medicine (IOM), introduction to *The Future of the Public’s Health in the 21st Century* (Washington, DC: The National Academies Press, 2003), xiv.

<sup>7</sup> Elin Gursky, “Epidemic Proportions: Building National Public Health Capabilities to Meet National Security Threats,” [http://homelandsecurity.org/journal/Epidemic\\_Proportions\\_2.pdf](http://homelandsecurity.org/journal/Epidemic_Proportions_2.pdf) (accessed July 26, 2008), 1.

<sup>8</sup> U.S. Constitution, amend. 10, [http://www.usconstitution.net/xconst\\_Am10.html](http://www.usconstitution.net/xconst_Am10.html) (accessed August 1, 2008).

<sup>9</sup> IOM, *The Future of Public Health*, (Washington, DC, National Academy Press, 1988): 4.

The shaping of public health occurs as a result of the health problems needing to be addressed in a particular community and by the political system within which it functions. Success is largely dependent upon “bottom-up” support. It is at that local level that an understanding of how programs should function and what resources are necessary to address particular health needs are realized. Since health problems are often addressed at the local level under varying degrees of political support, the scope and scale of capacity and capability of public health varies widely.

Today, public health is at center stage and is being summoned to take on a new mission—that is, a national public health security mission—while maintaining its traditional focus. The new mission is placing unprecedented demands upon an already weak and fragmented system. A system that the IOM described in 1988 as disorganized, having weak and unstable leadership, outdated statutes, inadequate financial support, and lack of effective links between public and private sectors. Much has changed in public health since 1988, including progress in the science of improving health at the population level, emergence of public-private partnerships, and more recently, an influx of investments for bioterrorism preparedness. What has not changed is the fact that the nation’s public health system remains fragile, leaving the health of the nation vulnerable due to outdated health information systems and technologies, an insufficient trained public health workforce, antiquated laboratory facilities, a lack of epidemiological surveillance systems, and incomplete domestic preparedness and emergency response capacity.<sup>10</sup>

Under the new mission for public health, the present situation is one of multiple federal, state, and local agencies responding in multiple ways to an excess of planning information for public health and homeland security. This information is coming from policy makers, governmental agencies, academicians, and non-profit organizations. In October 2007, the president released Homeland Security Presidential Directive/HSPD-21 establishing a National Strategy for Public Health and Medical Preparedness, which outlined requirements for governmental public health. This directive came after the

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<sup>10</sup> IOM, *The Future of the Public’s Health in the 21st Century*, 3.

Department of Homeland Security (DHS) released fifteen national planning scenarios in 2004 and the Target Capabilities List: A Companion to the National Preparedness Goal in 2006 for use in emergency planning. In addition, there are requirements for compliance with the national incident management system and for meeting cooperative agreement grant requirements for funding released annually by the Centers for Disease Control and Prevention (CDC), the Assistant Secretary for Preparedness and Response (ASPR), and the DHS. All this information and associated requirements create numerous challenges for public health leaders in addressing its new mission. Public health is faced with changing federal mandates, shifts in local, state, and federal responsibilities, varying funding patterns, and dramatic, and at times, rapid changes in planning and programmatic direction coming from policy makers. These challenges may not be much different from what other governmental agencies face; however, they are further compounded given public health's history of evolution and its current system infrastructure.

Dealing with these complex challenges creates confusion and inefficiencies in addressing fundamental public health system needs. The current workforce capacity for preparedness can barely address day-to-day program planning necessary to ensure that federal funding guidance and performance measures are met. This leads to the inability of public health to address overarching system weaknesses. Multiple agencies in a fragmented system responding to a plethora of information contribute to the confusion and inefficiency in preparedness. This may be related to the contradictory nature of some of the information leading to frequent shifting of priorities, program objectives, performance metrics, and resource allocations. It may also be due to the complexity of prevention and response planning for the catastrophic consequences of an infectious disease epidemic, pandemic, or bioterrorism.

This information and more is used by public health for preparedness. Yet there is little being done to address the very system that is needed to accomplish both the traditional and the new mission in order to prevent disease, and promote and protect the

health of this nation. Given the prominence of public health today, it is time to reassess the system's infrastructure and resources to ensure that the full spectrum of responsibilities can be met.

A key factor in dealing successfully with future public health crises is a robust and sustainable public health system. Coordination of prevention and response activities, along with strong linkages among multiple partners, are integral in public health preparedness. The ability of the public health system to contain an infectious disease epidemic is dependent upon the capacity to do so at every jurisdictional level. This means that the public health system is only as strong as the weakest jurisdiction in the system. Evidence of actual and potential harm to the health of the public from weaknesses in the public health system has been mounting, but may not have been clearly recognized until the SARS epidemic. SARS, coupled with the threat of bioterrorism and another pandemic, has catalyzed the need for a national public health system.

## **B. PROBLEM STATEMENT**

The problem is threefold: first, the public health system evolved organizationally to serve the population-health of communities, not to coordinate the health security of the nation; second, the current public health system has been neglected for decades, leaving it ill equipped and undertrained to fill its new national security mission; and third, governance for public health is primarily local, meaning that agencies follow orders of governors and boards, not national plans. Preparing the U.S. public health system for its new mission of national security poses extensive and complex challenges for a fragile, ill-prepared and ill-equipped system that was never envisioned or organized to take on this level of responsibility.

## **C. RESEARCH QUESTION**

How can the lessons learned from the Canadian SARS response be applied toward developing a national public health system in the United States?

## **D. LITERATURE REVIEW**

### **1. Introduction**

The intent of the literature review was to identify current knowledge about the public health system's organizational evolution and its roles and responsibilities in prevention, detection, response, and control of infectious diseases in the United States and Canada. Specifically in Canada, this included a comprehensive review of the SARS epidemic in 2003 and subsequent governmental response. Also completed was an examination of infrastructure, resources, and funding for governmental public health. In addition, the author aimed at identifying critical system components needed for the public health system to meet the new challenge of national public health security. For the purposes of this review, the literature has been divided into three sub-groups, consisting of: 1) academic literature, 2) governmental reports and policy documents, and 3) professional literature produced by the non-profit sector.

A review of current and past literature reveals a significant amount of information in the area of public health history and its evolution covering preventive and promotional health, infectious disease prevention and control, and chronic diseases. Although not abundant, there are several academic studies regarding governmental public health system infrastructure and funding spanning local, state, and federal governments. Governmental public health preparedness guidance documents, emergency plans, and strategies are plentiful. In addition, there are a number of presidential directives and executive orders relating to the role of public health in homeland security. There is a significant amount of literature available covering SARS in general and the epidemic in Canada, including science-based, peer-reviewed and governmental reports, as well as textbooks. There is, however, sparse research and little available peer-reviewed literature that address the components or infrastructure needed for a national public health system capable of ensuring national security.

## 2. Academic Literature

There is extensive literature focusing on public health from its origin, to its organization, and changing roles and responsibilities throughout history. Niyi Awofeso describes six major approaches to public health practice. They are: 1) health protection mediated through social structures, 2) public sanitation, 3) contagion control, 4) preventive medicine, 5) primary health care, and 6) health promotion.<sup>11</sup> Public health now faces a new era of preparedness and national security. Academic literature regarding public health in a national security role is limited. There are a number of articles citing challenges for public health in meeting this new mission given its current fragile structure, traditional missions, and historical roots in federalism.

In Laurie Garrett's book, *Betrayal of Trust: The Collapse of Global Public Health*, she portrays extraordinary examples and facts regarding national and international public health and the need for developing effective public health systems. As well, Thomas Abraham in *Twenty First Century Plague: The Story of SARS* (2004) contributes to an understanding of the "politics and economics of disease," focusing on how SARS was fought in China and at the global level.

SARS is covered extensively in the academic literature. Comprehensive studies have been conducted revealing a great deal of the science behind disease origin, transmission, and serological and antibody testing. The emergence of the disease and ensuing epidemic in China, Canada, and a number of other countries has been analyzed. In addition, a significant number of epidemiological studies have been conducted. All of this evidence is critical in identifying the infrastructure needs in order to ensure that the public health system is prepared to detect, respond to, and manage an infectious disease epidemic, whether it is naturally occurring or intentionally introduced.

Given the substantial investments made by the federal government since 2002 to upgrade public health and health care preparedness,<sup>12</sup> it is only reasonable to expect

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<sup>11</sup> Niyi Awofeso, "What's New About the 'New Public Health'?" *American Journal of Public Health*, 94, no. 5 (May 2004): 705.

<sup>12</sup> DHHS, "HHS Announces \$896.7 Million in Funding."

policy makers and the public to ask if these investments have created a more prepared public health system. A challenge does exist, however; there is little agreement about what actually constitutes public health preparedness or how it should be measured.<sup>13</sup> The literature and evidence base for public health preparedness, being such a new field, has been described as “scant at best.”<sup>14</sup>

Over the last four decades, the academic community has offered a variety of insights into strategy formation and strategic management. More recognizable to leaders in homeland security and public health is the literature spanning the study of organizations on leadership, political science on public policy making, management for business, and the military on strategies of conflict. The field of strategy is enormous, as is the body of literature that provides a great deal of knowledge on strategy.

Making sense of and understanding strategy from the vast body of literature is a challenge. However, Henry Mintzberg, Bruce Ahlstrand, and Joseph Lampel in *Strategy Safari: A Guided Tour Through the Wilds of Strategic Management* provide an overview of ten “schools of thought” on strategy formation as well as ideas about strategy itself.<sup>15</sup> The work does not, however, identify a solution for the “best” strategy or a strategy that could be described as “one size fits all.” Rather, the work provides a tool kit inclusive of ten schools of thought on strategy, allowing for a more balanced view of the field. The literature on strategy also points out that even though the concept of strategy may be rooted in stability, much of the study of strategy focuses on change.<sup>16</sup> Public health preparedness is a new and complex field and the environment surrounding preparedness changes often. Gaining knowledge about strategy formation will contribute to a greater understanding of strategy use in achieving national public health security.

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<sup>13</sup> Steven M. Asch et al., “A Review of Instruments Assessing Public Health Preparedness,” *Public Health Reports*, 120, no. 5 (September-October 2005): 539.

<sup>14</sup> Ibid.

<sup>15</sup> Henry Mintzberg et al., *Strategy Safari: A Guided Tour Through The Wilds of Strategic Management* (New York: Free Press, 1998), 3.

<sup>16</sup> Ibid., 18.

### 3. Governmental Reports and Policy Documents

There are a number of governmental reports, documents and policy directives in the literature relating to homeland security and public health preparedness. The recently released *HSPD-21* that establishes a National Strategy for Public Health and Medical Preparedness is intended to “transform our national approach to protecting the health of the American people against all disasters.”<sup>17</sup> In November 2005, the Homeland Security Council released the National Strategy for Pandemic Influenza, which identified three main pillars of the strategy: preparedness and communication; surveillance and detection; and response and containment.<sup>18</sup> *Homeland Security Presidential Directive/HSPD-5*, issued in 2003, provides for the development of a “new” National Response Plan.<sup>19</sup> The purpose of this directive is to establish a comprehensive, national, all-hazards approach to domestic incident management for prevention, preparedness, response, and recovery.<sup>20</sup>

All of these policy documents provide varying degrees of, and at times conflicting, direction on priorities for homeland security and public health preparedness. What is missing in this sub-literature group is information addressing public health system issues including the necessary capacity and capability to address national security. Also missing is the foundation upon which to develop these directives; that is, identifying what constitutes public health preparedness.

Despite many new legislative initiatives, public health preparedness has in part been driven since early 2002 by the DHHS annual grant requirements and guidelines for public health and hospital preparedness. This includes criteria for plan development,

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<sup>17</sup> President, Directive, “Homeland Security Presidential Directive/HSPD-21,” The White House, October 18, 2007, <http://www.whitehouse.gov/news/releases/2007/10/20071018-10.html> (accessed October 19, 2007).

<sup>18</sup> Homeland Security Council, “National Strategy for Pandemic Influenza,” <http://www.pandemicflu.gov/plan/federal/index.html#national> (accessed November 11, 2007).

<sup>19</sup> President, Directive, “Homeland Security Presidential Directive/HSPD-5,” The White House, February 28, 2003, <http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html> (accessed August 12, 2008), 281.

<sup>20</sup> President, Plan, “National Response Plan,” The White House, December 2004, <http://www.scd.state.hi.us/documents/nrp.pdf> (accessed August 13, 2008), 1-426.

performance evaluation, and reporting. It is this literature that provides the guidance for public health preparedness planning. Funding is tied to many requirements and performance metrics.

The CDC and ASPR provide preparedness program guidance and performance measure requirements based on legislation in the form of benchmarks to build infrastructure capacity. In 2003, both agencies began transitioning from measuring capacity (e.g., staffing) to assessing capability (e.g., response times).<sup>21</sup> There is no shortage of performance measures; however, the literature reveals that most instruments used have relied on subjective or structural measures, lacked scientific evidence for the measures assessed, or failed to define clearly what entity was responsible for accomplishing the task.<sup>22</sup>

Retired Colonel Randall J. Larsen in *Our Own Worst Enemy* (2007) provides an enlightening examination of key issues that contribute to national security and submits that the two greatest threats to U.S. national security are nuclear and biological threats. There are excellent examples of why the government is not prepared to help in the time of crisis and he specifically addresses the need for national public health security.

Additional public health preparedness practice research is needed to build a scientific evidence base for performance outcomes. This will be vital as the public health system continues to mature in its new homeland security role. Outside of anecdotal reports, the literature is silent on evidence that the public health system is better prepared to respond to catastrophic disasters or terrorism.

As can be seen from this portion of the literature review, there have been a number of governmental attempts to guide public health preparedness planning, strategy development, and program evaluation. These attempts contribute to confusion, frequent programmatic changes, performance measure changes and resource allocation shifting.

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<sup>21</sup> U.S. Government Accountability Office, *Public Health and Hospital Emergency Preparedness Programs: Evolution of Performance Measurement Systems to Measure Progress*, (Washington, DC: GAO, 2007), 10.

<sup>22</sup> Asch et al., "A Review of Instruments Assessing Public Health Preparedness," 532.

All of this is occurring while the public and policy makers continue to call for assurances that the public health system is prepared. Public health preparedness planning, as indicated in the literature, appears to be driven primarily by federal funding requirements and political influences instead of gaining a common understanding of what basic system components and infrastructure is necessary to achieve public health preparedness and adequate health security for the nation.

There were a number of governmental reports published in Canada before and after SARS that address the state of public health and the need for revitalization of the system. Four major reports that provide key insights into the weaknesses in Canada's public health system and lessons to be learned from SARS were critically reviewed. One report was published prior to SARS and three following the epidemic. The reports include: 1) *The Health of Canadians—The Federal Role*, the final report on the state of the health care system in Canada by the Standing Senate Committee on Social Affairs Science and Technology, chaired by the Honorable Michael J. L. Kirby, October 2002; 2) *Learning from SARS: Renewal of Public Health in Canada*, a report of the National Advisory Committee on SARS and Public Health, chaired by Dr. David Naylor, Dean of Medicine at the University of Toronto, October 2003; 3) *For The Public's Health: A Plan of Action*, the final report of the Ontario Expert Panel on SARS and Infectious Disease Control, chaired by Dr. David Walker, Dean, Faculty of Health Sciences and Director of School of Medicine, Queen's University, April 2004; and 4) *SARS and Public Health in Ontario*, interim report of the SARS Commission, chaired by the Honorable Mr. Justice Archie Campbell, April 2004.

These four reports contribute significantly to understanding the many challenges faced by public health and health care workers during the SARS epidemic. They provide a chronological series of events that took place as SARS emerged and the public health and health care system responded. As well, these reports outline many of the challenges faced by a public health system that was ill prepared and ill equipped to deal with an infectious disease epidemic. Recommendations for improvement are made in the reports and the response by the Canadian government is tracked.

Unlike the abundance of literature in the way of governmental reports on SARS, limited literature on the public health system in Canada is available, primarily because prior to SARS, no public health agency for the country existed. There was, however, a public health branch in the Ontario Ministry of Health and Long Term Care (OMHLTC). Primary focus in Canada at the time of SARS was health care.

#### **4. Literature from Non-profit Organizations and Professional Associations**

Also important as a basis for this research are congressional testimonies, reports and publications by non-profit organizations and professional associations. These documents outline recommendations for public health preparedness infrastructure, strategy development, funding priorities, evaluation, and identification of preparedness gaps that remain unfulfilled. More notable are reports provided by the IOM on the future of public health (1988 and 2003), pandemic influenza planning, and reports regarding infectious disease. Additionally, testimonies, studies, and reports prepared by the RAND Corporation provide assessments of public health emergency preparedness, identification of barriers in performance, and inadequate accountability systems. The Association of State and Territorial Health Officials (ASTHO) and the National Association of County and City Health Officials (NACCHO) likewise present a number of reports on local and state public health system organization, infrastructure, and funding. In addition, both organizations provide survey data on public health workforce and survey results on state and local public health preparedness strategies, plans, and evaluation methodologies.

RAND provides several articles and testimonies pressing the need for a clear definition of public health preparedness, what public health preparedness requires, and who is involved in public health preparedness.<sup>23</sup> According to one RAND study, the absence of a clear definition of public health preparedness presents challenges to public health leaders. These challenges include: 1) an inability to determine if the nation is better prepared to respond to bioterrorism or natural disasters, 2) the continued struggle

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<sup>23</sup> Lurie et al., "Conceptualizing and Defining Public Health Emergency Preparedness," S9-S11.

by policy makers to prioritize investments, and 3) the inability to ensure adequate investments without a commonly applied framework for developing standards and metrics to evaluate performance outcomes.

ASTHO and NACCHO on the other hand, provide a series of surveys and issue briefs claiming that the investments in public health preparedness at the state and local level have yielded some improvements in infrastructure capacity to respond to terrorism and catastrophic disasters, yet more needs to be done. ASTHO released the results of a survey in a February 2006 publication titled, *Public Health Preparedness: How Do We Measure Success?* Several common themes emerged behind the reasons for state public health agencies reaching beyond the performance requirements set by CDC. States are searching for “utilitarian mechanisms” to bring greater consistency across federal grant requirements and ensure that performance measurements become a routine function of preparedness programs.<sup>24</sup>

The results of this survey and others similar to it identify some lessons learned. What is more revealing is that states continue to develop metrics based on federal grant guidance, and in doing so, each state’s approach and final product is different. State and local public health agencies find themselves changing directions with each new policy directive or changing grant guidance, and have considered themselves “laboratories for the development of performance measures to assess implementation of their preparedness programs.”<sup>25</sup> The survey results also bring to light some encouraging trends; however, including the development of metrics as an evolutionary process, program implementation as a process of growth and maturation, and movement from measuring capacity to measuring capability in public health preparedness.

Turning to the IOM, it provides science-based advice on matters of biomedical science, medicine, and health. The significance of the literature published by the IOM is that this non-profit organization works outside the sphere of government to ensure

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<sup>24</sup> Lurie et al., “Conceptualizing and Defining Public Health Emergency Preparedness,” S7.

<sup>25</sup> Association of State and Territorial Health Officials, *Public Health Preparedness: How Do We Measure Success?* (Washington, DC: ASTHO, 2006), 2 <http://www.astho.org/pubs/Preparedness-MeasuringSuccess.pdf> (accessed August 22, 2007).

scientifically informed analysis and independent guidance. The focus of their mission is to serve as advisor to the nation to improve health by providing un-biased, evidence-based information to policy makers, professionals, and leaders in every sector of society and the public at large.<sup>26</sup> A number of publications released by the IOM provide valuable evidence-based information for public health preparedness planning, and cover a range of topics, including the public health system and its infrastructure, pandemic influenza, community containment for pandemic influenza, emerging infectious diseases, and preparedness of the public health community. Despite this evidence-based literature, the IOM is not often cited in the sub-literature groups of government and non-profit organizations. The IOM is, however, referred to in some of the academic literature, which addresses public health preparedness.

## **5. Summary**

This review canvassed the literature on public health systems and infrastructure, strategy, governmental public health, the SARS epidemic in 2003, public health preparedness planning, and evaluation. Policy makers, academia, and governmental public health agencies tasked with preparing the nation for infectious disease, terrorism, or catastrophic disasters view these issues from widely diverse perspectives. Policy makers' views are shaped from the opinions and needs of constituents and various interest groups. Governmental agencies strive to follow the direction of legislative mandates, executive orders, and funding guidance. Non-profit organizations and professional associations focus on advocacy for their members. Researchers and academics try to make sense of it all, apply relevant theory and provide a scientific basis for the direction and decisions made.

The literature on the need for or development of a national public health system for providing national security is limited. This review has resulted in a demonstrated need for further research in the design of and critical needs for the current U.S. public health system to fulfill its new mission of national public health security.

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<sup>26</sup> IOM, "About the IOM," <http://www.iom.edu/CMS/AboutIOM.aspx> (accessed September 9, 2007).

## **E. SIGNIFICANCE OF RESEARCH**

Public health has been called upon to ensure that the nation's health is protected and to be the leader in national public health security. A cohesive effort is needed to better understand what infrastructure and resources are needed to ensure the nation is prepared for an infectious disease epidemic, whether naturally occurring or intentionally introduced. This research effort seeks to identify lessons learned from the Canadian governmental response to the SARS epidemic in 2003 that may be applicable in the United States. This research also seeks to identify the critical infrastructure and resources that are needed for the public health system in the United States to fulfill its new mission of national public health security. Contributions in data and analysis toward revitalizing and modernizing the current U.S. public health system will be made. It will serve as a starting point for thinking in new ways and designing new strategies for harnessing the collective power of thousands of public health agencies across the United States in protecting this nation's health. Lastly, this research will contribute to the overall field of homeland security by enhancing knowledge in the area of national public health security.

Primary consumers of this research will be federal, state, and local public health and homeland security policy makers, leaders and practitioners. Secondary consumers of this research will include academic institutions, non-profit organizations, and possibly the media. Future research efforts will be necessary to get up-to-date information on existing public health infrastructure and resources in the United States. In addition, vigorous inquiry and debate will be necessary in order to explore impacts on the current roles and responsibilities of public health given its new mission. A challenge will be maintaining the traditional while implementing the new.

## **F. METHODOLOGY**

The goal of this research is to make a contribution toward improving the U.S. public health system's ability to provide national security. The research methodology utilized for this thesis is a comparative case study approach. The main focus of the case study was the Canadian governmental health system's response to the SARS epidemic

from November 2002 through July 2003 when SARS was declared contained worldwide. The author then used comparative analysis to ascertain strengths and weaknesses in the Canadian health system compared to the U.S. public health system in order to formulate improvement recommendations.

The SARS epidemic, specifically in Canada, was chosen because of its proximity to the United States and for the fact that both countries' public health systems are products of federalism. In addition, SARS is one of the most recent "live" responses to a novel infectious disease that was transmissible human-to-human and quickly spread through our interconnected world, country to country and continent to continent. Detailed analysis of the events as they unfolded are documented and presented through a story-type narrative. The story is told from the emergence of the virus, through its transmission, and how it swept across the globe, infecting thousands and killing hundreds. Specific response events are shared chronologically from the experiences in Toronto, Ontario. The story reveals the enormous impact this novel virus had on public health and health care workers, the government, and how an unprepared system may in fact increase illness and deaths caused by a novel infectious disease. In addition, this story reveals the tremendous impact on the economy and social stability of a country during and immediately following an epidemic.

Through this story and the governmental response to SARS, the author presents a grid isolating and characterizing the public health system components that were most problematic in Canada during the SARS epidemic. As systemic deficiencies emerge, lessons to be learned are identified. The U.S. public health system components are then compared to those in Canada in order to generate recommendations for improving national public health security.

## **G. OVERVIEW OF REMAINING THESIS CHAPTERS**

Chapter II presents an overview of the history on infectious diseases and outlines roles and responsibilities for public health in responding to an infectious disease

outbreak. The science behind SARS is presented and a discussion is provided on how microbes and humans interact. This chapter also provides initial background on the SARS epidemic and prepares the reader for the SARS story.

Chapter III provides a compelling case study story of the SARS epidemic in Canada. It presents the horrific challenges faced by public health and health care workers in battling a novel infectious disease that was attacking the very infrastructure designed to protect its citizenry. The emergence of the disease and response to the epidemic is tracked in Ontario, Canada. Numbers of cases, transmission routes, and critical events are presented.

Chapter IV begins with a presentation of the decay of public health over the last several decades, citing examples of previous warnings and alarms regarding the need for a strong public health system. Next, this chapter provides the reader with an overview of governmental public health in Ontario and presents the government's response to the SARS epidemic. Key system-preparedness capacity and capability issues are identified and presented.

Chapter V outlines a number of key lessons to be learned from the SARS epidemic based on four major reports highlighting weaknesses in Ontario's public health system. From these reports, common lessons learned emerge and recommendations are cited. Next, this chapter outlines a number of improvements made in the Canadian public health system, presenting funding allocations and infrastructure support since 2004.

Chapter VI provides a more comprehensive overview of governmental responsibilities for public health in Canada and the United States. Organizational tables for both federal agencies are presented outlining capacity, roles and responsibilities. In addition, the WHO's roles and responsibilities are highlighted. Next, a comparative analysis is provided in table format of critical system components of the public health systems in Canada and the United States. The narrative that follows provides results of the analysis and provides a basis for formulating public health system improvement recommendations.

Chapter VII provides a summary of findings from the SARS case study and a comparative analysis of the Canadian and U.S. public health systems. Conclusions are presented and recommendations formulated based on this research.

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## II. MICROBIAL WAR—THE SARS EPIDEMIC

### A. HISTORY OF INFECTIOUS DISEASES

Public health covers a broad range of complex issues internationally down to the individual family and includes consequences of poverty, war, and natural and manmade disasters. Separating people with disease from the healthy population is an ancient practice with Biblical and Koranic references to the isolation of lepers. By the seventh century, China had a policy for detaining sailors and other foreign travelers suffering from plague.<sup>27</sup> The term quarantine was used in the late fourteenth century and isolation of people arriving from plague infected areas occurred at seaports.<sup>28</sup> This type of public health containment measure became widespread internationally in following centuries. The WHO reported an outbreak of plague as recently as 1994 in India with 700 suspected cases and fifty-six deaths. This outbreak captured international media attention resulting in economic consequences of an estimated \$1.7 billion lost in trade and travel.

One of the oldest known infectious viral diseases is smallpox. Its existence goes back over 3,000 years appearing in Egypt initially then introduced in southern China about the year 50 AD, into Europe in the following few centuries, in western Africa by the tenth century, and in America in the sixteenth century.<sup>29</sup> In the 1950s, it is estimated that 50 million cases occurred globally each year with approximately 15 million deaths. Global eradication occurred in 1979 following a successful worldwide vaccination campaign. Since naturally occurring smallpox has been eradicated for thirty years and population-based vaccination has been stopped, it is now a concern that a deliberate release of the virus could cause significant harm. Is the capacity and capability of the

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<sup>27</sup> World Health Organization (WHO), *The World Health Report 2007 – A safer future: global public health in the 21st century*, <http://www.who.int/whr/2007/en/> (accessed September 23, 2007), 2.

<sup>28</sup> *Ibid.*, 2.

<sup>29</sup> *Ibid.*, 5.

public health system in the United States prepared to contain a deliberately caused smallpox outbreak rapidly to minimize injury and death, and to ensure smallpox does not become endemic again?

Population growth, rapid urbanization, environmental degradation, and misuse of antimicrobials have disrupted the equilibrium of the microbial world. The infectious disease situation is anything but stable.<sup>30</sup>

## **B. WAR AGAINST NATURE**

Fighting a war against nature—that is, a war against communicable diseases—is a form of warfare that has awakened some governments to the fact that microbes pose a significant threat to national security. In the United States, the anthrax attacks in 2001 focused attention on the intentional use of biological agents as terrorist weapons. The Severe Acute Respiratory Syndrome (SARS) epidemic in 2003, however, served as a wake-up call that an infectious disease, even if not intentionally used as a weapon, could be equally disruptive and costly as a conventional war.<sup>31</sup> The SARS epidemic was a war against an enemy too small to see with the human eye, came without warning, and traveled across the globe through communities not fully prepared to fight. This threat did not come from an invading military army or terrorists using biological agents; rather, this threat came from nature. This was a war against an unknown virus that had successfully found a new host and caused an infectious disease epidemic in humans. In the beginning, nothing was known about SARS. It was not known:

- where the virus came from;
- what tests were needed to determine if one had SARS;
- how long it might be until one got sick after coming in contact with someone who had SARS (incubation period);
- what one's symptoms should be if sick with SARS (clinical description);
- the timeframe for possibly exposing others (infectious period);

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<sup>30</sup> WHO, *The World Health Report 2007*, “Overview,” 2.

<sup>31</sup> Thomas Abraham, *Twenty First Century Plague: The Story of SARS* (Baltimore: Johns Hopkins University Press, 2004), 2.

- the microbe that causes SARS; or
- what treatments or vaccines were needed to reduce one's illness or to treat one from SARS?

Today, there is still no prevention or treatment for SARS.<sup>32</sup>

From middle school science class, most remember that a virus needs a living cell to survive and reproduce itself. A virus basically preys on other life forms. A host could be a person, or other living animal, including birds and arthropods, or plants. Interaction between virus and host does not always lead to disease. More severe forms of viral disease tend to appear the first time a virus encounters a new host. This new acquaintance may cause a more virulent relationship between the host and the virus, leading to fatal disease. Many of the new viral diseases appearing in humans over the last several decades have emerged from viruses jumping from animal host to human host (zoonotic diseases). This is in part due to human population expansion across the globe and occupation in new ecological regions of the world.<sup>33</sup>

The SARS global epidemic in 2003 has been recognized as the first major infectious disease threat of the twenty-first century.<sup>34</sup> SARS targeted a critical component of homeland security—the public health system. From the first few cases of SARS, this virus not only challenged the medical and public health system, it also attacked the soldiers who were vital to caring for and defending the health of the society as a whole; public health and health care workers. The first health worker to die of SARS was a fifty-seven-year-old ambulance service provider in the southern Chinese city of Guangzhou.<sup>35</sup> The SARS epidemic eventually sickened over 1,700 health workers

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<sup>32</sup> Centers for Disease Control and Prevention (CDC), “Frequently Asked Questions about SARS,” April 26, 2004, <http://www.cdc.gov/ncidod/sars/sars-faq.pdf> (accessed April 26, 2008).

<sup>33</sup> Health Canada, National Advisory Committee on SARS and Public Health, “Learning from SARS: Renewal of Public Health in Canada,” (Ottawa, October 2003), 23, <http://www.phac-aspc.gc.ca/publicat/sars-sras/pdf/sars-e.pdf> (accessed April 22, 2008).

<sup>34</sup> James W. LeDue and M. Anita Barry, “SARS, the First Pandemic of the 21st Century,” *Emerging Infectious Diseases*, 10, no. 11 (November 2004): 1.

<sup>35</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 18.

worldwide.<sup>36</sup> The soldiers included doctors, nurses, emergency medical providers, laboratorians, epidemiologists, and research scientists who worked around the clock to prevent, investigate, and fight the virus.

Health care soldiers take care of those who are ill, while public health soldiers investigate outbreaks to unravel mysteries about microbes that cause disease. Laboratorians and scientists conduct research and work to discover and test for disease. Public health disease investigators use knowledge in the areas of medicine, epidemiology, and statistics to determine who, when, where, and what about an infectious disease. All these soldiers must work together to develop and implement effective prevention, control, and treatment measures to reduce illness and death caused by an infectious disease.

Health care facilities were also severely impacted by SARS. Transmission in hospitals was a major contributing factor to the spread of SARS during the epidemic. Health care workers accounted for 21 percent of all cases globally. In Toronto alone, of the seventy-four cases reported from April 15 through June 9, 39 percent were health care workers, 38 percent resulted from exposure during hospitalization, and 23 percent occurred among hospital visitors.<sup>37</sup> The risk of transmission was greatest among those involved in direct patient care or other close contact with a patient. Transmission to casual or social contacts was uncommon; however, secondary cases have been documented after exposures in the workplace and on airplanes and other conveyances.<sup>38</sup>

Unlike soldiers in a conventional war trained to face death, public health and health care soldiers are trained to save lives.<sup>39</sup> With SARS, these soldiers found themselves thrust to the front lines of a war against nature and the time needed to uncover the mystery of a deadly novel virus, prevent further spread, and treat those infected.

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<sup>36</sup> WHO, "Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003," [http://www.who.int/csr/sars/country/table2004\\_04\\_21/en](http://www.who.int/csr/sars/country/table2004_04_21/en) (accessed April 24, 2008).

<sup>37</sup> Umesh D. Parashar and Larry J. Anderson, "Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak," *International Journal of Epidemiology*, 33, no. 4 (2004): 630.

<sup>38</sup> Ibid.

<sup>39</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 2.

Uncovering the mystery of a novel virus is as much like a story of inquiry and discovery as it is a story of science and medicine. There is an outbreak, people are getting sick, and no one knows why. The investigation is about disease and is conducted by public health. It requires a strong line of inquiry about a disease to uncover clues about why people are getting sick. This fact-finding mission takes time. In order to unravel the mysteries behind a novel virus such as SARS, many questions must be answered. This requires the collective work of many soldiers in public health and health care.

Without adequate public health system preparedness, the collective health of populations living across geographical regions and international boundaries is threatened by infectious disease. It is now known that SARS is a viral respiratory illness transmissible from person to person by close contact. Close contact, in this context, is defined as caring for or living with someone who is infected, and therefore, has possible direct contact with their respiratory secretions.<sup>40</sup> SARS is thought to be transmitted most readily by respiratory droplets produced when an infected person coughs or sneezes. The virus can also spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose, or eyes. In addition, SARS may be spread more broadly through the air, through feces or by other ways that are not currently known.<sup>41</sup>

When exposed to someone infected with SARS, the incubation period is typically three to ten days. In a very small portion of the SARS cases, incubation periods of up to fourteen days have been reported.<sup>42</sup> SARS begins with flu-like symptoms characterized by fever (>100.4 °F), fatigue, headache, chills, muscle pain, a feeling of uneasiness, and in some cases, diarrhea.<sup>43</sup> People infected with SARS are most likely to be contagious

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<sup>40</sup> CDC, "Frequently Asked Questions About SARS," 1.

<sup>41</sup> Iowa Department of Public Health (IDPH), "Epi Manual: Guide to Surveillance, Investigation, and Reporting," SARS, [http://www.idph.state.ia.us/idph\\_universalhelp/main.aspx?system+IdphEpiManual](http://www.idph.state.ia.us/idph_universalhelp/main.aspx?system+IdphEpiManual) (accessed June 1, 2008).

<sup>42</sup> IDPH, "Epi Manual," SARS.

<sup>43</sup> Ibid.

when they have symptoms, such as fever or a cough. Patients have been found to be most contagious during the second week of illness, with the maximum time period of communicability being less than twenty-one days.<sup>44</sup> While most people spread SARS to one or two other people, some people were super spreaders—that is, they spread the virus to a disproportionately large number of other people. In these early stages of the epidemic, the rate of transmission was low with a SARS patient spreading the virus to two or maybe three other people.<sup>45</sup>

The agent that causes SARS is a member of the family coronaviridae.<sup>46</sup> During the SARS epidemic, a SARS-like coronavirus (SARS-CoV) was isolated from palm civets (*Paguma larvata*) captured in remote areas of China where the epidemic originated. This virus closely matched virus samples taken from people who were sick. Other animals have shown evidence of infection, but on a smaller scale. There were no clinical samples available from the first SARS patient in China to test for the virus; however, the second identified SARS case was a chef, Huang Xingchu, who worked at a restaurant and was reported to have atypical pneumonia. As a chef, he came into regular contact with several types of live caged animals used as exotic game food, including civets. He sought medical care and subsequently infected his wife, two sisters, and seven medical staff with SARS.<sup>47</sup>

Epidemiological investigations suggest that SARS probably first emerged in satellite cities of Guangzhou, Guangdong Province. (Refer to Figure 2 in Chapter III.) The virus was most likely circulating for approximately two months before the first major outbreak in Guangzhou. Serological tests and isolation of the virus confirmed that SARS-CoV was the primary infectious agent of the early cases of SARS.<sup>48</sup> Forty-two

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<sup>44</sup> IDPH, “Epi Manual,” SARS.

<sup>45</sup> J.M. Last, ed., *A Dictionary of Epidemiology*, 4th ed. (New York: Oxford University Press, 2001), 36.

<sup>46</sup> IDPH, “Epi Manual,” SARS.

<sup>47</sup> N S Zhong, et al., “Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People’s Republic of China, in February 2003,” *The Lancet*, 362 (October 25, 2003): 1355.

<sup>48</sup> *Ibid.*, 1357.

percent of the early SARS patients were involved in either the trade or preparation of food from wild animals in markets in Guangdong Province.<sup>49</sup> In response to the concerns regarding the origin of the SARS virus, the CDC issued an embargo order on importation of civets on January 13, 2004. Up to this time, civets were being imported into the United States and distributed further.<sup>50</sup>

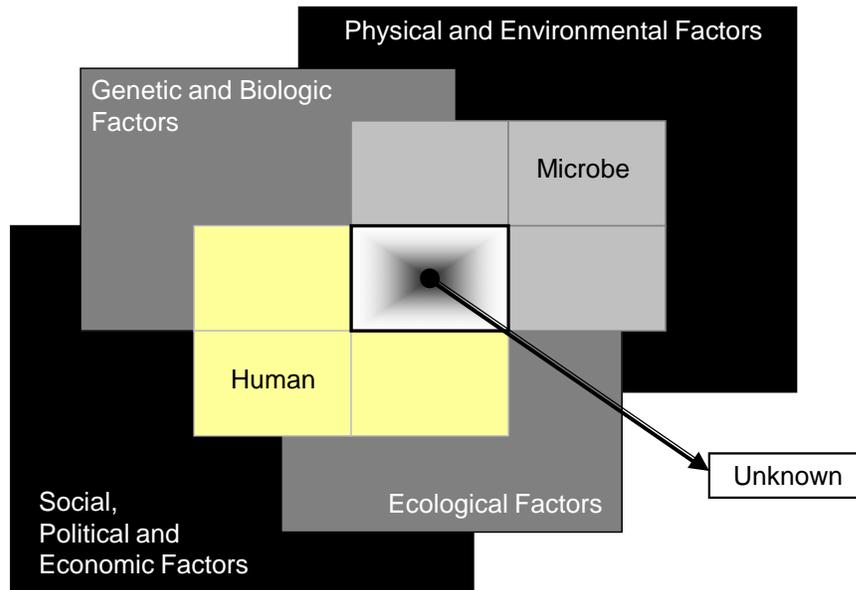
Not only is the behavior of a virus a threat to health, but also human behaviors, such as the food eaten or relationships with the environment that can create optimal conditions for the emergence of a new infectious disease. It does, however, take more than a virus simply jumping from animal host to human host to cause the emergence of a novel infectious disease leading to an epidemic or pandemic. A number of factors can create an environment in which infectious diseases emerge and become endemic in society. It is the convergence of these factors and the human–microbe interaction that contribute to the emergence of novel infectious diseases. The microbial threat is increased with the convergence of any one or multiple set of factors: 1) genetic and biological, 2) physical environmental, 3) ecological, and 4) social, political, and economic factors.<sup>51</sup> Refer to Figure 1.

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<sup>49</sup> Parashar and Anderson, “Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak,” 628.

<sup>50</sup> CDC, “Notice of Embargo of Civets (Family: Viverridae),” January 13, 2004, [http://www.cdc.gov/ncidod/sars/civet\\_ban\\_exec\\_order.htm](http://www.cdc.gov/ncidod/sars/civet_ban_exec_order.htm) (accessed April 27, 2008).

<sup>51</sup> Mark S. Smolinski, Margaret A. Hamburg, and Joshua Lederberg, eds., *Microbial Threats to Health: Emergence, Detection, and Response*, Institute of Medicine (IOM), Committee on Emerging Microbial Threats to Health in the 21st Century, Board on Global Health (Washington, DC: The National Academies Press, 2003), 4-5.



Adapted from Smolinski, Hamburg, and Lederber, eds., Institute of Medicine, *Microbial Threats to Health: Emergence, Detection, and Response*. (2003), 5.

Figure 1. Infectious Disease Convergence Model

The center box represents the convergence of factors leading to emergence of a novel infectious disease. The white outer edges of this box identify what is known about the factors in infectious disease emergence, and the black center represents the unknown. Crossing into the center box are the two main characters, the human host and the microbe. The human host and microbe interaction is influenced by the factors in the outer boxes.<sup>52</sup>

An epidemic is the occurrence of cases of an illness in a community or region that is clearly in excess of what is normally expected. An outbreak is similar to an epidemic but is limited to a localized increase in the incidence of a disease, e.g., in a village, town, or closed institution.<sup>53</sup> The number of cases indicating the presence of an epidemic

<sup>52</sup> Smolinski, Hamburg, and Lederberg, eds., *Microbial Threats to Health: Emergence, Detection, and Response*, 5.

<sup>53</sup> Last, *A Dictionary of Epidemiology*, 129.

varies according to 1) the agent, 2) the size and type of population exposed, 3) the previous experience or lack of exposure to the disease, and 4) the time and place of occurrence.<sup>54</sup> A pandemic is an epidemic occurring worldwide, or over a very wide area, crossing international boundaries, and usually affecting a large number of people.<sup>55</sup> During November 2002 to July 2003, 8,098 probable SARS cases were reported to the World Health Organization (WHO) from twenty-nine countries; thus, this was a pandemic.<sup>56</sup>

In order for an epidemic or pandemic to occur, the virus must be readily transmissible from human to human, as was SARS. The emergence of a novel infectious disease, a resurgence of endemic diseases, the appearance of new antimicrobial-resistant forms of diseases, and the intentional use of biological agents to do harm are all included in the spectrum of microbial threats. Winning wars against infectious disease and contributing to the public health security of the nation requires strengthening public health preparedness at all levels. No single country, state, or community, regardless of how capable, wealthy, or technologically advanced, can alone prevent, detect, and respond to all public health threats. In an era of rapid global travel, any country, state, or city could face the challenges and consequences of an infectious disease epidemic or pandemic.

### **C. GENESIS OF THE EPIDEMIC**

International and U.S. public health officials worked urgently to address the SARS epidemic that ultimately spread from continent to continent. Worldwide, the epidemic spanned just over seven months from November 2002, with the first case identified as atypical pneumonia, to July 2003 when the WHO declared the SARS epidemic contained. SARS affected five continents and spread across the globe in a

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<sup>54</sup> Last, *A Dictionary of Epidemiology*, 60.

<sup>55</sup> *Ibid.*, 131.

<sup>56</sup> CDC, "SARS Case Count," <http://www.cdc.gov/ncidod/sars/reporting.htm> (accessed June 6, 2008).

matter of a few weeks, basically traveling at the speed of a jet airplane.<sup>57</sup> This means that an outbreak in any one part of the world may be only a few hours away from becoming an imminent public health threat somewhere else. This poses a “universal vulnerability” to the public’s health worldwide. Nearly forty new diseases were unknown a generation ago, and during the last five years, the WHO has verified more than 1,100 epidemic events worldwide.<sup>58</sup>

By March of 2003, SARS had spread from Guangdong Province in China to neighboring Hong Kong, Canada, and beyond. The epidemic caused more than 900 deaths.<sup>59</sup> Outside of Asia, Canada was the country hardest hit by SARS. Most Canadian cases were concentrated in the Ontario area and all deaths were in Toronto.<sup>60</sup> Over 10,000 individuals in the Greater Toronto Area (GTA) were placed in voluntary isolation or supervised quarantine.<sup>61</sup> Table 1 provides a summary of probable SARS cases and deaths in Canada with onset of illness from November 1, 2002 to July 31, 2003.<sup>62</sup>

Table 1. Summary of Probable SARS Cases and Deaths in Canada

Area	Cumulative # of Cases			Based on Data as of 31 December 2003						
	Female	Male	Total	Median age (range)	Number of deaths*	Case fatality ratio (%)	Number of imported cases (%)	Number HCW** affected (%)	Date onset first probable case	Date onset last probable case
Canada	151	100	251	49 (1-98)	43	17	5 (2)	109 (43)	23-Feb-03	12-Jun-03

\* Includes only cases whose death is attributed to SARS.

\*\*Health Care Worker (HCW)

<sup>57</sup> J.S.M. Peiris and Y. Guan, “Confronting SARS: a view from Hong Kong,” *Philosophical Transactions of the Royal Society B: Biological Sciences* (London, 2004) 359:1075.

<sup>58</sup> WHO, *The World Health Report 2007*.

<sup>59</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 1.

<sup>60</sup> David C. Naylor, Cyril Chantler, and Dian Griffiths, “Learning from SARS in Hong Kong and Toronto,” *Journal of the American Medical Association* 291, no. 20 (2004): 2483.

<sup>61</sup> Ontario Ministry of Health and Long-Term Care (OMHLTC), “Descriptive Epidemiology of the Severe Acute Respiratory Syndrome (SARS) Outbreak Ontario, Canada, 2003,” [http://www.health.gov.on.ca/english/public/pub/ministry\\_reports/sars\\_070106/sars\\_070106.html](http://www.health.gov.on.ca/english/public/pub/ministry_reports/sars_070106/sars_070106.html) (accessed May 2, 2008).

<sup>62</sup> WHO, “Summary of probable SARS cases.”

SARS was a tragedy. In the space of a few short months, the deadly virus emerged from the jungles of central China, traveled across the globe and killed forty-three in Ontario and struck down more than 330 others with serious lung disease. It caused untold suffering to its victims and their families, forced thousands into quarantine, brought the health system in the Greater Toronto Area and other parts of the province to its knees and seriously impacted health systems in other parts of the country.<sup>63</sup>

Chapter III provides an abbreviated story of the SARS epidemic in Canada. It is a reminder of how public health and health care fought nature through two waves of the battle against a new infectious disease during an extraordinary seven-month period of time. In this story, the emergence of a novel infectious disease occurs, the response to a worldwide epidemic follows, and key challenges faced by Ontario's public health system and lessons to be learned are uncovered. These events played out between November 2002 and July 2003 when worldwide containment of SARS was declared.

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<sup>63</sup> The SARS Commission, *Volume 1, Executive Summary - Spring of Fear* (Toronto: OMHLTC, December 2006) 1, <http://www.sarscommission.ca/report/index.html> (accessed May 12, 2008).

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### III. THE SARS STORY IN ONTARIO CANADA

#### A. EMERGENCE OF THE MYSTERY DISEASE

On November 16, 2002, the first case of atypical pneumonia, later to be identified and considered the first case of Severe Acute Respiratory Syndrome (SARS), occurs in Foshan City, Guangdong Province, China. Refer to Figure 2 for a map of this region. The patient is a forty-six-year-old village committee official who had been admitted to a hospital in Foshan. Within a few days, his wife and other family members also become sick. He had no history of travel outside Foshan in the weeks prior to becoming ill, nor had he been in contact with wild animals. He recovered and was discharged from the hospital on January 8.

On December 10, less than four weeks after this first case, a thirty-four-year-old restaurant chef, Huang Xingchu, is admitted to a hospital in Heyuan with a respiratory illness that does not respond to medical treatment. He cooks wild animal meat, but is not involved in killing animals. He recovers and is discharged from the hospital; however, seven medical workers who cared for him later fall ill.

A twenty-six-year-old factory worker in Jiangmen is struck with a respiratory illness that does not respond to medical treatment on December 21. Only a few days later on December 26, a thirty-year-old male who worked as a chef in Zhongshan is admitted to the hospital and infects twelve others, including two relatives and ten health workers.<sup>64</sup>

In early January 2003, the public in Heyuan and Zhongshan becomes alarmed about the number of health workers getting sick. Healthy people begin to seek medicines on their own for fear of contracting the mystery illness. The provincial centre for disease is notified by both communities and teams are sent to investigate. Beijing also sends a team. By January 23, the investigating team in Zhongshan has produced a five-page report describing the disease as “atypical pneumonia,” and releases the report to major hospitals in the region.

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<sup>64</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 148.

Zhou Zuofeng, later realized to be the first SARS “super spreader,” is admitted to Zhongshan Medical University in Guangzhou on January 30, 2003.<sup>65</sup> The number of SARS cases in Guangzhou is on the rise, and by mid-February, Hong Kong media is reporting that there is a mysterious illness in Guangdong Province causing panic. The WHO regional office in Manila sends a request to the Chinese Ministry of Health for information on February 10. On February 11, Guangdong provincial health authorities hold a press conference acknowledging the disease, but announce the outbreak is under control.



Adapted from China Guide.com, Map of Guangdong Province, China, May 30, 2008.

Figure 2. Map of Guangdong Province, China

By February 15, health officials from the Chinese Ministry of Health and Guangdong province have reported 305 cases and five deaths of an acute respiratory syndrome. The outbreak is clinically consistent with atypical pneumonia and these cases

<sup>65</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 146.

would later be added to the SARS count. At about the same time, the WHO Beijing office receives an email message describing a “strange contagious disease” that has “left more than 100 people dead” in Guangdong province in one week’s time. Additionally, the message further describes, “a panic attitude where people are emptying pharmaceutical stocks of any medicine they think may protect them.”<sup>66</sup>

On February 22, a sixty-four-year-old doctor from Zhongshan Medical University in Guangzhou travels to Hong Kong for a wedding and checks into the Metropole Hotel. The doctor had experienced symptoms of the flu for several days, but felt well enough to sight-see, do some shopping, and visit his brother-in-law. By the next day, he seeks medical care at the Kwong Wan Hospital and is admitted to the Intensive Care Unit (ICU) in respiratory failure. The doctor warns health workers caring for him that he had previously treated patients with atypical pneumonia and fears he had contracted a “virulent disease.”<sup>67</sup>

It was a forty-six-year-old sea merchant from Guangzhou who had traveled to Zhongshan in early February and most likely infected the doctor. The patient had been admitted to the Second Affiliated Hospital for approximately eighteen hours, infecting more than thirty hospital staff. He was then transferred by ambulance to the Third Affiliated Hospital of Zhongshan University. During the ambulance transfer, two doctors, two nurses, and the emergency medical technician became infected. The emergency medical technician Fan Xinde was the first health care worker to die of SARS. He was not originally scheduled to work on the day of this transfer, but had graciously agreed to cover the shift for a co-worker who had recently lost his mother and wanted to spend time with his bereaved father.<sup>68</sup> He was warned that the patient was infectious and he was given a “triple-layer” surgical mask and gloves to wear. During the transfer, the patient struggled to breath and vomited in the back of the ambulance.

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<sup>66</sup> WHO, “Update 95 – SARS: Chronology of a serial killer,” [http://www.who.int/csr/don/2003\\_07\\_04/en](http://www.who.int/csr/don/2003_07_04/en) (accessed April 20, 2008).

<sup>67</sup> Ibid.

<sup>68</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 17.

Following the transfer, Fan spent over an hour cleaning and disinfecting the ambulance. Fan became ill and died on February 24. Within the next week, twenty more medical staff and nineteen family members or close relatives of the patient also became ill.<sup>69</sup>

A global epidemic was ignited when this physician exposed and infected guests at the Metropole hotel after he checked in on February 21. These guests would travel on and plant the seed for large outbreaks in other countries, including Canada, causing secondary cases in family members, health workers, and other close contacts. The earliest cases of SARS, however, appear unlinked and are from several different municipalities in the Guangdong province area. Other early cases included another chef and an ambulance service worker. Before the first battle began in Canada, other battles with SARS were already occurring.<sup>70</sup>

On February 22, a day after the Guangdong doctor checked into the Metropole Hotel, Sui-chu Kwan, a seventy-eight-year-old female tourist from Toronto, Canada checks out of the hotel and begins her journey home. On arrival in Toronto, she is reunited with her family. On March 4, the Guangdong doctor dies of atypical pneumonia. By March 5, Sui-chu Kwan has died at home. Family members do not want an autopsy and the coroner identifies heart attack as the cause of death.<sup>71</sup> Five members of her family are infected with the mysterious disease and are later admitted to the hospital.

See Figure 3 for a representation of the SARS chain of transmission among guests at Metropole Hotel resulting in SARS being carried to Canada and other countries.

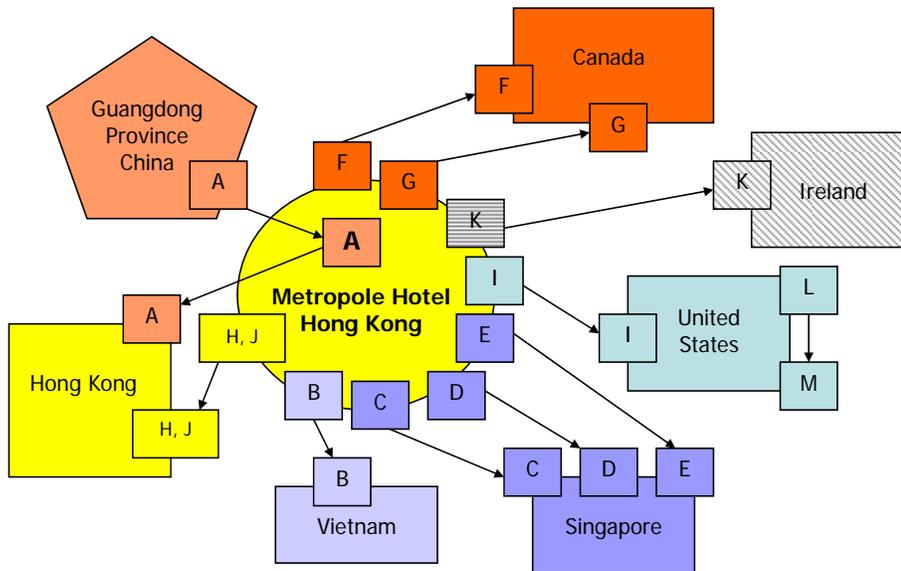
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<sup>69</sup> Zhong, et al., “Epidemiology and cause of severe acute respiratory syndrome (SARS),” 1355.

<sup>70</sup> Ibid.

<sup>71</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 25.

**A** represents the index patient (physician from Guangdong Province) and **B-J** represent individual patients exposed at the Metropole Hotel.



Source: Umesh D. Parashar and Larry J. Anderson, "Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak," *International Journal of Epidemiology*, 33, no.4 (2004): 628.

Figure 3. On March 12, the WHO issues a global alert in Hong Kong and Hanoi regarding a "mysterious illness," with reference to atypical pneumonia, soon to be called SARS. By March 13, Sui-chu's forty-four-year-old son has died in Scarborough Grace Hospital while physicians are in the process of ruling out tuberculosis. Sui-chu Kwan is considered the first SARS case in Toronto.<sup>72</sup>

On March 14, health authorities in Ontario take steps to alert doctors, hospitals, ambulance services, and public health units across the province that there are several cases of atypical pneumonia in Toronto which have resulted in two deaths, occurring within a single family. Prior to this alert, the British Columbia Centre for Disease Control and Toronto public health officials had sent broadcast emails to doctors and infection control specialists in late February regarding influenza-like illnesses being reported in travelers from China. On March 15, the WHO names the mysterious illness

<sup>72</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

after its symptoms: severe acute respiratory syndrome (SARS) and declares it “a worldwide health threat.” In addition, the WHO issues a rare travel advisory as evidence mounts that SARS is spreading by air travel along international routes. The first case definitions of suspect and probable cases of SARS are released and the WHO further calls on all travelers to be aware of the signs and symptoms, and issues guidance to airlines.

By March 16, over 150 suspect and probable cases of SARS have been reported from around the world; suspected cases are being reported in Canada, Germany, Taiwan, Thailand, and the United Kingdom as well as Hong Kong, Vietnam, and Singapore. The cumulative total cases reported to WHO is escalating rapidly.<sup>73</sup>

The United States reports its first suspected case to the WHO on March 20 and by March 26, the CDC has received fifty-one reports of suspected SARS cases from twenty-one states. The first suspected case is a fifty-three-year-old male who traveled to Singapore and became ill on March 10. Subsequently, four clusters of suspected cases are identified. Three were from a traveler who visited Southeast Asia and stayed at the Metropole Hotel.<sup>74</sup>

## **B. THE FIRST BATTLE UNFOLDS AND PEAKS**

By mid-March, laboratory tests on Ms. Kwan’s son came back negative for tuberculosis and other family members remained sick.<sup>75</sup> Public health officials and several physicians began to unravel part of the mystery. There was an unusual respiratory illness in Guangdong that had apparently spread to Hong Kong. Ms. Kwan had recently traveled to Hong Kong, returned to Toronto and had died at home. Soon after, her son developed a respiratory illness, died, and other family members were ill. The attending physicians recognized the need to implement prevention measures to

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<sup>73</sup> WHO, “Update 95 – SARS: Chronology of a serial killer.”

<sup>74</sup> CDC, “MMWR Report Update: Outbreak of Severe Acute Respiratory Syndrome – Worldwide, 2003,” *Morbidity and Mortality Weekly Report*, 52 (12): 243, <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5212a1.htm> (accessed April 27, 2008).

<sup>75</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 26.

reduce the spread of this unusual infectious disease, but the exact mode of transmission was still unknown. This decision led to ambulance transfers of ill family members to other hospitals with negative pressure isolation room capacity. Sunnybrook and Women's College Health Science Centre, Mount Sinai Hospital, and Toronto Western all accepted ill family members. A granddaughter was admitted to the Hospital for Sick Children.<sup>76</sup>

Behind the scenes, a person exposed to Ms. Kwan's son in the emergency department returned to Scarborough Hospital by ambulance on March 13 and had suffered a heart attack. His contact with Ms. Kwan's son was known; however, his cardiac symptoms did not alert health workers to be concerned about SARS. They used only standard infection control precautions while treating, and subsequently, transferring this patient to York Central Hospital for additional cardiac care. This patient would be the source of another cluster of infections that eventually affected more than fifty people and would close York Central Hospital. Another person who had been treated in the emergency department in a bed adjacent to Ms. Kwan's son had returned to Scarborough Hospital on March 16 with respiratory symptoms and a fever. He was placed in isolation; however, his wife who was with him in the emergency department infected seven visitors, six hospital staff, two other patients, two paramedics, a firefighter, and a housekeeper. In addition, the physician who worked to save this patient's life developed SARS along with three assisting nurses. As one would expect, anxieties were growing about this mysterious disease.<sup>77</sup>

On March 13, Health Canada received notification of the Toronto cluster, and convened the first of what would become daily teleconferences involving federal, provincial, and territorial public health officials.<sup>78</sup> The Ontario Ministry of Health and Long Term Care held a press conference the next day and brought this mysterious disease to the headlines of national and international news. The battle continued to rage at

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<sup>76</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 26.

<sup>77</sup> Ibid.

<sup>78</sup> Ibid.

Scarborough Hospital; more patients, staff, and visitors developed symptoms of the new disease, and on March 23, emergency and intensive care services began to refuse new admissions and transfers from other hospitals. Visitor access was being limited. In addition, outpatient clinics were closed, health workers were barred from working at other institutions, and multiple home quarantine orders were being issued to those who were potentially exposed. Strict infection control policies and procedures were being implemented in health care settings. Compounding the situation was the limited availability of negative pressure isolation rooms in the Toronto area, and when additional rooms were located, the number of qualified staff to care for the ill had already been exhausted.

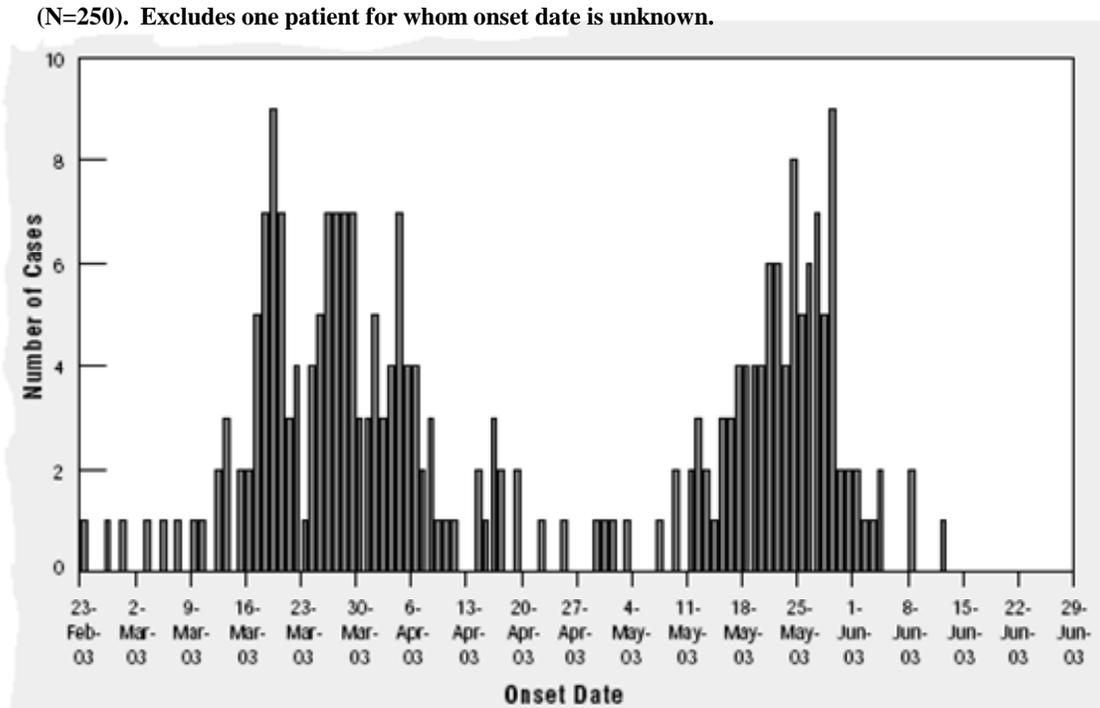
While Toronto was waging a battle against the virus, British Columbia was dealing with a man who had also stayed at the Metropole Hotel and had arrived at the Vancouver General Hospital with flu-like symptoms. Unlike Ms. Kwan, he went straight to the hospital and had not been in contact with any family or friends since his return. The attending physician and other health workers ensured that this patient was masked and quickly isolated. This occurred before anything was known in Vancouver about what was occurring in Toronto. Later, there would be only one report of secondary transmission from this case.<sup>79</sup>

To give health officials authority to track exposed and infected people, and issue orders to prevent the spread of disease, the Ontario government designated SARS as a reportable disease under the *Health Protection and Promotion Act* on March 25. On that date, Health Canada was reporting nineteen cases of SARS in Canada, eighteen in Ontario and a single case in Vancouver; however, forty-eight more patients suspected of having SARS had been admitted to area hospitals. Many more had symptoms and would eventually be identified as SARS cases. A declaration of a provincial emergency was declared on March 26; this required all hospitals to create SARS units to care for patients.

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<sup>79</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 27.

It would later be learned that this period, March 25-27, was the peak of the first battle or wave of SARS in Toronto. Refer to Figure 4. With new information from China, worldwide cases had soared to 1,323 with forty-nine deaths.<sup>80</sup>



Adapted from Health Canada, National Advisory Committee on SARS and Public Health, “Learning from SARS: Renewal of Public Health in Canada,” (October 2003).

Figure 4. Probable Cases in Canada, February 23 to July 2, 2003

The Ontario Provincial emergency declaration also gave Premier Ernie Eves the power to direct and control local governments and facilities to ensure that essential services were provided. On the same day the premier declares the emergency, the province activates its multi-ministry Provincial Operations Centre (POC) for emergency response. All hospitals in the Greater Toronto Area (GTA) are ordered to go “code orange,” i.e., all non-essential services are to be suspended. In addition, hospitals are

<sup>80</sup> WHO, “Update 95 – SARS: Chronology of a serial killer.”

required to limit visitors, create isolation units for potential SARS patients, and provide appropriate infection control protection equipment to employees. SARS patients are being cared for at over twenty hospitals in the GTA.

On March 30, Canadian officials close York Central Hospital to new patients and request hundreds of its employees to quarantine themselves voluntarily.<sup>81</sup> By April 2, the cumulative world total of SARS cases has passed the 2,000 mark.<sup>82</sup>

Public health workers in Toronto and York continue to trace and quarantine people exposed to SARS with some good results. These workers are praised by many and credited for containing the SARS outbreak. However, despite this success, concerns continue to mount that SARS would spread to the community. On April 3, individuals who attended a funeral, would be quarantined because family members of the deceased have developed SARS symptoms. An employee of a large technology firm who attended this funeral, becomes non-compliant with a quarantine order and returns to work when ill. He infects one co-worker and sends nearly two hundred more into quarantine. Toronto public health closes a school when one student (a child of a health worker) presents with SARS symptoms. Four other schools are closed by local school boards out of concern over SARS. Despite these actions, there is no real evidence that SARS was spreading in the community. Using traditional public health interventions such as tracing those who had been exposed to someone with SARS symptoms and ordering them into quarantine, community spread appears to be minimal.

By the end of the first week in April, ninety-one probable and 135 suspect SARS cases have been reported in Canada and ten people have died.<sup>83</sup> By April 11, SARS cases had been reported in nineteen countries on four continents with the cumulative number of worldwide cases approaching the 3,000 mark.<sup>84</sup>

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<sup>81</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 28.

<sup>82</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

<sup>83</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 34.

<sup>84</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

Still concerned about community spread, Toronto public health officials aggressively investigate a cluster of thirty-one suspect and probable SARS cases during the second and third week of April in members of a religious group. Initial exposures may have occurred at the Scarborough Hospital, and subsequently, during two large gatherings of the religious group on March 28 and 29. The virus quietly spread through the religious group to extended family members, health workers who treated them, and other close contacts. On April 13, a family physician working in a Sunnybrook and Women's SARS unit may have been infected when caring for members of this religious group. He begins to suffer from increased shortness of breath and is immediately transferred to the ICU where non-invasive procedures are used to assist his breathing. When this fails, a breathing tube is inserted. Transfer and insertion of the breathing tube takes several hours, including exposing other health workers to coughed-up secretions and aerosols generated by the devices used to assist his breathing. Eleven more health workers become ill.

On April 20, Sunnybrook and Women's closes the SARS unit and ICU because too many health workers are ill or quarantined. This results in desperate requests from hospital administrators for medical support. At this point, Sunnybrook and Women's is now carrying the largest volume of SARS patients in the GTA. The military sends critical care specialists. One physician comes from the United Kingdom and another from Montreal. Further support only comes after the province contracts with a private agency.<sup>85</sup>

Public health workers continue active surveillance and quarantine to ensure that SARS does not spread to the community. People exposed through the religious group live in Toronto and York and in the surrounding regions of Durham and Peel. Their public health units join forces to conduct the investigation. Hospitals begin to complain that they are receiving multiple calls from different public health units answering the same questionnaires and surveys. This is the result of a lack of overarching coordination among public health units from different jurisdictions. At the same time, hospitals are

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<sup>85</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 36.

answering questions from the Provincial Operations Centre (POC) and the Ministry's Public Health Branch. By this time, local public health workers are nearing exhaustion. All non-SARS public health activity is suspended and most public health workers are only addressing SARS.<sup>86</sup> The total cumulative number of probable SARS cases has now climbed to 4,288 worldwide, with 140 in Toronto.<sup>87</sup>

Despite the heightened concern for community spread, by April 23, only one member of the religious group develops SARS and the number of new cases in Toronto appears to be decreasing. The media and frontline health workers are beginning to feel some relief. Hospitals begin to lift infection control precautions; personal protective equipment no longer has to be worn for all patients. Visitors are allowed back into hospitals and staff begin returning to "duty as usual." Just as Canadians think they might be winning the battle against SARS, the WHO issues a travel advisory on April 23 recommending that visitors to Toronto postpone all but the most essential travel. On the same day at a press conference, Mayor Mel Lastman had this response to the travel advisory.

I can tell you definitely we are in better shape today than we have been in a month...Where did the WHO come from? Who did they see? Who did they talk to? Did they go to our hospitals, did they go to our clinics, did they go anywhere? They sit somewhere, I understand Geneva, I don't even know where the hell they come from, but Geneva or someplace and they make decisions...<sup>88</sup>

There was concern by the United Nations over a small number of people in other countries who may have been exposed to SARS in Toronto. The advisory, issued for a three-week period, is withdrawn on April 30 following visits to Geneva by the Ontario Health Minister Tony Clement and the Public Health Commissioner, Dr. Colin D'Cunha. Lifting the travel advisory comes with a promise from Canadian officials that intense screening of travelers to and from Canada to prevent the exportation of disease would

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<sup>86</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 36.

<sup>87</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

<sup>88</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 38.

commence.<sup>89</sup> By May 2, the cumulative total of SARS cases worldwide surpasses 6,000, and on May 14, Toronto is removed from the list of “areas with recent local transmission.”<sup>90</sup>

### **C. CALM BEFORE THE NEXT BATTLE**

By WHO lifting the travel advisory to Toronto and removing the city from the list of local transmission, along with the decrease in new SARS cases, the community perceives that the outbreak is coming to an end. The Premier lifts the emergency declaration on May 17 and previous hospital requirements for suspension of non-essential services; however, enhanced infection control practices continue. The POC is also dismantled and the Ontario government assembles a panel of experts to study the response to SARS. Most governmental and health officials are providing a unified message that SARS has been contained. Public health begins to highlight the declining number of “active” SARS cases and the number of new cases instead of the cumulative numbers. Health Canada issues bulletins weekly, and on May 21, reports that no Canadian had experienced onset of SARS symptoms for over a month. It appears that a peak has been reached, with 140 probable, 178 suspect cases, and twenty-four Canadian deaths, all in Ontario.<sup>91</sup>

Despite this good news, some potential cases of SARS remain under investigation because of the SARS-like symptoms’ similarity to those of other respiratory illnesses. These investigations often involve infectious disease specialists, public health physicians, Health Canada personnel, and the CDC. A number of these investigations would result in the lack of epidemiological evidence to link people to a possible source of SARS infection.

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<sup>89</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 38.

<sup>90</sup> WHO, “Update 95 – SARS: Chronology of a serial killer.”

<sup>91</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 38.

Between late April and early May, three psychiatric patients develop pneumonia; all had been patients in York General Hospital. One patient comes back to the hospital through the emergency department, is placed in the waiting area and is given a mask to wear. The patient nervously paces the waiting area removing his mask frequently. No epidemiological link to a source of SARS infection could be made to any of these patients. However, all end up initially being placed in isolation and are managed as suspected SARS cases. There are differing views by the investigation team as to whether the clinical picture was consistent with SARS, but without epidemiological links and with negative test results, a new cluster is ruled out.<sup>92</sup>

During the same time, several elderly patients on the fourth floor of the York General Hospital had been fighting what was believed to be “post-operative lung infections.” Apparently, infection spread over several weeks to other patients, visitors, and staff from these patients. On April 29, an intensive care unit nurse from York General is admitted to Toronto General Hospital with respiratory illness. She had taken care of one of the elderly patients who subsequently had died. Serology test results are negative for SARS at first, but later come back positive. This case would later be considered part of a growing SARS cluster in York General Hospital.<sup>93</sup>

By mid-May, health workers in the emergency department who have taken care of family members of one of the elderly patients with symptoms similar to SARS, begin to grow anxious about the disease’s re-emergence. Radiologists also express concern about suspicious x-rays. Without epidemiological links and following public health guidance, the hospital’s infection control director and the vice president of medical affairs try to reassure these workers. St. John’s Rehabilitation Hospital, meanwhile, received several transfers from other hospitals, including one from York General’s fourth floor. Health workers from St. John’s inform senior management and Toronto Public Health that three patients are exhibiting symptoms of SARS. Immediately, the hospital implements appropriate precautions. In consultation with Toronto Public Health, it is agreed that

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<sup>92</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 39.

<sup>93</sup> *Ibid.*, 38.

there has been a respiratory illness outbreak, but suggested that it was most likely not SARS. This decision comes in the midst of public health still tracking down thirty to forty possible cases of SARS per day. Toronto Public Health staff does visit the hospital and establishes that no epidemiological link can be identified.<sup>94</sup>

#### **D. SECOND BATTLE IS UNDERWAY**

Only one week after WHO declares Toronto free of local SARS transmission, health officials acknowledge that five people are under investigation for SARS and that maybe SARS has not been defeated. This announcement is followed by a press release. Anyone who had visited St. John's between May 9 and 20 or York General Hospital between May 13 and 23 is ordered into quarantine. York General Hospital immediately stops new admissions except for those with SARS-like symptoms. SARS has again spread to York General, St. John's, Toronto General, and Scarborough Hospital. The second battle against SARS is underway.

Hospitals in the GTA are instructed to resume heightened infection-control procedures. This time four hospitals are designated as SARS units and are given the name "SARS Alliance." The four hospitals include York General, Scarborough, St. Michael's, and Sir William Osler Health Centre in Etobicoke. Without a provincial emergency declaration, the Ontario Ministry of Health and Long Term Care takes the lead role with local public health in coordinating the outbreak response. An operations center is established in the Ministry office. A joint leadership role is assigned to two assistant deputy ministers to oversee the institutional and clinical functions. However, several hospital administrators and a number of physicians ask that one person be placed in charge to avoid confusion.<sup>95</sup>

Once again public health workers gear up for more investigations and interviews of contacts and suspected cases. On May 22, health authorities in Canada inform the WHO of a new hospital-based cluster of five cases of acute respiratory illness in Toronto,

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<sup>94</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 40.

<sup>95</sup> *Ibid.*, 41.

and by May 26, Toronto returns to the list of areas with recent local transmission. It would later be realized that May 22 was the onset date of the last Ontario SARS case. The cumulative global total of SARS cases has now surpassed 8,000.<sup>96</sup> Fatigue remains a problem for public health; however, this time the outbreak is smaller, the virus is better understood, and appropriate infection control procedures have already been established. By the end of May, forty-eight probable and twenty-five suspect cases have been identified in this second wave of the outbreak. Refer to Figure 4.<sup>97</sup> Like the first wave, transmission is primarily to other hospital patients, health workers, and family contacts. Another call for medical assistance is made, and several American infectious disease specialists and epidemiologists respond to Toronto. Again, a private sole-source provider offers to assist physicians and nurses with the outbreak for a fee and provide services.

During the course of the second wave, a medical student had to be placed in quarantine after potential exposure to SARS during an obstetrics rotation at York General Hospital. Two days after he is released from quarantine, he develops symptoms while working at Mount Sinai Hospital, precipitating the quarantine of five women and their newborns and a number of health workers. Another incident involves 1,700 high school students who were quarantined after a student at their school fell ill with SARS-like symptoms.<sup>98</sup> By June 18, the global outbreak has entered its one hundredth day, and the number of new cases reported worldwide is dwindling to a handful.<sup>99</sup>

On June 30, Nelia Laroza, a fifty-one-year-old nurse at North York General Hospital, becomes the first Canadian health worker to die from SARS. A second nurse, Tecla Lin, dies on July 19, and a family physician, Nestor Santiago Yanga, dies on August 13.<sup>100</sup> Many health workers faced a fundamental conflict between personal safety and a professional obligation or duty to act. Only a small number of health

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<sup>96</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

<sup>97</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 41.

<sup>98</sup> Ibid.

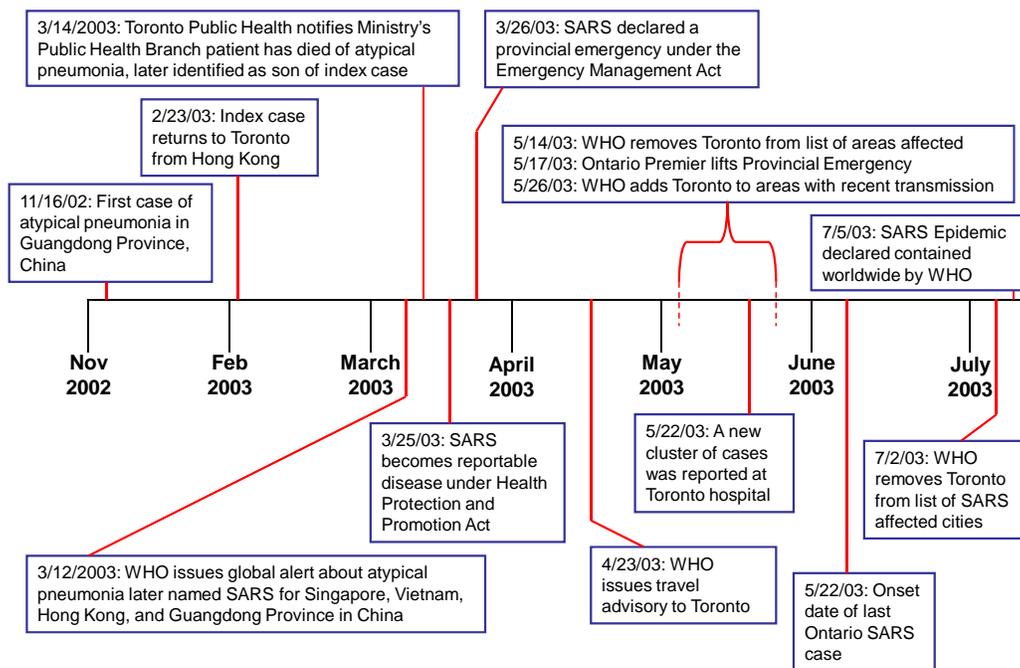
<sup>99</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

<sup>100</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 41.

workers refused to treat SARS patients or to work in SARS units. Many willingly volunteer in the face of a mysterious disease that has no cure and is attacking the very infrastructure set-up to care for the sick. The toll on health workers in Canada was high with more than one hundred ill and three deaths.<sup>101</sup>

## E. SARS DECLARED CONTAINED WORLDWIDE

On July 2, Toronto is again removed from the list of areas with recent local transmission, and on July 5, the WHO declares that SARS outbreaks have been contained worldwide, but calls for continued surveillance.<sup>102</sup> Refer to Figure 5 for a timeline of critical events during the SARS outbreak in Ontario, Canada.<sup>103</sup>



Adapted from Ontario Ministry of Health and Long-Term Care, Canada, "Descriptive Epidemiology of the SARS Outbreak - Ontario, Canada 2003."

Figure 5. Timeline of Critical Events

<sup>101</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 1.

<sup>102</sup> WHO, "Update 95 – SARS: Chronology of a serial killer."

<sup>103</sup> OMHLTC, "Descriptive Epidemiology of the SARS Outbreak Ontario, Canada."

SARS took root in hospital settings, where health care workers, unaware that a new disease had surfaced, and fighting to save the lives of patients, exposed themselves to an infectious agent without proper barrier and personal protection. These initial outbreaks were characterized by chains of secondary transmission outside the health care setting, primarily affecting family members and close contacts. This disease placed enormous burdens on the public health and health care system and exposed weaknesses in preparedness for and response to an infectious disease epidemic in Canada and around the world.<sup>104</sup> As reported by the WHO, Canada had a total of 251 probable SARS cases and forty-three deaths. Of the 251 probable cases, 109 were health care workers with three deaths.<sup>105</sup>

Chapter IV provides an overview of Ontario's governmental public health system, its governance, authorities, and jurisdictional boundaries. The governmental response to the SARS epidemic including command and control, roles and responsibilities, alerting, communication, linkages, and information sharing is examined.

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<sup>104</sup> Abraham, *Twenty First Century Plague: The Story of SARS*, 140.

<sup>105</sup> WHO, "Summary of probable SARS cases."

## IV. GOVERNMENTAL PUBLIC HEALTH AND THE RESPONSE TO SARS

### A. DECAY OF PUBLIC HEALTH

In a 2002 report, the Institute of Medicine (IOM) referred to the “public health system” as a complex network of individuals and organizations that, when working together, can represent “what we as society do collectively to assure the conditions in which people can be healthy.”<sup>106</sup> Public health systems around the world have deteriorated due to lack of investment of resources by governments over the last several decades.<sup>107</sup> Due to this lack of investment, the Canadian public health system was ill-prepared and ill-equipped to handle SARS.

The alarm regarding the deterioration of public health in the United States was first raised by an IOM Report in 1988. This report identified a number of systemic concerns, including disorganization, weak and unstable leadership, decreasing professional competence, outdated statutes, gaps in data collection and analysis, and inadequate financial support.<sup>108</sup> Likewise, concerns regarding the general decline in public health capacity in Canada have been expressed since 1970.<sup>109</sup> Mr. Justice Horace Krever, in his report, *Commission of Inquiry on the Blood System in Canada* (1997), recommended that the provincial and territorial ministers of health provide sufficient resources for public health services and in doing so stated:

Public health departments in many parts of Canada do not have sufficient resources to carry out their duties. They must have sufficient personnel and resources to conduct adequate surveillance of infectious diseases, to develop and implement measures to control the spread of infectious diseases, including those that are blood borne, and to communicate with

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<sup>106</sup> IOM, *The Future of the Public's Health in the 21st Century*, xiv.

<sup>107</sup> Trust for America's Health, “SARS and Its Implications for U.S. Public Health Policy: We've Been Lucky,” <http://healthyamericans.org/reports/files/SARSreport.pdf> (accessed June 21, 2008).

<sup>108</sup> IOM, *The Future of Public Health*, 32.

<sup>109</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 52-55.

other public health authorities at both the federal and the provincial-territorial levels. Continued chronic underfunding of public health is a disservice to the Canadian public.<sup>110</sup>

Specifically in Ontario, Mr. Justice Dennis O’Conner in May 2002 recommended an amendment to the *Health Protection and Promotion Act* (1990) to fill vacant positions immediately for medical officers of health, and that the Ontario Ministry of Health and Long Term Care conduct regular compliance assessments of local boards of health in meeting public health service requirements.<sup>111</sup> Likewise, Senator Michael Kirby, in a report of the Canadian Standing Senate Committee on Social Affairs, Science and Technology (2002), stated:

The Committee was told and is aware, however, that promotion, prevention, protection and population health activities do not claim anything like the close focus and high status that health care has in the eyes of the Canadian public and, obviously, public policy decision makers. Although it is clear that, collectively, the non-medical determinations of health have far greater impact on the health of the population than health care, the fact is that very positive outcomes from promotion, prevention, protection, and population health activities are generally visible only over the longer term, and thus they are less news worthy. Because they are less likely to capture the attention of the general public, they are less attractive politically.<sup>112</sup>

There seems to be complacency in the view of the public and policy makers regarding a high priority need for public health capacity at all levels of the Canadian government. This may be due in part to the optimism that vaccinations, antibiotics, and clinical medicine are powerful soldiers strong enough to fight off any novel virus or infectious disease. SARS has taught us that this optimism may be misguided, and that infectious diseases continue to be a significant public health threat. For example, according to the U.S. surgeon general’s annual reports from the 1970s and 1980s,

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<sup>110</sup> Public Works and Government Services Canada, *Commission of Inquiry on the Blood System in Canada (Krever Commission)* 1073, <http://www.hc-sc.gc.ca/ahc-asc/activit/com/krever-eng.php> (accessed May 18, 2008).

<sup>111</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario* (Toronto: OMHLTC, April 15, 2004) 38, <http://www.sarscommission.ca/report/index.html> (accessed May 12, 2008).

<sup>112</sup> *Ibid.*, 40.

tuberculosis was to be eradicated from the United States by 2000. Instead, American public health officials are now dealing with multi-drug-resistant- and extensively-drug-resistant forms of the disease.

Whether naturally occurring or intentionally introduced, microbes can cause illness, disability, and death in individuals. At the same time, entire populations, economies, and governments can be disrupted. These microbes are resourceful and adaptable, giving them the potential to breach our greatest public health defenses. Factors relating to the environment, society, and our global interconnectedness enhance the likelihood of disease emergence and spread. As well, it is imperative to deal with the twenty-first century threat of the intentional use of biological agents to do harm, human against human.<sup>113</sup>

## **B. GOVERNMENTAL PUBLIC HEALTH IN ONTARIO**

Based on the Ontario Populations Projections by the Ministry of Finance (2008), the population in Ontario is 12.8 million, with approximately six million living in the Greater Ontario Area (GTA). The GTA is comprised of Toronto and the regional municipalities of Durham, Halton, Peel, and York. This area is projected to be the fastest growing region in Ontario. The majority of SARS cases during the outbreak occurred in Toronto, and subsequently, the York, Durham, and Peel regions. Refer to Figure 6 for distribution of SARS cases by health unit of residence.<sup>114</sup>

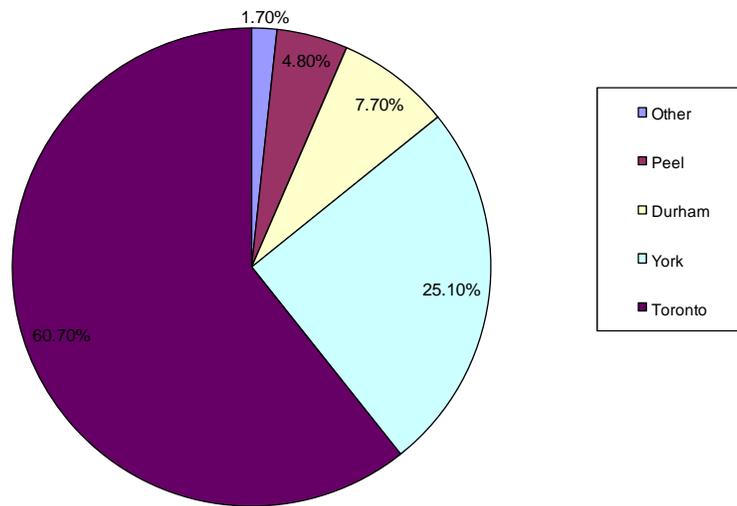
There are approximately 140 public health units and departments at the municipal level that serve populations ranging from 600 to 2.4 million people. Thirty-six local public health units serve Ontario. This is where direct public health services are provided, including prevention and protection against infectious disease, and where frontline public health workers battle infectious disease outbreaks like SARS. Each health unit is governed by a board of health, which is an autonomous corporation under the *Health Protection and Promotion Act*, (1990). A medical officer of health, for most

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<sup>113</sup> Smolinski, et al., *Microbial Threats to Health: Emergence, Detection, and Response*, xvii.

<sup>114</sup> OMHLTC, "Descriptive Epidemiology of the SARS Outbreak Ontario, Canada.

health units, is responsible for administering programs and reports to the board. During the SARS outbreak, there were thirty-seven public health units in the GTA engaged in the response.<sup>115</sup>



Adapted from Ontario Ministry of Health and Long-Term Care, Canada, "Descriptive Epidemiology of the SARS Outbreak - Ontario, Canada 2003."

Figure 6. SARS Cases by Health Unit of Residence

### C. PUBLIC HEALTH RESPONSE TO SARS IN ONTARIO

In the SARS 2006 Commission Report, Ontario's central provincial public health system is described as being woefully inadequate and unprepared.

SARS showed that Ontario's public health system is broken and needs to be fixed. Despite the extraordinary efforts of many dedicated individuals and the strength of the many local public health units, the overall system proved woefully inadequate. SARS showed Ontario's central public health system to be unprepared, fragmented, poorly led, uncoordinated,

<sup>115</sup> OMHLTC, "Descriptive Epidemiology of the SARS Outbreak Ontario, Canada," 4.

inadequately resourced, professionally impoverished, and generally incapable of discharging its mandate. Ontario was fortunate that SARS was ultimately contained without widespread community transmission or further hospital spread, sickness and death. SARS was contained only by the heroic efforts of dedicated front line health care and public health workers and the assistance of extraordinary managers and medical advisors. They did so with little assistance from the central provincial public health system that should have been there to help them.<sup>116</sup>

The litany of problems identified during the governmental public health system's response in Ontario during the SARS epidemic should be used as a basis for identifying applicable recommendations for improving public health preparedness in the United States. This chapter focuses on system issues, not on those who worked within the system. What *did* go right in a system where so many things went wrong was the extraordinary work and dedication of the public health and health care soldiers who fought SARS.<sup>117</sup>

#### **D. COMMAND AND CONTROL**

In Ontario, there is no authorization under law for “who’s in charge,” and therefore, no clear line of accountability for managing a public health emergency. Clarification in command and control for the operational response to SARS did not begin to emerge until March 26, 2003 when the premier of Ontario declared SARS a provincial emergency under the authority of the *Provincial Emergency Plans Act*. This declaration activated the Provincial Operations Centre (POC) and brought representatives from provincial ministries to the response table. Concurrently, each ministry activated its own ministry advisory group (MAG). Initially, there was confusion and frustration between the POC and the MAGs. The POC was staffed by individuals who had broad emergency response backgrounds. The MAGs, on the other hand, were staffed by individuals who had greater knowledge about infectious diseases, but had limited experience with SARS.

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<sup>116</sup> The SARS Commission, *Volume 1, Executive Summary - Spring of Fear*.

<sup>117</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*.

These groups were, at the time of the outbreak, informally functioning and co-located. Once the declaration occurred, it took seventy-two hours for both groups to be situated in one physical location, at the POC.

Prior to the SARS outbreak, the POC had never been activated.<sup>118</sup> Staffing for the POC and MAGs became immediately problematic as only one individual was being assigned per group when 24/7 staffing was being required. There was little infrastructure designed to support the MAGs and assist with the operations at the POC. As well, a credentialing process was absent from the staffing pattern for the POC.

Another point of confusion was the role of the commissioner of public safety and the commissioner of public health or chief medical officer of health at the POC. It was unclear which position was ultimately in charge and responsible for managing the public health emergency. The command structure of the POC prior to SARS had not contemplated sharing responsibility with a “lead” ministry, such as the Ontario Ministry of Health and Long Term Care, or a chief medical officer of health. The perception was that the responsibilities of these two positions were duplicative and it was unclear which position was ultimately in charge.

In addition, under the *Health Protection and Promotion Act*, local medical officers of health were responsible for the response to SARS. It was the province, however,—the Public Health Branch of the Ontario Ministry of Health and Long Term Care—to whom the local public health units looked for guidance. Many medical officers felt there was no coordinated effort to facilitate the SARS response at the local level. A number of health workers informed the SARS Commission that the Public Health Branch of the Ontario Ministry of Health and Long Term Care had over time become dysfunctional internally and had poor relationships with local public health units. When SARS appeared, leadership seemed to be absent from the branch.

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<sup>118</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*. 145.

## **E. ALERTING AND COMMUNICATION**

In general, communication about SARS came from various agencies within the system with no clearly identified source. Information often came with conflicting or out-of-date recommendations. For example, information came from the public health commissioner, local public health units, the POC, the Ontario Hospital Association, the Ontario Medical Association, the Public Health Branch of the Ontario Ministry of Health and Long Term Care, the Ministry of Public Safety and Security, and Health Canada.<sup>119</sup> In addition, multiple spokespersons from multiple agencies all interacting with the media produced conflicting information and reduced the credibility and confidence the public and front-line workers in the public health system had for those in charge.

Infrastructure, procedures, and roles and responsibilities for distributing health alerts were non-existent. Local health units, physicians, ambulance services, hospitals, long-term care facilities, community health centers, and other sector responders identified the need for a comprehensive alerting system, and clearly identified roles and responsibilities for information sharing at all levels of government. In addition, information shared needed to be categorized by public information, clinician information, and other response partner information. For example, public health and health care workers indicated that no system existed prior to the SARS outbreak for communication of routine and emergent infectious disease alerts from Health Canada to the operational levels of the system (i.e., hospitals, long-term care facilities, ambulance services, clinics, and physicians). Hospital administrators indicated they had no direct communication from Health Canada regarding SARS.<sup>120</sup> Also reported was the lack of feedback or information sharing regarding the interaction between Health Canada and the WHO. Health Canada departed from the WHO's international recommendations on SARS diagnostic criteria until later in the outbreak and failed to communicate evidence-based reasons for such a decision. This created credibility and trust concerns between Health

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<sup>119</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*. 150.

<sup>120</sup> *Ibid.*, 145.

Canada and attending physicians across the province. According to the author Steven M. R. Covey, trust is a critical leadership competency that is actionable and can be created. Without trust, the quality of communication may be diminished leading to inefficiencies in emergency response.

There is one thing that is common to every individual, relationship, team, family, organization, nation, economy, and civilization throughout the world—one thing which, if removed, will destroy the most powerful government, the most successful business, the most thriving economy, the most influential leadership, the greatest friendship, the strongest character, the deepest love.....That one thing is trust.<sup>121</sup>

It was not until May 29, 2003 that Health Canada announced full alignment of its criteria for diagnosis of SARS with that of the WHO.<sup>122</sup> Had “trust” among Health Canada, public health, and health care providers been previously established and transparent communications achieved, improvements may have been realized in identifying, diagnosing and reporting SARS cases more efficiently and effectively.

Local public health units have the responsibility to collect infectious disease information for reportable disease at the individual case level. Health care providers are required to report to local public health units; however, there is no clear responsibility for local public health units to provide information back to health care providers. Health care providers thought they would receive SARS information from local public health units; however, the public health units felt they could not share case information due to confidentiality restrictions. In addition, local public health units did not have sufficient resources to do so, and they did not believe it was their responsibility.<sup>123</sup> Health care providers also perceived that local public health units were paying more attention to community contact tracing and quarantine. This diminished the importance of and actual interaction with hospitals to help identify how their practices might be contributing to

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<sup>121</sup> Stephen M. R. Covey with Rebecca R. Merrill, *The Speed of Trust: The One Thing That Changes Everything* (New York: The Free Press, 2006), 1.

<sup>122</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*, 143.

<sup>123</sup> *Ibid.*, 151.

the further spread of SARS.<sup>124</sup> Health Canada does not have a clear legal mandate to require provinces to share health surveillance information with each other and the federal government.<sup>125</sup>

Not only was communication a concern among higher level public health system players and between public health and health care, but also in regard to information sharing with other sectors, such as emergency medical services.<sup>126</sup> Hospitals reported receiving inquiries from multiple public health units for the same information on the same patient. When hospitals informed public health of this duplication, they were informed that public health had no means to share information across public health units or with other sectors in aggregate form.<sup>127</sup> It was also identified that local medical officers of health did not regularly participate in arranged conference calls to share information and coordinate response activities. This further contributed to the lack of information sharing and resulted in conflicting messages being passed on to local health units and hospitals.<sup>128</sup>

Toronto Public Health (TPH) did establish a SARS hotline with over 200 staff providing health information and counseling, case and contact identification, and consultation on emerging issues in affected health care settings and communities. The hotline received over 300,000 calls with a peak of 47,567 calls in a single day.<sup>129</sup> The majority of calls were related to illness, exposures, emergency supply needs, quarantine compliance, business failure, loss of income, racial profiling, and fear of being shunned. This hotline provided an avenue for the public to get information, however, it did not contribute to enhancing communication between public health and health care.

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<sup>124</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*, 145.

<sup>125</sup> *Ibid.*, 48.

<sup>126</sup> *Ibid.*, 151.

<sup>127</sup> *Ibid.*

<sup>128</sup> *Ibid.*

<sup>129</sup> Sheela V. Basrur, Barbara Yaffe, and Bonnie Henry, "SARS: A Local Public Health Perspective," *Canadian Journal of Public Health*, 95, no. 1, (January/February 2004): 22.

## **F. ROLES AND RESPONSIBILITIES**

The SARS outbreak was moderate in size, in part because some effective public health and health care actions were taken to contain its spread. In addition, the causative agent was actually less contagious than other more common respiratory and enteric viruses.<sup>130</sup> The containment of SARS relied heavily on the application of public health prevention and control measures rooted in nineteenth century science.<sup>131</sup> Effective implementation of prevention and control measures depends heavily upon public health system capacity and capability at the local and provincial levels. It also relies upon well-defined emergency response roles and responsibilities at all levels of government.

During the initial battle with SARS, medical workers responsible for directly treating people infected with SARS and implementing infection control measures were unclear on the roles and jurisdictional responsibilities of Health Canada, the Ontario Ministry of Health and Long Term Care, and the local public health units. For example, it was unclear who was to serve as the contact with the WHO; who was responsible for keeping the overall system informed; who was responsible for developing and issuing press releases; who was to provide advice on appropriate infection control procedures; and who was providing clinical and case definitions for SARS. Frontline medical workers indicated that these issues appeared to be a source of debate between the Ontario Ministry of Health and Long Term Care and Health Canada. Clarity in roles and jurisdictional responsibilities and greater communication among Health Canada, the Ontario Ministry of Health and Long Term Care, and local public health units could have eliminated some of this confusion. Some frontline medical workers referred to “fragmentation” in the system, “silos,” and “chaos” in describing the lack of clarity in roles and responsibilities.<sup>132</sup>

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<sup>130</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 64.

<sup>131</sup> Naylor et al., “Learning From SARS in Hong Kong and Toronto,” 2484.

<sup>132</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 143.

The main roles and responsibilities of the TPH included disease surveillance and reporting, case investigation and management, identification and quarantine of contacts, health risk assessment, and providing consultation and technical assistance to health care providers regarding infection control. The TPH also played an important role in public information and education at the local level. These activities were overseen by the associate medical officer of health under the leadership of the medical officer of health and provincial public health officials. Approximately 700 TPH staff engaged in the SARS response between mid-March and the end of June. Nearly 400 workers were assigned to SARS on any given day.<sup>133</sup>

In order to sustain the TPH response during the SARS epidemic, public health officials and physicians had to be brought in from other public health units from around the country and from the federal government. Most were assigned to case management, contact tracing, and epidemiology teams. These teams worked seven days a week from 8:00 a.m. to 11:00 p.m. on two shifts.<sup>134</sup>

### **1. Contact Tracing and Case Management**

The identification of people potentially exposed to a case of SARS or other infectious disease is called contact tracing. It involves the monitoring and evaluation of those exposed. Contact tracing is also critical in order to reduce the spread of disease and provides a means to focus containment and control efforts on people who are at high risk. The process includes identifying people prior to or early in the course of their illness, and implementing appropriate control measures before those individuals can spread the disease to others. Quarantine of exposed people was a control measure used during the SARS epidemic. Effective use of quarantine reduces the interval between the onset of symptoms and implementation of control measures, thus reducing the number of exposures, and subsequently, the number of cases.

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<sup>133</sup> Basrur et al., "SARS: A Local Public Health Perspective," 22.

<sup>134</sup> Ibid.

A dedicated phone line was established for health care providers to report cases to the province. Case management teams investigated all reports by obtaining detailed histories of symptoms, laboratory test results, and epidemiological linkages with other SARS cases. Preliminary determinations were made from three options: 1) the individual met the definition of a probable or suspect case, 2) the individual did not meet the case definition, or 3) the individual remained under investigation. Since SARS symptoms resembled those similar to influenza and other respiratory illnesses, the disease was often difficult to diagnose. It was labor intensive to rule out SARS cases. Since the final decision had major implications for the affected person, close contacts, and health care settings, each case investigation took an extraordinary amount of time and effort. The case management teams at the TPH held daily case conferences consulting with infectious disease experts and worked joint investigations with other public health units.

During the outbreak, approximately 2,000 case investigations were conducted, each taking an average of nine hours to complete.<sup>135</sup> All potential cases were contacted daily to update their clinical status until a final diagnosis could be made. In addition, TPH placed staff in hospitals with SARS cases to facilitate public health management. For each case, a detailed list was developed outlining activities for ten days prior to onset of symptoms and while they were symptomatic. At-risk contacts were identified and decisions made regarding isolation and quarantine.

## **2. Follow-up of Case Contacts**

Contacts that were not symptomatic were placed in quarantine for a ten-day period (incubation period). Thermometers and masks were delivered to people in quarantine and provisions made for delivery of essential goods. Each contact placed in quarantine was telephoned at least once a day to ensure quarantine was maintained. Over 23,300 people were identified as possible contacts, and of those, 13,374 were placed in voluntary quarantine.<sup>136</sup> Cooperation and compliance was high, with only twenty-seven

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<sup>135</sup> Basrur et al., "SARS: A Local Public Health Perspective," 23.

<sup>136</sup> Ibid.

mandatory orders being issued for those who did not initially comply.<sup>137</sup> Although not used in Toronto, law enforcement was used in Guangdong province to track down contacts of cases who then received follow-up for the ten days after exposure.<sup>138</sup>

### **3. Epidemiology**

Information collected by the case management teams was delivered to epidemiological teams daily to update surveillance databases and for submission to the provincial government. Limited disease surveillance information was shared with infectious disease specialists, emergency room physicians, and other Ontario public health units. Although surveillance information was shared, there was no standard policy or mechanism to share this information to ensure those who needed it received it. The volume of information generated from public health investigations far exceeded previous experience in TPH. The fourteen-year-old reportable disease surveillance system in place at the time of the SARS epidemic was not robust enough to support case management and follow-up with the volume of cases under investigation and people in quarantine.<sup>139</sup> TPH had to rely on an old-fashioned paper based system which made collection of data inefficient, duplicative, and time consuming.

#### **G. LINKAGES BETWEEN PUBLIC HEALTH AND HEALTH CARE**

Confusion seemed to exist regarding the relationships between the public health units and hospitals and other health care settings. The public health units had to report through local governments, leading to challenges with work that needed to be done directly with the Ontario Ministry of Health and Long Term Care. This contributed to a lack of information sharing, coordination, and duplication of effort by the public health units. Both public health and hospital workers indicated that there was inconsistency in outbreak management procedures across public health units in the GTA.<sup>140</sup> In part, these

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<sup>137</sup> Basrur et al., “SARS: A Local Public Health Perspective,” 23.

<sup>138</sup> Alison P. Galvani, “Emerging Infections: What Have We Learned from SARS?” *Emerging Infectious Diseases* 10, no. 7 (July 2004): 1351.

<sup>139</sup> *Ibid.*

<sup>140</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 144.

challenges may be due to the absence of clearly defined roles and responsibilities, policies, and guidelines for the public health units in the broader health care system. As well, these challenges may be attributed to weak links between the local public health units and the Public Health Branch of the Ontario Ministry of Health and Long Term Care.

Direct public health services are traditionally provided and usually best governed at the local level. Both public health and health workers, however, have expressed a need to consider a broader provincial approach redistributing work and clearly identifying roles and responsibilities of local public health units and the provincial Public Health Branch of the Ontario Ministry of Health and Long Term Care. This could also provide clearer responsibility and accountability for leadership on the part of the Ontario Ministry of Health and Long Term Care.<sup>141</sup>

## **H. HOSPITALS**

Dealing with a novel infectious disease with no diagnostic criteria, etiology, or treatment modality creates great apprehension on the part of health care providers. It also creates challenges for hospitals and clinics in responding to illness caused by an unknown infectious virus. The clinical signs and symptoms of SARS are not sufficiently distinct from other respiratory illnesses to allow for a reliable differential diagnosis. However, a combination of clinical and epidemiological findings can provide the necessary clues for the diagnosis of probable SARS.<sup>142</sup> For this reason, it is critical that public health and health care have the capacity and capability to share information efficiently and effectively about infectious disease cases, epidemiological links, trends, and findings.

Many SARS patients required hospitalization due to the severity of illness. Due to the possibility of airborne transmission, these patients required negative pressure isolation rooms or were placed in specially adapted units. Hospitals quickly realized that the capacity for negative pressure isolation rooms and the number of staff adequately

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<sup>141</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 144.

<sup>142</sup> Parashar and Anderson, "Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak," 631.

trained to work in these areas was not sufficient to deal with SARS. This led to grouping patients in individual rooms or on the same hospital floor in order to concentrate infection control efforts and resources. This strategy proved effective in many settings during the epidemic.<sup>143</sup>

An infection control program in most hospitals in the GTA was not a priority at the time of the SARS outbreak. In addition, there was no functioning regional infectious disease program being led by the Ontario Ministry of Health and Long Term Care.<sup>144</sup> What did exist at the time of the outbreak was an informal network of infection control practitioners from a few hospitals who were sharing information. A few hospitals were fortunate to learn about the outbreak through this small informal network. Another identified gap in the hospital response was the lack of ongoing infectious disease surveillance—both routine and emergent—that would have better prepared hospitals for a possible infectious disease outbreak.

## **I. EMERGENCY PREPAREDNESS**

Ontario had no pandemic influenza plan in place when SARS emerged.<sup>145</sup> Since these diseases are similar, having such a plan in place may have reduced confusion about roles and responsibilities, clarified command and control, and provided direction for alerting and information sharing during the SARS outbreak. It may have also provided the foundation for expanding the SARS response in a phased “ramping up” approach to ensure the response was commensurate with the scope and the extent of the expanding outbreak. A phased approach may have provided guidance on looking forward regarding further hospital spread, community spread, and greater spread across the country. Dr. James Young, commissioner of Public Security, told the SARS Commission:

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<sup>143</sup> Parashar and Anderson, “Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak,” 631.

<sup>144</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 144.

<sup>145</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*.

We had no idea at that point in time if or how to control with certainty the SARS outbreak. The scope of what was happening, in fact, was increasing. We were having more cases by the day, not fewer and there was no end in sight and that was the experience, in fact, at that point in time, in Hong Kong, in Taiwan and in Beijing, as it started, that it got bigger and bigger and no one was bringing it under control at that point in time.<sup>146</sup>

The outbreak had primarily been hospital based; however, a number of questions were being asked. Would the virus spread beyond the hospital setting? Would the virus spread to the community? Would the virus spread farther to other communities, or to other provinces, or across Canada? If the outbreak did get bigger, how would the public health and health care system respond? Did this virus have the virulence to spark a pandemic in Canada? Faced with these questions, an ad hoc science committee at the provincial level was assembled on April 2, 2003 to develop possible scenarios for the expansion of the public health response to SARS. It was during these ad hoc committee meetings that Ontario's Pandemic Influenza Plan was requested, and the committee learned Ontario had no plan. A member of the science committee from British Columbia quickly obtained copies of their Pandemic Influenza and Bioterrorism Emergency plans for use by the committee. Three worst-case scenarios were formulated to expand response plans for SARS spreading from the hospital setting to the community, across the GTA, and into other provinces. Fortunately, SARS was ultimately contained and community spread was limited. If this had not been the case, these scenarios would have been crucial to the ongoing response and control of the SARS epidemic.

Although a pandemic influenza plan was not in place at the time SARS emerged, it was under development. This planning process facilitated some relationship building which supported the response. Some argue that this was not the case, since the draft plan was not offered to the ad hoc science committee, nor had others outside the Ontario Ministry of Health and Long Term Care seen or participated in its development. Calls from the Ontario Ministry of Health and Long Term Care for the development of local pandemic influenza plans began as early as 1999 and commitments had been made by the

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<sup>146</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*, 44.

ministry to do the same; however, little progress had been made on a province-wide plan.<sup>147</sup> Without a provincial level plan, it is difficult to develop and implement local plans. Bringing the ad hoc science committee together with experts from across the country proved invaluable as members brought their own expertise, public health emergency plans, and structures that could be adapted quickly in Ontario.

The theme regarding the lack of federal, provincial, and local roles and responsibilities and the lack of “pre-planned machinery” for public health preparedness continued to surface. Another obstacle against the fight on SARS was the lack of linkages between public health and hospitals—linkages that should have been in place if a pandemic influenza plan had been developed and implemented.<sup>148</sup> These linkages may have provided more direction on alerting, roles and responsibilities, and information sharing among public health, hospitals, and other health care settings.

Emergency response systems had to be designed from scratch. The outbreak was managed, out of necessity, around the Public Health Branch of the Ontario Ministry of Health and Long Term Care rather than through it. Key operational units had to be put together “on the fly,” with individual experts recruited from the field, such as the science committee. In addition, there was no functioning epidemiological unit at the ministry level at the time of SARS.

Surveillance emerged as another area of fragmented responsibility. Local public health was geared toward implementing prevention and control strategies. Provincial public health leaders did not take on the role of a central information collection point or facilitating the analysis of the culminating data. There did not seem to be an entity with the overall jurisdictional authority or leadership to collect and analyze information, identify and communicate findings of the analysis, send alerts about unusual clusters of cases, and develop and implement prevention and control strategies.<sup>149</sup> The surveillance

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<sup>147</sup> The SARS Commission, *Volume 4, First Interim Report - SARS and Public Health in Ontario*, 51.

<sup>148</sup> *Ibid.*, 50.

<sup>149</sup> *Ibid.*, 153.

system in place was disease-specific and could not be quickly adapted to deal with SARS or any new disease. There was no structure established to collect, analyze, and report information.

Governmental public health in Canada—specifically Ontario—struggled with a number of key system-preparedness capacity and capability problems in response to the SARS epidemic, including the following:

- conflicting authority between levels of government, creating confusion about who was in charge of the outbreak overall;
- limited leadership in leading outbreak response;
- weak capability for sending alerts and notifications (risk communication non-existent or fragmented);
- inconsistent public information and education;
- no formal agreements in place to share public health and health care practitioners across jurisdictions;
- limited availability to national public health strategies, emergency preparedness and outbreak management plans;
- critical underinvestment in public health infrastructure, weak surveillance system reporting, and analytical epidemiological resources; and
- poor linkages between the government and frontline practitioners, and between public health, health care, and other sectors.

A number of systemic deficiencies have been identified regarding the governmental public health system's response to SARS. This epidemic placed unprecedented demands on the public health and health care system. It challenged public health capacity at all governmental levels and created great uncertainty in the clinical setting regarding diagnosis and treatment of SARS patients. Public health and health care workers in Ontario did a remarkable job controlling the spread of SARS, despite the heightened personal risk for contracting a new and dangerous infectious disease while working under great psychological and physical demands.

Prior to SARS, potential harm to the health of Canadians from weaknesses in the governmental public health system infrastructure had been growing; however, not to a level that sounded an alarm loud enough to get the attention of policy makers. It took a

novel infectious disease like SARS, killing over forty Canadians, making hundreds more ill, paralyzing the health care system, placing over 13,000 GTA residents in quarantine, and producing an economic backlash for policy makers to recognize the critical need to invest in the public health system. In 2003, the National Advisory Committee on SARS and Public Health renounced the complacency of policy makers to invest adequately in Ontario's public health system.

SARS is simply the latest in a series of recent bellwethers for the fragile state of Canada's ...public health system. The pattern is now familiar. Public health is taken for granted until disease outbreaks occur, whereupon a brief flurry of lip service leads to minimal investments and little real change in public health infrastructure or priorities. This cycle must end.<sup>150</sup>

Ontario has not responded to past wake-up calls for investing in public health. Systemic problems have been identified in the past and many of the same systemic flaws that emerged during SARS were preventable. Given the appropriate political will, the Ontario provincial and federal government must make the financial investment and long-term commitment to the public health security of its citizenry.

There are important lessons to be learned from the SARS epidemic that should be used toward improving public health preparedness in the United States. Chapter V provides an overview of the lessons to be learned from SARS in Ontario and outlines improvements made by the government toward revitalizing its public health system.

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<sup>150</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 64.

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## V. LESSONS TO BE LEARNED FROM SARS IN ONTARIO AND IMPROVEMENTS MADE

The issues and challenges faced during the SARS epidemic in Canada were enormous. However, in the end, SARS was controlled by front-line health care workers, public health specialists, and scientists who had the courage to battle an unknown invader. This was despite personal risk while taking strong prevention and control measures that worked in the end. The personal sacrifice was great; two nurses and a doctor died from SARS in Toronto alone, and almost half of those who got SARS were health workers on the job. Toronto lost hundreds of millions of dollars in revenue due to conventions and meetings being cancelled. Tourists changed vacation plans and avoided the GTA. Many Chinese businesses and restaurants were affected by irrational public fears of SARS. The estimated impact on the Canadian economy was over \$2.5 billion.<sup>151</sup> Although lives and revenue have been lost, the response to SARS and lessons to be learned provide an opportunity for improving public health emergency preparedness in the United States. This idea was emphasized by Dato Chua Jui Meng, Minister of Health, Malaysia at a 2003 meeting of the World Health Organization (WHO).

There is a word in the Chinese dictionary for CRISIS. It is WEI JI i.e. the combination of 2 words, danger and opportunity. Inherent in a crisis and depending upon how we respond to it can be found the mother lode of OPPORTUNITY. All that has been done across the globe against SARS by humanity collectively must become the MODEL for man's response to new microbes that will surely threaten HUMANITY in the FUTURE. Therein lies the OPPORTUNITY for all of us.<sup>152</sup>

Canada's ability to fight an epidemic such as SARS was tied more closely to the strengths of the public health system's infrastructure than to the general capacity of the publicly-funded personal health service system. SARS demonstrated the need for greater

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<sup>151</sup> Basrur et al., "SARS: A Local Public Health Perspective," 23-24.

<sup>152</sup> Dato' Chua Jui Meng, "Opening Ceremony Speech," World Health Organization Global Meeting on SARS, Kuala Lumpur, June 17, 2003, [http://www.who.int/csr/sars/conference/june\\_2003/materials/presentations/meng/en/](http://www.who.int/csr/sars/conference/june_2003/materials/presentations/meng/en/) (accessed May 25, 2008).

linkages between the public health and health care settings, especially in the areas of information sharing, communication, alerting, disease surveillance, and detection, and infection control. In addition, SARS has helped the public health sector recognize the importance of and need for comprehensive emergency planning and capacity building. It has also helped to establish clearer lines of authority and identifying roles and responsibilities by sectors at the different levels of government.<sup>153</sup> Most importantly, SARS was an alarm finally heard by the government, policy makers, and the public regarding the need for and importance of a robust public health system.

#### **A. SUMMARY OF INVESTIGATIVE REPORTS**

There are many lessons to be learned from SARS. Unfortunately, many previous lessons had not actually been generalized or institutionalized. Previous alarms regarding the need for a strong public health system were simply ignored. The response to the SARS outbreak rocked a major segment of Ontario's health system for many weeks and it quickly consumed the public health system. Between 2002 and 2004, there were many reports characterizing the state of Canada's public health system, most of which were initiated by federal or provincial governments. Below is a list of four major reports that highlight key issues regarding weaknesses in Canada's public health system and lessons to be learned from SARS. One report was published prior to SARS and three following the epidemic.

- *The Health of Canadians – The Federal Role*, final report on the state of the health care system in Canada by the Standing Senate Committee on Social Affairs Science and Technology, chaired by the Honorable Michael J. L. Kirby, October 2002;
- *Renewal of Public Health in Canada*, a report of the National Advisory Committee on SARS and Public Health, chaired by Dr. David Naylor, Dean of Medicine at the University of Toronto, October 2003;
- *For the Public's Health: A Plan of Action*, final report of the Ontario Expert Panel on SARS and Infectious Disease Control, chaired by Dr. David Walker, Dean, Faculty of Health Sciences and Director of School of Medicine, Queen's University, April 2004; and

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<sup>153</sup> Basrur et al., "SARS: A Local Public Health Perspective," 24.

- *SARS and Public Health in Ontario*, interim report of the SARS Commission, chaired by the Honorable Mr. Justice Archie Campbell, April 2004.

## **1. Kirby Report**

This report was published prior to the SARS epidemic. The way in which primary medical care is generally delivered in Canada was examined. A variety of weaknesses were identified; for example, fragmentation of care and services, lack of importance given to health promotion, and a misalignment of incentives that promotes disease prevention. The Kirby Report also highlighted infectious disease trends that threaten the health of Canadians. Some of these include the potential increase in the spread of infectious diseases through environmental changes, travel, and migration. Also discussed were behavioral changes, particularly high-risk sexual practices and drug use, as potential causes for an increase in disease spread. Public resistance to immunization and anti-microbial resistance in infectious organisms were also covered. The committee put forth a strong recommendation for the federal government to ensure strong leadership and provide additional resources to sustain, better coordinate, and integrate the public health system in Canada.<sup>154</sup>

## **2. Naylor Report**

Systemic deficiencies and weaknesses were the focus of the Naylor report. Lessons to be learned from the SARS response included poor relationships among different levels of government and between health care and public health. A lack of surge capacity in the clinical and public health system was identified, and getting timely access to laboratory testing and results proved to be problematic. Protocols for data collection and sharing among the different levels of government and with other sectors were absent. Epidemiological capacity was minimal and coordination of outbreak management across jurisdictions led to duplication of effort and inefficiencies. Infection

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<sup>154</sup> Senate Standing Committee on Social Affairs, Science and Technology, *The Health of Canadians—The Federal Role, Recommendation for Reform*, (October 2002), <http://www.parl.gc.ca/37/2/parlbus/commbus/senate/Com-e/soci-e/rep-e/report02vol6-e.pdf> (accessed May 23, 2008).

control policies and procedures were outdated and the technical assistance and consultation provided by public health was fragmented. Linkages between public health and medical care services were determined to be weak.<sup>155</sup>

Key recommendations of the Naylor report included: creating a Canadian Agency for Public Health with a chief public health officer; the development of a national health strategy; creating a public health partnership program to build capacity in public health at the local level; and developing a national strategy to renew and sustain the public health workforce.

### **3. Walker Report**

The Walker report proposed a blueprint for strengthening the health care system and responding to emerging health risks and future emergencies that included over fifty-three recommendations. One overarching recommendation was that federal and provincial efforts to improve public health must be coordinated and complementary.<sup>156</sup> In addition, this report provides a number of lessons to be learned that focus on local public health activities.

Like the Naylor report recommending a Canadian public health agency, the Walker Report recommended the establishment of a public health agency for Ontario. In addition, the report provided recommendations for a revitalization strategy to increase capacity and training for public health workers and to restructure the existing provincial-municipal cost sharing agreements. Development and implementation of a regional infection control network and establishment of a provincial infection control committee was recommended. In addition, infection control policies and procedures need to be updated.

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<sup>155</sup> Health Canada, Committee on SARS and Public Health, "Learning from SARS," 144.

<sup>156</sup> OMHLTC, *Final Report of the Ontario Expert Panel of SARS and Infectious Disease Control, April 2004*, "For the Public's Health: A Plan of Action," [http://www.health.gov.on.ca/english/public/pub/ministry\\_reports/walker04/chapter\\_4.pdf](http://www.health.gov.on.ca/english/public/pub/ministry_reports/walker04/chapter_4.pdf) (accessed May 23, 2008).

A focus on emergency preparedness was highlighted by recommending the creation of an Office of Health Emergency Preparedness. This office would be responsible for the development and dissemination of emergency plans. In addition, this office should develop medical response teams and facilitate rapid deployment of health care personnel in the province to address surge capacity.<sup>157</sup>

Communications was also a focus of the Walker Report recommending the development of a Public Health Alert Network (PHAN) with the capacity to reach all key stakeholders in an emergency. At the time of the outbreak, Ontario did not have a communication infrastructure to alert or share public health information. Another lesson to be learned was the need for a comprehensive disease surveillance system that could be integrated with other systems across local, provincial, and federal agencies. A need was also identified to implement information sharing protocols that prescribe who is responsible for sharing what information and when.

#### **4. Campbell Report**

In the post SARS era, the Campbell report offered twenty-one principles for health care reform, and of the four reports, was most critical of Ontario's central public health system, describing it as "fragmented, uncoordinated, poorly led, and inadequately resourced."<sup>158</sup> Based on the identified public health system weakness, key lessons to be learned included the need for emergency planning, improvements in public health infrastructure, and strengthening links between hospitals and other health care settings. A top priority was to ensure that public health has the necessary resources for safe water, food, and protection against infectious diseases. Campbell's report also highlighted the need for creating an Ontario Centre for Disease Control independent of the Ministry of Health and the need to support a chief medical officer.

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<sup>157</sup> OMHLTC, *Final Report of the Ontario Expert Panel of SARS and Infectious Disease Control*, April 2004.

<sup>158</sup> The SARS Commission, *Volume 1, Executive Summary - Spring of Fear*.

## **B. COMMON LESSONS AND RECOMMENDATIONS**

The Kirby, Naylor, Walker, and Campbell reports share a common vision for the renewal of the public health system in Canada. This vision comes with three critical overarching needs: 1) a commitment to providing and sustaining increased resources for rebuilding and maintaining the public health infrastructure; 2) improving federal-provincial and interagency cooperation and collaboration; and 3) preparedness. Three of the four reports also identified critical lessons to be learned in the area of communication and information sharing. This resulted in calling for the development of a public health communication strategy to be used during public health emergencies. Likewise, three of the four reports called for improving the federal and Ontario infectious disease surveillance systems in order to collect, analyze, detect, and distribute information about infectious diseases more efficiently.

To many in the first responder community, these themes may not come as a surprise. For example, issues with communication, planning, resource management, and coordination are problems that have been cited before in after-action reviews and reports following other disasters. Following the Oklahoma City Bombing in 1995, the *After Action Report: Alfred P. Murrah Federal Building Bombing* (2003) highlighted incident command and coordination as being weak in numerous local, state, and federal agencies. In *The Federal Response to Hurricane Katrina Lessons Learned* (2006), flaws were identified in overlapping roles and responsibilities in multiple federal agency command posts and a lack of coordination. Following the September 11 attacks in 2001, *The 9/11 Commission Report* (2004) identified problems in command, control, and communications, recommending the need for national adoption of an incident command system and a unified command. Despite the documentation of many lessons from other disasters, similar re-occurring weaknesses continue to surface and similar mistakes seem to be repeated in other disasters. Reviews and reports of disaster response provide for the identification of lessons; however, actually learning from these lessons and making “change” may be more challenging.

### C. PUBLIC HEALTH SYSTEM IMPROVEMENTS IN CANADA

Canada has initiated improvements in its public health system since the SARS epidemic by shaping a new federal approach to address systemic weaknesses. This approach is based on three pillars:

- building a new federal public health agency;
- creating a chief public health officer (CPHO) for Canada; and
- building a Pan-Canadian public health network.<sup>159</sup>

Under this new approach, all three levels of government share responsibility for public health. The federal effort is led by the *new* Public Health Agency of Canada (PHAC) and has the responsibility for communicating with foreign governments and multilateral health agencies. Provincial and territorial efforts are led by chief medical officers of health and the public health workers have “front-line” responsibility for responding to public health emergencies in their respective jurisdictions. Local efforts are led by a public health officer and public health workers who engage in routine public health prevention and health promotion programs. All three levels of government share in the responsibility for public health policy, monitoring health threats, and education. In addition, each level still has some form of responsibility for public health regulation.

In May 2004, the Minister of State for Public Health, Dr. Carolyn Bennett announced details about the *new* PHAC, which by statute would be linked, but remain separate from Health Canada. Minister Bennett announced plans for appointment of a CPHO. Dr. David Butler-Jones is PHAC’s first CPHO and is still serving in this capacity.<sup>160</sup> Health Canada is responsible for helping Canadians maintain and improve their health, and the PHAC has been created to deliver on the Canadian government’s commitment to help protect the health and safety of all Canadians. PHAC’s focus is on public health emergencies, infectious disease outbreaks, and preventing chronic diseases.

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<sup>159</sup> Public Health Agency of Canada (PHAC), “The Federal Strategy,” [http://www.phac-aspc.gc.ca/about\\_a propos/federal\\_strategy-eng.php?option=email](http://www.phac-aspc.gc.ca/about_a propos/federal_strategy-eng.php?option=email) (accessed June 21, 2008).

<sup>160</sup> PHAC, “Government of Canada announces details of new Public Health Agency of Canada and appoints Acting Chief Public Health Officer,” news release, May 17, 2004, [http://phac-aspc.gc.ca/media/nr-rp/2004/2004\\_01-eng.php?option=email](http://phac-aspc.gc.ca/media/nr-rp/2004/2004_01-eng.php?option=email) (accessed June 27, 2008).

Dr. David Butler-Jones is based out of Winnipeg, where Canada's only level-four microbiology laboratory for human health is located. This is the location for coordination of infectious disease functions and epidemiology, and has critical functions nationally and internationally in the event of an infectious disease outbreak. The CPHO also has offices in Ottawa responsible for collaboration and coordination with other departments and sectors in emergency preparedness and response to national public health threats and emergencies.

During the same announcement, Minister Bennett launched the creation of six National Collaborating Centres for Public Health that reside across the country with an initial investment of \$15 million over two years.<sup>161</sup> Each centre has a specific public health focus. The six centres include:

- Atlantic – focus is on determinants of health and studying how social factors affect health;
- Quebec – focus is on public policy and risk assessments studying the impact of public policy on Canadians' health;
- Ontario – focus is on infrastructure, info-structure, new tools development, and studying how public health information can best be gathered and utilized to minimize health risks;
- Prairies – focus is on infectious diseases studying the present and future risks of emerging and re-emerging diseases;
- British Columbia – focus is on environmental health studying the effects of the environment on human health.
- Aboriginal Health – focus is on studying the health disparities and factors that exist for Canada's aboriginal peoples in urban, rural, and remote communities.

Lastly, this announcement identified Winnipeg as home to the International Centre for Infectious Diseases (ICID) with a focus on research, training, and commercialization and innovation in addressing the threat and impacts of infectious

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<sup>161</sup> PHAC, "Government of Canada announces details of new Public Health Agency of Canada and appoints Acting Chief Public Health Officer."

diseases. The ICID is responsible to ensure that collaborative mechanisms exist to allow university and government scientists to work together more closely, and to facilitate the commercialization of their discoveries.<sup>162</sup>

#### D. INVESTMENTS IN PUBLIC HEALTH

In 2004, the Canadian government made a significant investment totaling \$965 million toward the new PHAC, associated centres, and programs to bolster the infrastructure of Canada’s public health system. Table 2 provides a breakdown of investments.<sup>163</sup>

Table 2. Investments in Public Health in Canada 2004

<b>Canadian Funding (CAD)</b>	<b>Investment Areas</b>
\$40 million	Maintaining the preparedness measures established as a result of the SARS epidemic.
\$30 million	Modernizing the facilities and supporting additional research at federal microbiology laboratories including Health Canada’s National Microbiology Laboratory.
\$16 million	Contributing to growing a skilled public health workforce.
\$15 million	Creating the National Collaborating Centres for Public Health.
\$12 million	Creating health emergency response teams to be mobilized and provide medical services in the event of an emergency.
\$12 million	Creating the Public Health Agency of Canada.
\$10 million	Strengthening surveillance standards and data collection in collaboration with provincial, territorial, and other stakeholders.
\$10 million	Strengthening linkages with international public health organizations.
\$10 million	Protecting the health of First Nations and Inuit communities.
\$8 million	Implementing the Emergency Stockpile System.
\$2 million	Supporting the Pan-Canadian Public Health Network System.
<b>\$165 million</b>	<b>Subtotal – committed over a two-year period</b>
\$100 million	Investing in Canada Health Infoway to assess, develop and implement a real-time public health disease surveillance system.
\$400 million	Investing in the provinces and territories over the next three years to support a national immunization strategy and relieve stress on provincial and territorial public health systems that worked during the SARS epidemic.
\$300 million	Purchasing of vaccines by provinces and territories on a per capita basis.
<b>\$800 million</b>	<b>Subtotal – includes ongoing funding on a per capita basis</b>
<b>\$965 million</b>	<b>TOTAL</b>

<sup>162</sup> PHAC, “Government of Canada announces details of new Public Health Agency of Canada and appoints Acting Chief Public Health Officer.”

<sup>163</sup> PHAC, “A Public Health System for the 21st Century,” [http://www.phac-aspc.gc.ca/media/nr-rp/2004/2004\\_01bk1-eng.php](http://www.phac-aspc.gc.ca/media/nr-rp/2004/2004_01bk1-eng.php) (accessed June 27, 2008).

March 2008 marked five years since the beginning of the SARS epidemic in Canada. The government has committed over \$1 billion during this time to improve the public health system.<sup>164</sup> An additional \$100 million was also invested to fund local public health activities further. Progress continues in rebuilding and sustaining a stronger public health system in Canada. The commitment of resources continues in the areas of collaboration and networks, emergency preparedness, infectious disease surveillance, and laboratory capacity.

A key accomplishment was the establishment of the PHAC and appointment of the country's first CPHO. This agency has made progress in rebuilding the public health system in Canada. A few examples follow.

### **1. Collaboration and Networks**

The Canadian Public Health Network provides a forum for all levels of government to participate in policy discussions and decision making on key public health issues. PHAC also participates at the international level with the WHO, the Security and Prosperity Partnership (SPP), and the Global Health Security Action Group in order to advance the public health agenda in Canada. In addition, Canada is a signatory on the updated International Health Regulations (IHR) through the WHO.<sup>165</sup>

### **2. Emergency Preparedness**

Canada's Pandemic Influenza Plan was revised late in 2006 with input from provincial and territorial governments. The plan outlines roles and responsibilities for all levels of government and sets out command and control structures and authorities for responding to public health emergencies. Multidisciplinary Health Emergency Response Teams are prepared to be deployed across the country to provide medical surge capacity.

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<sup>164</sup> PHAC, "Fact Sheet: Progress Achieved since SARS," <http://www.phac-aspc.gc.ca/sars-sars-gen/sars0308-eng.php?option=email> (accessed June 27, 2008).

<sup>165</sup> Ibid.

In addition, the country has stockpiled antiviral drugs and has secured a domestic vaccine supplier. As well, infection control practice guidelines for hospitals and other health care settings have been updated and distributed.<sup>166</sup>

The *Public Health Agency of Canada Act*<sup>167</sup> was given Royal Assent on December 12, 2006, bringing into force and providing the statutory basis for the PHAC and the position and duties of the CPHO.<sup>168</sup> The Act reaffirms the federal government's commitment to public health. The Minister of Health, the Honorable Tony Clement was quoted as saying, "It underscores the important role that the Public Health Agency of Canada and the Chief Public Health Officer play in strengthening our public health system. We will continue our collaboration with provinces, territories and stakeholders to address public health issues and prepare for public health emergencies."<sup>169</sup>

This legislation establishes the PHAC as a separate entity and provides regulatory making authority for the collection, analysis, interpretation, publication, and distribution of public health information. It outlines jurisdictional responsibilities over public health and legal authorities, and implements many health policy recommendations outlined by the National Advisory Committee on SARS (Naylor Report) "Learning from SARS – Renewal of Public Health in Canada," October 2003.

### **3. Infectious Disease Surveillance and Response**

The Global Public Health Intelligence Network, designed to track media stories in multiple languages to monitor and identify potential emerging public health threats around the world, continues to be enhanced. PHAC has developed and implemented the Canadian Network for Public Health Intelligence (CNPHI) that has the capability of gathering information from pharmacy sales, emergency room visits, and from other

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<sup>166</sup> Ib PHAC, "Fact Sheet: Progress Achieved since SARS."

<sup>167</sup> Parliament of Canada, "Bill C-5: Public Health Agency Act," [http://www.parl.gc.ca/common/bills\\_ls.asp?lang=E&source=library\\_prb&Parl=39&Ses=1](http://www.parl.gc.ca/common/bills_ls.asp?lang=E&source=library_prb&Parl=39&Ses=1) (accessed June 27, 2008).

<sup>168</sup> PHAC, "Act to Establish Public Health Agency Comes into Force," news release, December 15, 2006, [http://www.phac-aspc.gc.ca/media/nr-rp/2006/2006\\_11-eng.php](http://www.phac-aspc.gc.ca/media/nr-rp/2006/2006_11-eng.php) (accessed June 29, 2008).

<sup>169</sup> Ibid.

surveillance systems. This information is analyzed and the system has the capability to issue alerts when significant trends emerge. In addition, a Canadian Integrated Outbreak Surveillance Centre (CIOSC) has been developed that provides internet-based alerting capability to share public health information quickly across the country.<sup>170</sup>

In December 2006, a new *Quarantine Act* was implemented that strengthens the capacity of the government to reduce and prevent the spread of infectious disease from ill travelers entering and departing Canada. Airports in Halifax, Montreal, Ottawa, Toronto, Calgary, and Vancouver have implemented quarantine provisions. Approximately 95 percent of the international air travelers arrive and depart Canada from these airports.

#### **4. Laboratory Capacity**

On March 24, 2003, international collaboration among laboratories isolated the new coronavirus from a SARS patient. Between April 8 and April 10, scientists found positive antibody titers to SARS-CoV in a high percentage of SARS patients and none in control patients. On April 16, the WHO announced that this coronavirus, previously never seen in humans, was the cause of SARS. The speed with which the virus was identified that caused SARS was made possible by the collaboration of ten countries, including Canada. However, this occurred more than one month after the start of the SARS outbreak in Ontario.<sup>171</sup>

The National Microbiology Laboratory (NML) has increased capacity to respond to outbreaks by enhancing virus sequencing technology and vaccine research. In addition, NML's mobile laboratory capacity has been expanded, increasing its capability to respond to the site of an outbreak domestically and internationally. Most notable is the construction of high tech operations at NML to handle scientific information such as DNA fingerprints and to manage the flow of laboratory information while being networked with other laboratories.<sup>172</sup>

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<sup>170</sup> PHAC, "Fact Sheet: Progress Achieved since SARS."

<sup>171</sup> OMHLTC, "Descriptive Epidemiology of the SARS Outbreak Ontario, Canada," 18.

<sup>172</sup> Ibid.

## E. SUMMARY

Emerging and re-emerging infectious diseases are a permanent fixture on the public health landscape at the local, state, national, and international levels. People will continue to travel and migrate, goods will continue to be traded, and the convergence of microbes and humans will continue to occur, posing a “universal” threat to public health security. Further compounding this challenge is the threat of accidental or intentional release of biological agents. In order to mitigate the threat of nature and the incidence and effects of infectious diseases, a strong, robust, sustainable public health system is needed at all levels of government. This is reinforced by the following quote from the *SARS Commission Report*.

Why was Ontario so unprepared for SARS? Our public health and emergency infrastructures were in a sorry state of decay, starved for resources by governments of all three political parties. The health system’s capacity to protect its workers was in a state of neglect: what little existed was badly malnourished. There was no system in place to prevent SARS or to stop it in its tracks. The only thing that saved us from a worse disaster was the courage and sacrifice and personal initiative of those who stepped up the nurses, the doctors, the paramedics and all the others sometimes at great personal risk, to get us through a crisis that never should have happened. Underlying all their work was the magnificent response of the public at large: patient, cooperative, supportive.<sup>173</sup>

Typical with emerging infectious diseases like SARS, no effective drugs, vaccines, or natural immunity exist to combat them. The key to controlling SARS and other novel infectious diseases is traditional public health prevention and control strategies such as case identification, contact tracing, and containment strategies. These may include isolation, quarantine, and infection control. These types of measures proved effective and were associated with slowing and eventually controlling the spread of SARS. As Benjamin Disraeli (1804-1881) remarked when introducing his Public

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<sup>173</sup> The SARS Commission, *Volume 1, Executive Summary - Spring of Fear*, 2-3.

Health Act to British Parliament in 1875, “public health is the foundation for the happiness of the people and the power of the country. The care of the public health is the first duty of statesmen.”<sup>174</sup>

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<sup>174</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 220.

## **VI. COMPARATIVE ANALYSIS OF THE CANADIAN AND U.S. PUBLIC HEALTH SYSTEMS**

Given today's universal vulnerability to the threat of infectious disease spread and the threat from a weaponized biological agent, it is appropriate and timely to compare the Canadian public health system's lessons learned during SARS to the current U.S. public health system's capacity and capability. There is no national public health system or accepted set of national public health preparedness standards that provide a foundation toward ensuring the U.S. public health system is prepared to prevent, mitigate, or respond to disease epidemics, another pandemic, or a bioterrorist attack. However, by evaluating the lessons learned from SARS in Canada and comparing these lessons to current public health capacity and capability in the United States, recommendations for system improvement will be made. The result is to identify a way forward in ensuring adequate capacity, capability, and better public health system preparedness in the United States.

### **A. GOVERNMENTAL AND INTERNATIONAL RESPONSIBILITIES FOR PUBLIC HEALTH**

#### **1. Canada**

As a federation, Canada operates on three levels—federal, provincial, and municipal (local)—and is divided into thirteen provinces and three territories. Refer to Figure 7 for a map of Canadian provinces and territories. Ontario was the province hit hardest by SARS. The federal role in public health is limited constitutionally; thus, restricting the country's national and international coordination efforts during a public health emergency. The federal government does have the authority to legislate some aspects of public health including quarantine provisions, national borders, and trade and commerce. Health Canada was the federal department responsible for public health and the majority of the federal response activity occurred at the Public Health Branch during SARS.<sup>175</sup>

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<sup>175</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 49.



Adapted from [www.comeexplorecanada.com/canada/](http://www.comeexplorecanada.com/canada/) (accessed July 19, 2008).

Figure 7. Canadian Provinces and Territories

Public health is primarily a provincial responsibility, though revenue generation and spending capacity is concentrated at the federal level. Earmarked revenue transfers to other governments are limited; instead, grants and contributions are directed to non-profit and non-governmental organizations.<sup>176</sup> Medical care is provided through universal health insurance plans administered by each province. Hospitals rely on public grants, and physicians work primarily as private fee-for-service contractors. Public health units are partially funded by municipalities, and thus, also work semi-autonomously.

Most provincial and territorial levels of government have a chief medical officer; however, the reporting relationships to the federal government vary considerably. In addition, each province has public health workers engaged in planning and providing technical assistance and consultation to local units. Like the chief medical officer, capacity at this level varies greatly from one province to the next. There are basically

<sup>176</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 2.

four patterns of governance of local public health services in Canada: including regional health authorities, regional boards, quasi-municipal or county systems, and provincial models.<sup>177</sup>

In the Province of Ontario, the pattern of governance is the quasi-municipal. The Ontario Ministry of Health and Long Term Care (OMHLTC) provides minimum requirements for core public health programs and services that include disease prevention and health protection. Local health units have the responsibility to conduct surveillance, case-finding, contact tracing, immunization, infection control, and risk assessment. Local health units are also required to report infectious diseases to the Ontario Ministry of Health and Long Term Care. During the SARS outbreak, Ontario declared SARS a reportable disease, which allowed local officials to issue prevention and control measure orders such as isolation and quarantine.<sup>178</sup>

A challenge is that primary legislative power rests with the provinces and territories, but service delivery remains on the frontlines with local public health units. In Ontario, local boards of health are responsible for public health and serve either single or multiple municipalities and counties. Boards are appointed by the municipalities and provinces. In larger cities, the board may be a part of a city council. These local units have their own governance, but their activities are constrained by provincial law, regulations, policies, and conditions of funding.<sup>179</sup>

Today there is a Public Health Agency of Canada (PHAC) headed by a chief public health officer (CPHO) based in Winnipeg with regional offices and Centres across Canada for infectious and chronic disease, emergency preparedness, surveillance, and healthy human development. In addition, the agency oversees the National Microbiology

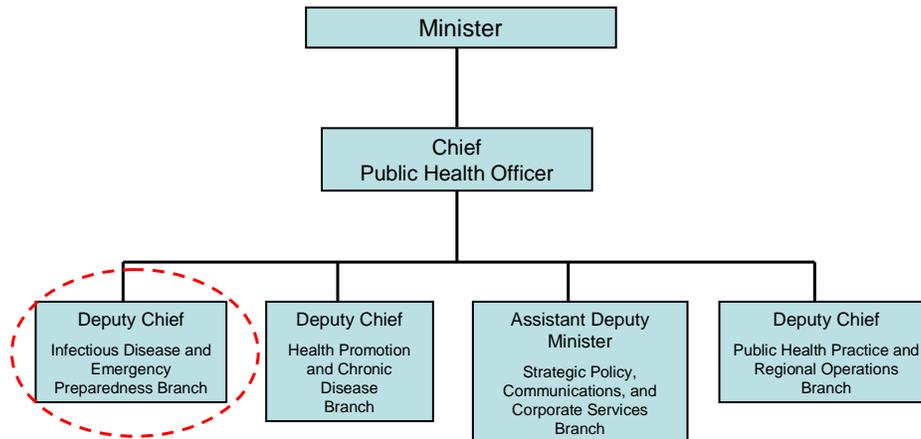
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<sup>177</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 49-50.

<sup>178</sup> OMHLTC, “Descriptive Epidemiology of the SARS Outbreak Ontario, Canada,” 49.

<sup>179</sup> Health Canada, “Learning from SARS: Renewal of Public Health in Canada,” 49.

Laboratory (NML) and the Laboratory for Foodborne Zoonoses (LFZ).<sup>180</sup> If SARS were to reemerge, the *new* PHAC would lead the federal response in coordination with Health Canada. Refer to Figure 8 for the PHAC Table of Organization.



Adapted from PHAC, Sustainable Development Strategy 2007-2010, *Sustainable Development in Public Health, A long term journey begins* [www.phac-aspc.gc.ca/publicat/sds-sdd/sds-sdd2-a\\_e.html](http://www.phac-aspc.gc.ca/publicat/sds-sdd/sds-sdd2-a_e.html) (accessed July 7, 2008).

Figure 8. PHAC Table of Organization

The Infectious Disease and Emergency Preparedness Branch (IDEP) focuses on the prevention and control of infectious diseases with staff prepared to respond to public health emergencies. Two centres make up the branch including the Centre for Infectious Disease Prevention and Control and the Centre for Emergency Preparedness and Response. The NML and the LFZ are also located in this branch along with the Pandemic Preparedness Secretariat.<sup>181</sup> Although all branches in the PHAC have responsibilities in preparedness, the IDEP branch plays a critical role in plan

<sup>180</sup> PHAC, “Government of Canada announces details of new Public Health Agency of Canada and appoints Acting Chief Public Health Officer.”

<sup>181</sup> PHAC, “Regions, Branches, and Centres,” <http://www.phac-aspc.gc.ca/centres-eng.php> (accessed July 11, 2008).

development, emergency response, providing guidance for provinces and municipalities on infectious disease prevention and control and providing public health laboratory services.

National and international leadership in health promotion, chronic disease prevention and control is provided by the Health Promotion and Chronic Disease Prevention Branch. This includes surveillance of chronic diseases and risk factors with a focus on special populations. Three centres are located in this branch and include the Centre for Chronic Disease Prevention and Control, the Centre for Health Promotion, and the World Health Organization (WHO) Collaborating Centre on Chronic Disease Policy.<sup>182</sup>

Responsibility for building the regional capacity of the PHAC and for providing strategic direction in public health surveillance rests with the director general of the regions in the Public Health Practice and Regional Operations Branch. This branch consists of the Office of Public Health Practice. PHAC has an office presence in all regions of Canada. Priorities in this branch include improving the public health infrastructure, information and knowledge systems, and public health law and information policy.<sup>183</sup>

The Strategic Policy, Communications and Corporate Services Branch provides support across the PHAC's branches and centres. Policy direction, partnership development, communication plans, strategies, and social marketing activities are coordinated by this branch. Finance and administration is provided along with compliance and auditing controls and information technology management. In addition, human resource management and safety services are provided.<sup>184</sup>

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<sup>182</sup> PHAC, "Regions, Branches, and Centres."

<sup>183</sup> Ibid.

<sup>184</sup> Ibid.

## 2. United States

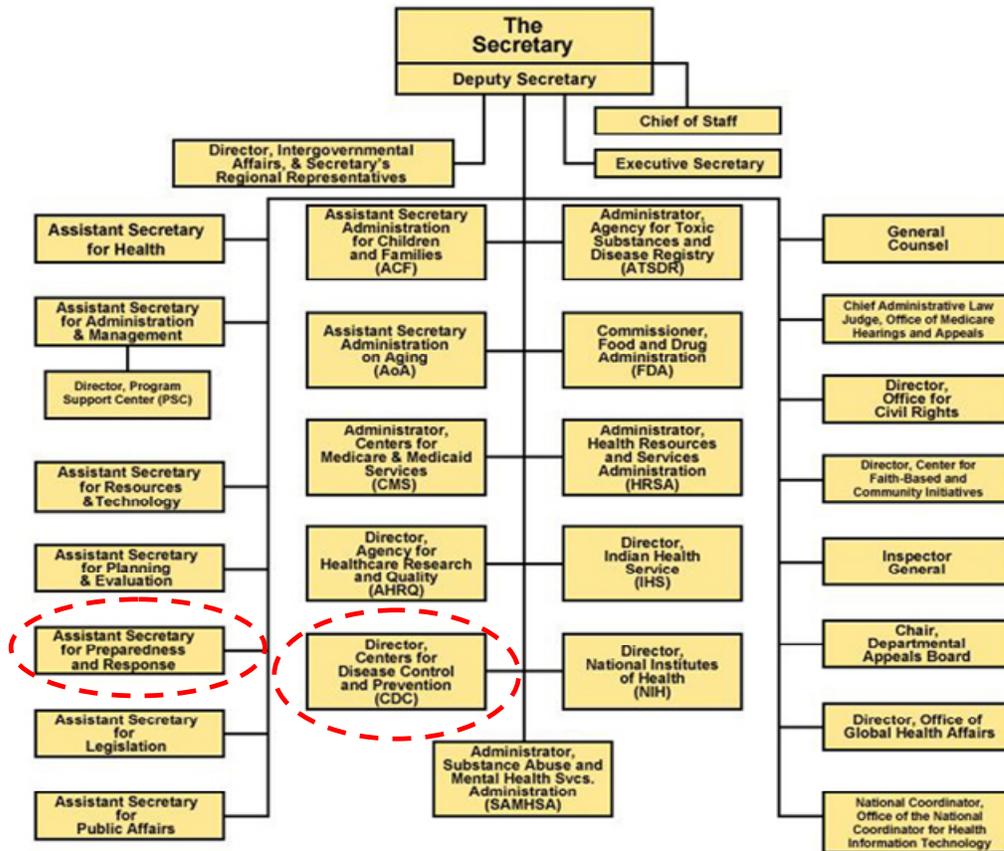
In the United States the constitution gives states primary responsibility for providing health services. The federal government has a limited role in the direct delivery of public health services, but provides leadership, has some regulatory authority, and contributes financial resources. Constitutionally, the federal government has the responsibility for preventing entry of disease into the United States and for preventing its interstate spread. Federal legislation governs immunization and vaccine purchase, and several other nationwide programs.

The ultimate authority for public health in the United States rests with the secretary for the Department of Health and Human Services (DHHS). This department is the lead federal agency for public health under the direction of the secretary.<sup>185</sup> The Office of the Assistant Secretary for Preparedness and Response (ASPR) serves as the secretary's primary advisory workforce on bioterrorism and other public health emergencies.<sup>186</sup> This office is responsible for coordinating interagency activities with other federal departments and with state and local officials responsible for preparedness. ASPR is comprised of four main offices: the Biomedical Advanced Research and Development Authority (BARDA); the Office of Preparedness and Emergency Operations (OPEO); the Office of Medicine, Science, and Public Health (OMSPH); and the Office of Policy and Strategic Planning (OPSP). Refer to Figure 9 for a table of organization of DHHS.

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<sup>185</sup> DHHS, "Secretary Biography," <http://www.hhs.gov/secretary/dhhssec.html> (accessed July 13, 2008).

<sup>186</sup> DHHS, "Organizational Text Chart," <http://www.hhs.gov/about/textorgcht.html> (accessed July 7, 2008).



Adapted from Department of Health & Human Services Organizational Chart, [www.hhs.gov/about/orgchart.html](http://www.hhs.gov/about/orgchart.html) (accessed July 7, 2008)

Figure 9. DHHS Table of Organization

The BARDA provides expert advice and coordinates interagency efforts to define and prioritize requirements for public health and medical countermeasures, related research, and product development and procurement. In addition, the BARDA is responsible for setting deployment procedures for medical countermeasures held in the Strategic National Stockpile (SNS). The OMSPH is responsible for providing expert medical, scientific, and public health advice on domestic and international medical preparedness policies, programs, and activities. This office serves as the ASPR liaison to science and health professional organizations on domestic and international issues.<sup>187</sup>

<sup>187</sup> DHHS, “Organizational Text Chart.”

The OPEO is responsible for developing operational plans and participating in training and exercises to ensure preparedness of the ASPR and the DHHS. This includes ensuring the ASPR has the logistical and systems support in place to coordinate the operational response to acts of terrorism and other public health emergencies.<sup>188</sup> Policy formulation and coordination for preparedness and response planning is the responsibility of the OPSP. Analysis of proposed policies, presidential directives, and regulations occurs in the OPSP office.<sup>189</sup>

Another key agency in DHHS which plays a significant role in public health preparedness is the Center for Disease Control and Prevention (CDC). The CDC is recognized by many as an international leader in the areas of surveillance systems, databases, outbreak investigation, and communicable disease epidemiology. The CDC provides a national focus on developing and applying disease prevention and control, environmental health, health promotion and health education activities designed to improve the health of the people of the United States. Serving as a lead federal public health agency, the CDC identifies and defines preventable health problems and maintains active surveillance of diseases through epidemiology, laboratory investigations, data collection, analysis, and distribution of information. In addition, the CDC actively engages in research, occupational safety, and public health workforce development. The CDC is responsible for controlling the introduction and spread of infectious disease in the United States and works collaboratively with other nations and international agencies on matters of public health concern.<sup>190</sup>

Although responsibility for public health rests primarily with the states constitutionally, the degree of commitment to public health by states varies. A 2005 study by Leslie M. Beitsch et al., *Public Health At Center Stage: New Roles, Old Props*, portrayed the variability in organization, functions, roles and responsibilities, and commitment to and investment in the public health infrastructure in the United States.

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<sup>188</sup> DHHS, "Organizational Text Chart."

<sup>189</sup> Ibid.

<sup>190</sup> CDC, "CDC Mission," [http://www.cdc.gov/maso/mab\\_Charts\\_CCCO.htm](http://www.cdc.gov/maso/mab_Charts_CCCO.htm) (accessed July 13, 2008).

Collection of information came from two surveys. One was conducted by the Association of State and Territorial Health Officers (ASTHO) with all fifty states responding, while the other was conducted by the National Association of City and County Health Officials (NACCHO) with 2,298 out of 2,865 local public health agencies responding.<sup>191</sup>

*a. Structure and Governance*

Fifty-eight percent of state public health agencies were freestanding, independent agencies and 42 percent were part of an umbrella organization, for example human services. The dominant organizational configuration was decentralization at 42 percent, while centralized organization comprised 26 percent, and mixed or shared at 32 percent.<sup>192</sup> State boards or councils existed in approximately half of the states and typically played a major role in public health policy making and regulation. In a similar 2001 study by Leslie M. Beitsch et al., *Structure and Functions of State Public Health Agencies*, almost all state public health agencies served as the lead public health authority.<sup>193</sup>

The state health officer (SHO) was appointed by the governor in 66 percent of the states, by the secretary of health and human services in 24 percent of the states, and by a board of health in 8 percent of the states. The remaining 2 percent included appointments by the governor and secretary.<sup>194</sup> The SHO was primarily responsible for the day-to-day functioning of the public health agency, for setting policy, and for making budget recommendations.

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<sup>191</sup> Leslie M. Beitsch, et al., "Public Health at Center Stage: New Roles, Old Props," *Health Affairs*, 25, no 4 (July/August 2006): 913.

<sup>192</sup> Ibid.

<sup>193</sup> Leslie M. Beitsch, et al., "Structure and Functions of State Public Health Agencies," *American Journal of Public Health*, 96, no. 1 (January 2006): 167.

<sup>194</sup> Beitsch et al., "Public Health at Center Stage: New Roles, Old Props," 914.

At the local level, public health provides services to the community through a variety of jurisdictional forms. County structure is dominant, with nearly six out of ten local agencies organized by county jurisdiction.<sup>195</sup> Boards of health have a major presence with almost 75 percent of all jurisdictions having a local board; however, responsibility for governing, policy making, and advising varies. The local board of health, however, only serves as the governing body for approximately 45 percent of the local public health agencies.<sup>196</sup> County commissions, state health agencies, and city councils make up the rest. There was no correlation between the type of organizational structure and population size.<sup>197</sup>

***b. Programs and Functions***

The ASTHO survey revealed that the breadth and scope of activities that state health agencies are engaged in vary widely. Activities range from disease surveillance, to data collection, to environmental regulation to Medicaid administration. All public health agencies have preparedness programs; most all have vital statistics data, maintain public health laboratories, and have anti-tobacco programs. Few states, however, have direct mental health and Medicaid responsibilities.<sup>198</sup>

Likewise, the NACCHO survey showed that local public health agencies also perform a wide variety of activities such as, childhood immunizations, communicable disease epidemiology, and screening for infectious disease. In addition, a variety of prevention programs are offered, including obesity, tobacco control, and injury prevention. Mental health and primary care are less likely to be offered at the local level.<sup>199</sup>

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<sup>195</sup> Beitsch et al., “Public Health at Center Stage: New Roles, Old Props,” 915.

<sup>196</sup> Ibid.,

<sup>197</sup> Beitsch et al., “Structure and Functions of State Public Health Agencies,” 169.

<sup>198</sup> Beitsch et al., “Public Health at Center Stage: New Roles, Old Props,” 915.

<sup>199</sup> Ibid., 916.

*c. Infrastructure and Support*

Data from the ASTHO and NACCHO survey were integrated to examine public health agency infrastructure and support. The mean total per capita state and local public health spending for 2004-2005 from federal, state, and local resources was \$149.<sup>200</sup> Spending of local and state public health agencies constituted 2.37 percent of all U.S. health spending for 2004 and 2.34 percent for 2005. Canada, on the other hand, invests 5.5 percent of its smaller per capita total health care spending on public health.<sup>201</sup> The primary budget drain in public health in the United States is workforce at the local and state level. On average, local public health agencies employed sixty-six full-time-equivalent (FTE) workers with a median of sixteen FTEs in 2005. As expected, the mean state public health workforce was greater with a median of 1,924 FTEs.<sup>202</sup>

Larger cities in the United States seem to have more robust public health infrastructures, though there are thousands of local (county-based) public health agencies that may be too small and which lack the critical infrastructure necessary to be effective. The first line for outbreak detection and management remains at the local and state level. The CDC must be invited to participate or offer support during an outbreak, but once invited, plays a significant role in outbreak investigations, consultation, and prevention and control.

The United States has a chain of policies including legislation, national goals and priorities, an executive order for a national public health preparedness strategy, and program plans directed toward public health preparedness. There are mechanisms in place to network with stakeholders and policy makers regarding funding and preparedness activities.

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<sup>200</sup> Beitsch et al., “Public Health at Center Stage: New Roles, Old Props,” 916.

<sup>201</sup> *Ibid.*, 920.

<sup>202</sup> *Ibid.*, 918.

### 3. World Health Organization

The WHO is the coordinating and directing authority for health in the United Nations.<sup>203</sup> This includes providing leadership on global health matters, shaping the research agenda, setting standards, sharing evidenced-based policies, and providing technical assistance and consultation to other countries. The World Health Assembly is the supreme decision making authority for the WHO, and meets annually in Geneva to determine and approve resolutions. Currently, there are delegations representing all 193 member states of the WHO.<sup>204</sup>

The International Health Regulations (IHR) 2005, a legally binding agreement with member states, provides the framework for the coordination and management of public health incidents that have international concern. The IHR are the only set of legal rules requiring WHO-member states to follow concerning the control of infectious diseases with the potential to spread internationally.<sup>205</sup> The regulations provide for reporting communicable diseases that have the potential for international spread. In addition, the regulations provide acceptable standards and measures that may be applied by countries to prevent diseases from spreading and identify norms and standards for seaports and airports to prevent the spread of infectious disease vectors by public conveyances that land at ports.<sup>206</sup> Canada and the United States are member states of the WHO.

#### B. COMPARATIVE ANALYSIS

Emerging infectious diseases such as SARS are increasingly important not only because of their potential to become epidemics, but also because they cause social instability. This is true for Canada, the United States, and the rest of the world. Table 3

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<sup>203</sup> WHO, "About," <http://www.who.int/about/en/> (accessed July 13, 2008).

<sup>204</sup> WHO, "Governance," <http://www.who.int/about/governance/en/index.html> (accessed July 13, 2008).

<sup>205</sup> David L. Heymann, "The International Response to the Outbreak of SARS in 2003," *Philosophical Transactions: Biological Sciences* 359, no. 1447 (July 2004): 1127.

<sup>206</sup> *Ibid.*, 1127.

outlines public health capacity and capability resources utilized in Canada during the SARS outbreak in comparison to current resource availability in the United States. This comparative analysis seeks to discover lessons learned that may be applicable in improving public health system preparedness in the United States.

Table 3. Comparative Analysis of Canada and the United States

Preparedness		
Authority	<ol style="list-style-type: none"> <li>1. The <i>Health Promotion and Protection Act (1990)</i> was in place.</li> <li>2. There was distinct and separate governmental leadership for public health, health care, and emergency services.</li> <li>3. Primary legislative power for public health rested with provinces and territories; however, no clear line of authority existed for “who’s in charge.”</li> <li>4. Public health service delivery was primarily a provincial and local level responsibility, but capacity and capability varied by province and local public health unit.</li> <li>5. Conflict and confusion was evident among different levels of government regarding roles and responsibilities.</li> <li>6. Most provinces had a chief medical officer; however, reporting relationships to federal government varied.</li> <li>7. Public health units across Canada were governed by a board of health, which is autonomous under the <i>Health Promotion and Protection Act</i>.</li> <li>8. Most local health units had a medical officer who reported to the board and who was responsible for administering programs.</li> <li>9. There were no required set of standards for the delivery of public health services that included preparedness.</li> </ol>	<ol style="list-style-type: none"> <li>1. The <i>Pandemic All Hazards Preparedness Act (2006)</i> is in place. Additionally, the Public Health Service Act has been amended to require the Secretary of the DHHS to lead all federal public health and medical response activities, public health emergencies, and incidents covered by the National Response Plan (NRP).</li> <li>2. The ultimate authority for public health rests with the Secretary of the DHHS.</li> <li>3. The U.S. Constitution gives states primary responsibility for health.</li> <li>4. All states have state health departments that are either free standing or which operate as a component of a larger department with a health commissioner or director and a board of health. Most states have a state epidemiologist/medical director.</li> <li>5. Most local or county public health agencies have a director for the agency, and most have a local board of health with physician involvement.</li> <li>6. Direct public health services are primarily provided by local health departments. A few state departments provide direct public health services.</li> <li>7. There are no required set of standards for the delivery of public health services that include preparedness; however, core functions and essential services are described. The CDC is currently working toward accreditation of public health agencies.</li> </ol>
Plans	<ol style="list-style-type: none"> <li>1. Health Canada now provides an annual Health Portfolio outlining national health goals and performance measures; however, there was limited emergency preparedness planning prior to SARS.</li> <li>2. The government has released Health Canada’s Preparedness for and Response to Respiratory Infections Season and the Possible Re-emergence of SARS Plan, fall/winter 2003-04.</li> </ol>	<ol style="list-style-type: none"> <li>1. Comprehensive guidance, emergency plans, and protocols.</li> <li>2. The NRP was released in December 2004 to align all federal coordination structures and capabilities into a unified all-discipline and all-hazards approach to domestic incident management.</li> <li>3. In January 2008 the National Response Framework provided guiding principles to enable unified national responses to disasters and emergencies.</li> </ol>

	<p>3. The PHAC has released a revised Pandemic Influenza Plan and Public Health Emergency Plan (2006).</p> <p>4. The MOHLTC in Ontario has released its Emergency Response Plan (MERP) version 2 (November 2007).</p>	<p>4. Since November 2005, the DHHS Pandemic Influenza Plan, has served as a blueprint for all DHHS pandemic influenza preparedness and response activities.</p> <p>5. Although there is no national public health preparedness strategy, Homeland Security Presidential Directive (HSPD) 21 was released in October of 2007, establishing a national strategy for public health and medical preparedness.</p>
Command and Control	<p>1. No incident management system was in place at the time of SARS.</p> <p>2. MERP 2007 now provides for command and control and the use of the incident management system and an incident management structure.</p>	<p>1. The National Incident Management System (NIMS) has been implemented across the U.S.</p> <p>2. Federal funding is tied to achieving NIMS compliance.</p>
Exercises	<p>1. The literature is silent on exercises being conducted by public health or health care.</p>	<p>1. Multidiscipline, local, state and federal exercises occur regularly and are required for federal preparedness funding.</p>
<b>Communication</b>		
Alerting	<p>1. Alerting was slow and fragmentary, although British Columbia did notify regional hospitals and public health units with a focus on acute care.</p> <p>2. Officials initially targeted acute-care, leaving long-term care facilities and general physicians out of the information loop.</p>	<p>1. CDC maintains a 24/7 Health Alert Network (HAN) and Epi-X Network connecting with state and local public health agencies.</p> <p>2. The WHO maintains global alert system but did not issue SARS alert until March 2003.</p> <p>3. Many states now have public health alerting capability as a result of bioterrorism funding.</p>
Risk Communication	<p>1. Although fragmented initially, British Columbia successfully got information to clinicians and hospitals in timely manner.</p> <p>2. Conflicting messages came from multiple spokespersons from different levels of government and from different agencies.</p> <p>3. Travel advisories were inconsistent, causing confusion.</p> <p>4. Multiple spokespersons were used during press briefings and conferences.</p>	<p>1. During SARS, the HAN, Epi-X Network, and the Global Outbreak Alert and Response Network (GORAN) were used, providing effective communication to state and local partners. The public was informed.</p> <p>2. Officials actively engage media for delivery of prevention messages and what to do in the event of emergency.</p> <p>3. Officials routinely notify state public health agencies through HAN of pending “urgent” press releases and conferences.</p>
<b>Capacity</b>		
Public Health Infrastructure	<p>1. There was an underinvestment in public health infrastructure, as noted in the Campbell, Kirby, Naylor, and Walker reports.</p> <p>2. The Public Health Branch of the OMHLTC was in charge at the provincial level when SARS occurred.</p> <p>3. There was diminished public health leadership that focused on public health specifically in infectious disease and epidemiology and outbreak response. The focus of the federal government had been on primary health care versus prevention.</p> <p>4. There was weak analytical capability among epidemiology staff. Epidemiology capacity had to be sought from other jurisdictions and from other countries.</p>	<p>1. The DHHS is the principal federal agency for protecting the health of all Americans.</p> <p>2. The DHHS offers over 300 programs with 64,750 full-time employees in eleven operating divisions, eight agencies in the U.S. Public Health Services, and three Human Service agencies.</p> <p>3. The FY 2008 budget is \$707.7 billion. Since 2002, over \$7 billion has been invested annually in preparedness for public health and hospitals.</p> <p>4. Fifty states have state health agencies. As of 2005, there were 2,865 local public health agencies</p> <p>5. The provision of local and state public health services varies across the country.</p> <p>6. The degree of resource commitment varies from state to state and from community to community. Some invest heavily, other invest little.</p>

	<p>5. Approximately \$1 billion has now been invested in rebuilding public health in Canada since SARS.</p> <p>6. There are approximately 140 public health units in Canada. Of these, 26 percent (thirty-six) responded to SARS in the Ontario area.</p> <p>7. There were varying degrees of public health service delivery and leadership among public health units.</p>	<p>7. Many agencies are too small and lack capacity to cover needs of the population in their jurisdiction.</p> <p>8. It is difficult to recruit and retain qualified staff in small rural communities.</p> <p>9. The Epi-Aid program through CDC allows for epidemiology students to work with states during outbreaks.</p> <p>10. Local and state public health agencies are extremely overburdened with traditional and new public health responsibilities with little to no additional infrastructure support in terms of funding and workforce.</p> <p>11. In FY 2008 the CDC budget \$6.5 billion with 8,896 full-time employees.</p>
Surveillance Systems	<p>1. Systems lacked Web-based public health communications systems across jurisdictions and the ability to link patient records and other health care data sources.</p> <p>2. The weak surveillance system was forced to use a paper-based system during the SARS response.</p>	<p>1. A national electronic disease surveillance system is currently used with all fifty state health agencies reporting; however, reporting to CDC is voluntary.</p> <p>2. A national influenza-like illness disease reporting system in place, which is also voluntary.</p> <p>3. Multiple other disease reporting systems are used by CDC to collect, analyze, and disseminate public health information.</p> <p>4. Significant challenges exist with multiple “silo” data bases from multiple agencies and divisions within DHHS. Databases do not interface.</p> <p>5. The ability to link to medical records is being explored and worked on by various states.</p>
Surge	<p>1. There was a lack of agreements for sharing public health and health care personnel across jurisdictions.</p> <p>2. Of those affected, 43% were health care workers.</p>	<p>1. The Emergency Management Assistance Compact has all 50 states as signatories and provides an avenue to share human resources across jurisdictions.</p> <p>2. The U.S. Public Health Services and CDC provide limited human resource surge capacity through Epi-Aid.</p> <p>3. Some states have specialized response teams and volunteers that include medical and public health staff.</p>
Infection Control	<p>1. Policies, procedures and guidance were outdated.</p> <p>2. The infection control network was fragmented, resulting in many infection control practitioners across the country lacking linkages for receiving information regarding SARS.</p> <p>3. Infection control in hospitals was not a priority program, resulting in limited routine disease reporting and linkages with public health.</p>	<p>1. The Division of Healthcare Quality Promotion in DHHS functions as part of the National Center for Infectious Diseases and provides comprehensive guidance, policies, and protocols on infection control in health care settings.</p> <p>2. Many states participate in infection control networks sharing information across agencies.</p> <p>3. Infection control is a significant part of each hospital’s quality improvement and preparedness programs.</p> <p>4. Many state health departments provide technical assistance and consultation on infection control.</p> <p>5. The Association of Professionals in Infection Control (APIC) provides strong national leadership in the prevention and control of infections.</p>

Laboratories	<ol style="list-style-type: none"> <li>1. SARS testing had to be pushed to local hospital labs to function as reference laboratories because the surge could not be handled.</li> <li>2. Laboratories were not linked to share laboratory and epidemiological data with multiple public health units.</li> <li>3. Researchers' rapid response to delineating the cause of SARS, characterizing the agent, developing diagnostics tests and generating initial clinical descriptions/definitions was good.</li> </ol>	<ol style="list-style-type: none"> <li>1. The Laboratory Response Network (LRN) became operational in 1999. Collaborative effort among CDC, the Federal Bureau of Investigation, and the Association of Public Health Laboratories.</li> <li>2. The federal government maintains an integrated network of state and local public health, federal, military, and international laboratories that can respond to bioterrorism, chemical terrorism and other public health emergencies.</li> </ol>
<b>Coordination</b>		
Linkages (public health, health care, animal industry and other sectors)	<ol style="list-style-type: none"> <li>1. Strong linkages between public health and the health care system were absent.</li> <li>2. There was poor response coordination across public health units and with other sectors.</li> </ol>	<ol style="list-style-type: none"> <li>1. There are strong linkages among public health agencies at the local, state, and federal levels, and among hospitals. This continues to improve.</li> <li>2. An identified weakness is direct linkages with individual physicians and the thousands of medical and special clinics across the country.</li> </ol>

## 1. Preparedness

### a. Authority

In Canada, confusion regarding authority or “who’s in charge” of a public health emergency either locally or nationally caused frustration, and at times, delays in response to the SARS outbreak. This may have been caused by the separate and distinct management of health care, public health, and general emergency response. As well, conflicts existed among the different levels of government in terms of who was responsible for what actions. Issuance of border controls was inconsistent and passenger screenings at airports varied. During the SARS response, regular conference calls were scheduled by the Ontario Ministry of Health and Long Term Care (OMHLTC) for local medical officers to share information; however, it was difficult for the local medical officers to break away from the response long enough to participate. Some, on the other hand, simply did not participate. Emergency plans outlining legal authorities and identifying roles and responsibilities were not in place at the time of the epidemic.

Public health service delivery in Canada is the responsibility of local public health units; however, primary legislative power rests with the provinces and territories. This contributed to frustrations on the part of local public health workers when trying to implement prevention and control measures through the use of public

health orders. There are approximately 140 local health units in Canada, of which thirty-six reside in Ontario. Each of these units functions autonomously under the *Health Promotion and Protection Act* and is governed by a board of health. Varying degrees of participation by these boards with the local public health units contributed to some confusion regarding roles and responsibilities with different levels of government.

The *Pandemic All Hazards Preparedness Act* of 2006 requires the secretary of DHHS to lead all federal public health and medical responses to public health emergencies and incidents covered under the National Response Plan (NRP).<sup>207</sup> Similar to Canada, the U.S. Constitution gives states primary responsibility for public health services, which are mostly provided by local public health agencies. All states have state health departments that are either free standing or are part of a larger “super” agency with a health commissioner or director. Unlike Canada, most states have a state public health medical director or epidemiologist. Physician involvement at the local level, however, is usually represented by a physician on a local board of health instead of being recognized as a medical health officer for the local agency or jurisdiction. Prominent in both countries are boards of health at the provincial/state level as well as at the local level.

***b. Plans***

Health Canada develops an annual health portfolio outlining national health goals and performance measures. Prior to SARS, few of these goals focused on infectious disease and preparedness. Specific emergency plans for infectious disease outbreaks were limited in Canada prior to the SARS outbreak; however, it was reported that a pandemic influenza plan was under development by the OMHLTC. Without integrated emergency plans, Canada experienced difficulty in linking institutional and non-institutional clinicians, other response partners, and different levels of government. The lack of planning contributed to confusion about the different roles and responsibilities among different levels of government, and overall authority for the SARS

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<sup>207</sup> U.S. Congress, “Pandemic All Hazards Preparedness Act,” <http://www.govtrack.us/congress/bill.xpd?bill=s109-3678> (accessed July 19, 2008).

response. A revised Pandemic Influenza Plan was released in 2006 and the OMHLTC released version two of the Ministry's Emergency Response Plan in November 2007.<sup>208</sup>

In the United States, comprehensive guidance, emergency plans, protocols, and fact sheets are provided by the DHHS. In December of 2004, the NRP was released, followed by the National Response Framework in early in 2008 by the Department of Homeland Security (DHS). Although there continues to be debate over the plans, guidance and direction is provided regarding roles, responsibilities, and authorities covering multiple governmental disciplines at the local, state, and federal level. In addition, DHHS has released thorough Pandemic Influenza implementation and response plans. More recently, the president released Homeland Security Presidential Directive (HSPD) 21, which established a national strategy for public health and medical preparedness in October of last year.<sup>209</sup> Plan development and implementation is required by DHHS in order to receive cooperative agreement funding allocations for public health and medical preparedness at the local and state level.

*c. Command and Control*

An incident command or management structure was not in place in Canada at the time of the SARS epidemic. This was evident given the numerous concerns expressed by public health and health care workers about confusion and lack of clarity regarding who was in charge during the epidemic. Since SARS, incident command and an incident management structure have been developed and are included in both Canada's pandemic plan and the MOHLTC's Emergency Response Plan.

The United States has invested a significant amount of time and effort into implementing a National Incident Management System (NIMS). Emergency management, public health, health care, law enforcement, and other disciplines are

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<sup>208</sup> OMHLTC, "Ministry Emergency Response Plan (MERP)," [http://www.health.go.on.ca/english/providers/program/emu/emerg\\_prep/emerg/emerg\\_resp\\_plan.pdf](http://www.health.go.on.ca/english/providers/program/emu/emerg_prep/emerg/emerg_resp_plan.pdf) (accessed July 3, 2008).

<sup>209</sup> President, Directive, "Homeland Security Presidential Directive/HSPD-21," 1-9.

required to take incident command and incident management training at the local and state level. This requirement is tied to receiving federal funding, and states are required to become NIMS compliant.

*d. Exercises*

Review of the literature and emergency plans did not reveal activities relating to exercises in Canada. In the United States, on the other hand, disciplines within all levels of government actively participate in exercises ranging from table-top to full-scale forums. Exercising, after-action reporting, and improvement planning is a requirement for receiving federal funding through cooperative agreements.

**2. Communication**

*a. Alerting and Risk Communication*

Reliable and timely alerting and information sharing are critical actions in an effective emergency response. Alerting capability and the capacity to share diverse health information with medical practitioners, other response partners, the media, and the public are key in establishing trust and credibility. During SARS, Canada's alerting was fragmented and slow; however, the Province of British Columbia did provide warnings to some regional clinicians, hospitals, and public health units through its Centre for Disease Control.

Risk communication was non-existent or was, at best, fragmented in Canada during the initial months of the SARS epidemic. This was in part due to the lack of certainty about diagnosis, treatment, and epidemiology during the beginning phases of the outbreak. In Canada, information being provided to the public and health care workers was not consistent. Press briefings often included three to four spokespersons without a clear "lead" expert identified. Travel advisories were issued in Canada; however, these advisories were inconsistent. While the economic impact of these advisories were profound, the epidemiological foundation for issuing them was weak.<sup>210</sup>

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<sup>210</sup> Naylor et al., "Learning From SARS in Hong Kong and Toronto," 2485.

The CDC maintains and utilizes a Health Alert Network (HAN) to alert and distribute routine and emergent public health information. All states are on the system. This is an efficient and reliable mechanism for alerting and for the sharing of public health information. SARS advisories, updates, and surveillance data were shared regularly with local and state public health departments across the nation. In addition, CDC utilizes a system called “Epi-X” that connects state epidemiologists and other public health officials. Near real-time disease outbreak information is shared on a regular basis. This system also has alerting capacity. State epidemiologists can post and contribute information on the system. Clear direction is provided regarding confidentiality. In addition, CDC often alerts state public health agencies prior to press conferences or briefings of an urgent nature to share information and ensure consistent public health messages.

As a result of bioterrorism funding, many states have implemented state HANs that function in the same manner as the HAN for CDC. For example, in Iowa, there are over 2,500 users on the system including local and state public health, all licensed hospitals, emergency medical services providers, law enforcement, emergency management, the governor’s cabinet, hazmat teams, and many others. Alerting and posting information on the portal is selective and secure to ensure confidentiality.

Openness and transparency among government, health care, and public health, as well as with the public, is critical when dealing with public health emergencies. Communication within the health care and public health systems, with the media and public, and among states, countries, and nations is a cornerstone of effective and efficient crisis response and management. According to C. David Naylor in *Learning from SARS in Hong Kong and Toronto*, this will require collaboration within and across jurisdictions “sharing values and goals, trust, goodwill, and agreed-upon rules of engagement.”<sup>211</sup> Ongoing planning efforts and investments in risk communication, public education, and technology for information sharing should be a priority in federal, state, and local public health agencies.

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<sup>211</sup> Naylor et al., “Learning From SARS in Hong Kong and Toronto,” 2487.

### 3. Capacity

#### a. *Public Health Infrastructure and Surge*

At the time of the SARS epidemic, the overall public health capacity, or infrastructure, was weak in Canada, and was identified as “critically underdeveloped.” It is evident that the underinvestment in public health infrastructure in Canada contributed to many challenges faced in responding to SARS. This is portrayed in the Campbell, Kirby, Naylor, and Walker reports summarized in Chapter V. Primary health care has been the focus in Canada with limited attention given to public health in the area of prevention and health protection. This misguided focus has led to a diminishing pool of qualified public health leadership and general workforce. Well-trained epidemiologists, infection control practitioners, public health nurses, and microbiologists were few and far between during the SARS outbreak. Without epidemiologists and others skilled in surveillance and outbreak management, response was challenged from the beginning of the epidemic. This gap had to be addressed by bringing public health workers to Ontario from other provinces and countries.

Canada did not have agreements in place for sharing public health and health care personnel across jurisdictional lines, further compounding the problem. This proved to be a significant surge capacity challenge during the response. Unlike Canada, all fifty states in the United States are signatories of an Emergency Management Assistance Compact that allows for the sharing of personnel across jurisdictional boundaries. In addition, a number of states have specialized response teams. For example, medical, environmental, and epidemiology staff can be deployed to address surge capacity in other states. There are also federal level response teams, and the U.S. Public Health Service has specialists who can be deployed to states when requested.

In the United States, the CDC alone has 8,896 full-time employees and an annual budget of \$6.5 billion (2008).<sup>212</sup> In the last six years, the United States has

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<sup>212</sup> CDC, “HHS What We Do: The Department of Health and Human Services,” <http://www.hhs.gov/about/whatwedo/html/> (accessed July 19, 2008).

invested over \$7 billion in preparedness for public health and hospitals.<sup>213</sup> All fifty states in the United States have public health departments and there over 3,000 local public health agencies for a population of 300 million. The Canadian government, on the other hand, has only invested approximately \$1 billion in public health since the SARS epidemic. Ontario alone has thirty-six local public health units for a population of 12.8 million (2008) based on the Ontario Population Projections by the Ministry of Finance.

Although there is a significant difference in funding levels between Canada and the United States for general public health and preparedness, both countries experience varying degrees of public health service delivery at the state or provincial and local level. This is primarily due to the “mixed” approach of governance and funding. Some communities invest more than others, and thus, leave the citizenry without assurance of basic public health service capacity.

Disease detection, outbreak response, and containment are the primary responsibility of local, state, and provincial public health agencies. Many local public health agencies in the United States and Canada are too small, are understaffed, and do not have adequate public health infrastructure to prepare for and respond to infectious disease outbreaks. In addition, many smaller communities find it difficult to recruit and retain a qualified public health workforce. Due to this situation, state or provincial public health agencies are called upon to provide frontline disease investigation leadership and epidemiological support. For example, in Iowa, there are six regional field epidemiologists—one for every 500,000 individuals spanning ninety-nine counties. Given an outbreak such as SARS, the capacity of six epidemiologists would not come close to providing the necessary investigatory leadership and workforce support that would be needed for a citizenry of 3 million.

Given the decay of public health over the past several decades in both countries, it should come as no surprise that the public health infrastructure does not have the capacity to address the full spectrum of its mission—protecting and promoting health

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<sup>213</sup> DHHS, “HHS Announces \$896.7 Million in Funding.

and preventing disease. Funding formulas and transfers cannot ignore the need for a wide breadth of public health service delivery.<sup>214</sup> The public health infrastructure prior to September 11 and the SARS epidemic was fragile and the breadth and importance of new preparedness responsibilities has overburdened the system even more. Investment in and sustainability of public health systems in both countries must be commensurate with the magnitude of traditional and new responsibilities entrusted to these systems and the workforce that save lives.

*b. Surveillance Systems*

The CDC is a leader in disease surveillance, outbreak investigation, and communicable disease epidemiology.<sup>215</sup> The CDC provides strong leadership in preparing for and responding to infectious disease. Currently, a national electronic disease surveillance system is used for reportable disease, though reporting is voluntary. There is no legislative mandate requiring states to report. The CDC also manages an influenza disease reporting system; again reporting by states is voluntary. There are many disease reporting systems used by the CDC, primarily disease-specific systems. One challenge is that there are multiple reporting systems that do not interface with one another, requiring many programs to report in different ways without the capability of integrating information across programs. The capability to link public health and medical records is being debated across the country and some states are making progress, though current capability remains weak for the most part.

Canada's surveillance system responded poorly and there was no internet-based communication system connecting jurisdictions and linking public health records during SARS. It should be noted that China had a stronger routine surveillance system than Canada because of previous work related to avian influenza that was quickly enhanced and used for the SARS outbreak. This allowed China immediately to begin

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<sup>214</sup> Beitsch et al., "Public Health at Center Stage: New Roles, Old Props," 919.

<sup>215</sup> Health Canada, "Learning from SARS: Renewal of Public Health in Canada," 60.

conducting active research during the outbreak. Canada did not have the capacity to link and share epidemiological data among laboratories, public health, and health care.

*c. Infection Control*

The impact of SARS on health care workers was significant. As previously stated, in Hong Kong alone, 22 percent of all persons affected were health care workers, and in Toronto, the proportion of health care workers affected was even higher at 43 percent.<sup>216</sup> The spread of infection to a large number of health care workers added to the stress that Canada faced in responding to SARS. Policies, procedures, and infection control guidance was outdated, though an informal infection control network did allow some practitioners to receive information on SARS. Infection control programs in hospitals were not considered a priority. Likewise, there was limited involvement by hospitals participating in routine infectious disease surveillance, leaving a significant gap in relationships with public health. Straightforward guidelines and policies on infection control protection measures against droplet and contact transmission were needed.

In the United States, the Division of Healthcare Quality Promotion in DHHS functions as part of the National Center for Infectious Diseases and provides comprehensive guidance on infection control in health care settings. Many state public health agencies support and participate in infection control networks, bringing together practitioners from diverse health care settings to share information. Additionally, many state public health agencies provide technical assistance and consultation in infection control and include these practitioners on health alerting systems. The Association of Professionals in Infection Control provides strong national leadership in the prevention and control of infections. Infection control is a significant part of most hospital quality improvement and preparedness programs.

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<sup>216</sup> Naylor et al., “Learning From SARS in Hong Kong and Toronto,” 2483.

*d. Laboratories*

China was able to establish laboratory capacity for testing and sharing information through an electronic E-SARS laboratory network while at the same time integrating and sharing epidemiological data. This proved critical in delineating the cause of SARS, characterizing the virus, and developing diagnostic tests and generating initial clinical definitions. Canada, however, had limited laboratory capacity, which required “pushing” SARS testing to local hospital laboratories because the country’s reference laboratories could not handle the surge of test requests. Canada is now in the process of improving this capacity.

In the United States, the Laboratory Response Network (LRN) became operational in 1999 providing a collaborative effort involving the CDC, the Federal Bureau of Investigation and the Association of Public Health Laboratories.<sup>217</sup> The LRN maintains an integrated network of federal, state, and local public health, military, and international laboratories that can respond to terrorism and other public health emergencies. The strength of laboratory capacity to quickly share information and link epidemiological data is critical for prevention and control. A key success in stopping the SARS outbreak can be attributed to the rapid response of researchers in developing diagnostic tests and generating clinical descriptions of the disease. Without capacity and capability to share epidemiological and laboratory information, this would not have been possible.

**4. Coordination**

*a. Linkages*

It is not surprising that linkages between public health and health care were weak in Canada, given the lack of specified authority, emergency plans, and communication systems. It was also evident in Canada that poor coordination existed among public health units. Hospital workers became frustrated by being contacted

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<sup>217</sup> CDC, “The Laboratory Response Network: Partners in Preparedness,” <http://www.bt.cdc.gov/lrn/pdf/lrnhistory.pdf> (accessed July 18, 2008).

multiple times regarding SARS case information that had already been reported to other units. Likewise, physicians were frustrated by conflicting information and an overall lack of information being provided regarding SARS case definitions. This was in part due to Health Canada initially not accepting the WHO's case definitions. In addition, when SARS initially appeared, the focus on providing information to acute health care settings only left a void in connecting with general physicians and practitioners in the non-acute care settings. There were also varying degrees of collaboration between local and provincial medical health officers.

Linkages are strong among federal, state, and local public health agencies in the United States with policy, guidance, and protocol direction. As well, most state and local public health agencies have strong connections with each other and with hospitals. These linkages are constantly being nurtured. An area that could be improved is the direct linkages with individual health care providers in agencies outside the hospital setting. Local public health agencies connect with these providers on a regular basis, but there is no universal mechanism in place to ensure these providers receive timely public health information.

### **C. SUMMARY**

Public health in the United States and Canada has a wide variety of health soldiers playing key roles in the prevention and control of infectious disease. It also represents an expansive network of agencies and boards at all levels of government with varying degrees of leadership, authority, responsibility, capacity, and capability to prepare for and respond to public health emergencies. These agencies are a product of federalism, with authorities resting with governors and ministers at the state and provincial level and with boards of health or medical officers at the local level. It is these authorities that direct state and local public health agencies, not national plans, grant guidance, or presidential directives. The result in the United States, for example, is fifty different plans for responding to public health emergencies. As well, different levels of disparities in public health service delivery exist from jurisdiction to jurisdiction. Elin Gursky summarizes

this core problem in a report to the Senate Committee on Health, Education, Labor, and Pensions, Subcommittee on Bioterrorism and Public Health Preparedness (September 2005).

We are attempting to build a platform of national public health preparedness to address global health threats on a system constitutionally organized at the state level, comprising vastly heterogeneous abilities at the local level. This approach is inherently flawed and by its design will ensure frustration and failure.<sup>218</sup>

In addition, there are no nationally accepted standards for public health preparedness. Likewise, there are no nationally accepted standards for public health service delivery in general. Both countries face similar challenges with policy makers to strike a reasonable balance between public health and health care funding.

The United States has a number of public health preparedness strengths over Canada, including comprehensive plans, incident management structures, alerting and surveillance systems, and infection control practices in health care settings. Canada, on the other hand, fell short in these areas during the SARS epidemic. In the United States, the CDC is seen as an international leader in the areas of surveillance systems, databases, outbreak investigation, and communicable disease epidemiology, although the same cannot be said for local and state public health agencies. The same weaknesses are seen in Canada at the provincial and municipal level. Given the fact that responsibility for public health rests with the states or provinces and direct services are provided by both local and state public health agencies underscores the need for a stronger public health system at these levels while sustaining the momentum of federal agencies like the PHAC and the CDC, and internationally by the WHO. An epidemiological fact is that the health of every nation depends upon the health of all others.<sup>219</sup>

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<sup>218</sup> Gursky, "Epidemic Proportions," 4-5.

<sup>219</sup> Laurie Garrett, *Betrayal of Trust: The Collapse of Global Public Health*, (New York: Hyperion, 2000), 10.

Chapter VII provides a summary of findings from this research, outlines conclusions drawn, and provides recommendations for improvement in preparedness by the U.S. public health system.

## **VII. IMPROVING U.S. PUBLIC HEALTH SYSTEM PREPAREDNESS**

### **A. SUMMARY OF FINDINGS AND CONCLUSIONS**

Public health is a critical component of homeland security. Emerging or re-emerging infectious diseases—whether naturally occurring or intentionally introduced—pose one of the greatest threats to the security of the United States. Governmental public health is under unprecedented scrutiny given its new mission of health security. This expanded mission has placed significant demands on the system’s capacity and capabilities and has revealed that the system is fragile from years of political neglect, is underfunded, and is overburdened. In its current state, this system cannot meet the full range of roles and responsibilities entrusted to it.

The response to the SARS epidemic in Canada clearly demonstrates the need for a robust and sustainable public health system at all levels of government. It is clear that the public health system in every nation needs to be prepared not only for the scope and scale of threats and attacks previously experienced, but also those looming in the future. At the same time, this system must continue to address its current mission of health promotion and chronic disease prevention. It is critical for the United States to devise long-term and sustainable strategic solutions for revitalizing and bolstering public health defenses and avoid the “piecemeal” fixes of the past.<sup>220</sup> The public and policy makers at the local, state, and federal levels must recognize the need for heightened attention, dedication, and commitment to the nation’s public health system.

SARS was a “live” dress rehearsal for a more serious threat posed by infectious disease. The challenges and stresses that the Canadian public health system and medical workers experienced during SARS must serve as the final warning that even some of the most advanced countries in the world will find it difficult to cope with similar or more dangerous infectious disease epidemics. SARS placed enormous pressures on the public

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<sup>220</sup> Trust for America’s Health, “SARS and Its Implications for U.S. Public Health Policy: We’ve Been Lucky.”

health and medical systems in terms of information sharing, investigations, contact tracing and follow-up, quarantine, isolation, infection control, and long periods of intensive medical care services. The very infrastructure designed to prevent illness, control disease spread, and care for and treat those who became ill was attacked. This novel virus nearly crippled the system designed to protect the public's health and created severe economic and social instability.

Public health agencies in the United States were established almost two centuries ago to address community needs such as collecting vital statistics, providing preventive health services, and promoting healthy lifestyles. The system was not designed to fill a critical national security mission associated with deliberate acts of biological terrorism or future pandemics. Public health has been organized to serve the health of populations, not to serve in a coordinated, systematic, command and control framework responding to an epidemic or pandemic producing large numbers of casualties.<sup>221</sup> Nor was there a vision that the public health system would be responsible for the coordination of public health security for the entire nation. Elin A. Gursky, in a report to the Subcommittee on Bioterrorism and Public Health Preparedness, Senate Committee on Health, Education, Labor, and Pensions in September of 2005, had this to say about national public health security in the United States.

National public health security cannot be built on a foundation of fragmented public health capacities and capabilities any more that our military could be effectively organized as thousands of independent local militias.<sup>222</sup>

The United States was fortunate that SARS did not attack our public health infrastructure and that there were only a few cases and no deaths; however, many similar system vulnerabilities exposed in Canada's public health system do exist in the United States today. By falling short again in not acting, the U.S. government (at all levels) will

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<sup>221</sup> Gursky, "Epidemic Proportions," 1.

<sup>222</sup> Ibid.

fail in protecting the public's health against the next novel infectious disease or bioterrorist attack. Protecting Americans against infectious disease is a governmental responsibility entrusted to public health. This trust cannot be broken.

As a product of federalism, similar to Canada, the U.S. public health system consists of thousands of local public health agencies, fifty state agencies, and approximately twenty-six federal agencies that hold some form of authority and responsibility for public health security. The degree to which these responsibilities are met vary from community to community, state to state, and from federal agency to federal agency. All act independently under varying levels of authority held by secretaries, governors, state health officers, and boards of health. This created the foundation and organizational structure upon which the U.S. public health system was built and currently exists. This foundation and organizational structure does not support public health's traditional or new homeland security mission.

Sustainable improvements in the U.S. public health system cannot be realized by short term influxes of funding to achieve national public health security. Preparedness for and responding to epidemics or bioterrorism and providing national public health security requires making strategic investments in revitalizing and modernizing the public health system and maintaining it to meet the public health threats of the twenty-first century.

In order to revitalize and modernize the U.S. public health system, two critical component areas must be addressed: 1) organizational capacity and 2) service delivery. Based on lessons learned in Canada and uncovering similar vulnerabilities in the United States, it is important to ensure organizational capacity—such as governance, administration, communication, information technology, and workforce—in order to deliver public health services effectively. Likewise, every American should expect a basic level of public health service delivery that includes: 1) health promotion and chronic disease prevention, 2) prevention of the spread of disease and epidemics, 3) injury prevention , 4) protecting against environmental hazards, and 5) responding to and recovering from public health threats and disasters. These basic services address the

traditional and the new missions of public health. Organizational capacity and service delivery must form the foundation for revitalizing and modernizing the current system into a national public health system.

Randall J. Larsen, retired U.S. Air Force colonel and author of *Our Own Worst Enemy* (2007) echoes this sentiment by saying, “I can tell you that a national public health system in the twenty-first century will be as important to national security as the Department of Defense was in the twentieth century.”<sup>223</sup>

This will be an expensive and time-consuming venture; however, it is a critical investment that must be made to achieve national public health security and ensure national survival. Revitalizing and modernizing the U.S. public health system into a national system will advance its new homeland security mission and will result in and support breakthroughs in the prevention and treatment of a wide range of diseases and other health risks that may not reach the level of an epidemic but have the potential to affect the health of millions of Americans.

## **B. RECOMMENDATIONS**

The way forward is twofold. First, at the national level, the president must convene a national commission to be led by the Institute of Medicine (IOM) and comprised of members of the public health, medical, and academic communities, leaders and experts from local, state, and federal agencies, and representatives from the private sector. The IOM needs to lead this commission because it functions outside the framework of government, ensuring scientifically informed analysis and independent guidance. The charge of this commission will be to formulate and present a report to Congress within eighteen months to establish a national public health system with the capacity and capability to meet the traditional and new missions of public health in the United States. The following are recommended at the federal level:

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<sup>223</sup> Randall J. Larsen, *Our Own Worst Enemy* (New York: Grand Central Publishing, 2007), 107.

- Identify and recommend an organizational framework (under a single authority) for a national public health system. This must encompass a critical review of the federal agencies with responsibilities for public health and must include authorities, organizational structure, and capacity and capability for service delivery. In addition, there must be a critical review of the Department of Health and Human Services (DHHS) including authorities, organizational structure, and capacity and capability necessary to serve as the lead federal agency for a national system. The intent of this review is to capitalize on existing strengths of this agency and to formulate recommendations for elevating this agency to function in this leadership role or to recommend an alternate approach.
- As occurred in Canada, review and determine the authorities and credentials for a national public health medical director (physician) who has extensive experience in public health practice. This position must be created and serve as the “credible” public health voice for the federal government during routine and crisis situations. This position must also have the authority to base recommendations and decisions on science and not be held hostage by political influences. The review must include physician positions in the federal government having responsibility for public health, the position of the surgeon general, and other physician positions within the DHHS. The intent of this review is to formulate recommendations for the overall medical direction for the lead public health agency for routine programs, during emergency response, and for the national system. In addition, the commission needs to identify leadership roles and responsibilities for collaborating with state public health medical directors and epidemiologists.
- Establish a national board of health, identifying authorities for setting and promulgating federal and national health policy. This shall include establishing the process for board member appointments and outlining credential requirements. In addition, the commission needs to identify leadership roles and responsibilities for information sharing and collaboration with state and local boards of health.
- Define roles and responsibilities that will encompass the traditional and new mission for governmental public health (local, state, and federal public health agencies, local and state boards of health, and the new national board of health) framed under the auspices of national accreditation standards that will need to be met by all governmental public health agencies and boards. The commission should review the work currently being done at the national level by the Public Health Accreditation Board (PHAB) for state and local agencies. Standards must be developed and applied to federal public health agencies and the lead federal public health agency for the national public health system.

- Secure and maintain funding commensurate with meeting the traditional and new mission of public health. The commission must study and formulate recommendations for a national per capita investment for governmental public health capacity and service delivery. This should include contributions from local, state, and federal governments. No single level of government can be responsible for this investment alone; rather, a shared commitment for governmental public health funding is critical. In formulating this investment rate, the commission must also identify an equitable distribution of funds based on clearly defined roles and responsibilities, capacity and service delivery for each level of government.

The second way forward rests at the state level. States must not sit idle and wait for the federal government to act; they must move forward in addressing organizational capacity and service delivery in meeting both critical missions. The following are recommendations for state health officers:

- Align and prepare for governmental public health accreditation. Develop state accreditation standards for governmental public health organizational capacity and service delivery, monitoring closely and integrating the work of the PHAB as appropriate. Ensure the standards are inclusive of state and local governmental public health agencies and boards.
- Launch an initiative between local and state governmental public health agencies and boards to assess organizational capacity and service delivery and develop recommendations for shaping and modernizing the governmental public health system. The focus must be on increasing system capacity, improving equitable service delivery, enhancing system performance, establishing a mechanism to measure process and health outcomes, and assuring the public of a basic level of public health service delivery in every community. This work must be based on accreditation standards.
- Provide the necessary leadership in establishing or enhancing the authorities, and active engagement of local boards of health with the state board of health. This needs to include relationship building between the state public health medical director and local public health medical directors and the physicians on boards of health. In addition, similar to the recommendation for a national public health medical director, the state public health medical director must serve as the “credible” public health voice for state government during routine and crisis situations and have the authority to base recommendations and decisions on science.

- Develop and implement a legislative strategy to promulgate a governmental public health system modernization act that provides authority, support, and sustainability for organizational capacity and service delivery. At a minimum, the act must include legislative findings and intent, definitions, lead agency responsibilities, and organizational capacity and service delivery components of the system. In addition, a council to advise the lead agency on system development and accreditation, an evaluation committee to evaluate system effectiveness and the accreditation process needs to be included. As well, data collection and information sharing authority must be addressed and establishment of a governmental public health system fund and authority of the state board of health to adopt rules to implement the act are critical.
- Ensure that the governmental public health system fund is held by the state treasury and is managed by the lead state public health agency to assist local public health agencies and boards in meeting organizational capacity and service delivery in accordance with public health standards. This fund must also support the state health department and board in executing lead agency responsibilities. Per capita formularies must be utilized in determining the distribution of funds with equitable responsibility for local investment. Funds remaining at the end of a fiscal year should not revert to the general fund.

These recommendations will challenge some in public health who support the “business as usual” culture and those who are resistant to accepting the new global public health mission of health security. The issues and challenges associated with public health system preparedness in achieving national security have placed public health at a crossroads of the traditional and the new. However, these recommendations provide the foundation for addressing both the traditional and new responsibilities entrusted to governmental public health in the twenty-first century. A new paradigm in public health is evolving. It is time to revitalize and modernize the existing system into a national system. This can be done by harnessing the collective force of public health agencies and workers across the nation to address both vital public health missions. This work, if done at all levels of government, will lead the way in transforming public health into a national system capable of fulfilling its traditional and new missions of promoting the health of the population and protecting the health security of this nation. Organizational capacity and service delivery form the foundation upon which the U.S. public health system must be transformed into a national public health system.

### **C. FUTURE RESEARCH**

Further research is needed to expand upon this work. Examples include: organizational structure of governmental public health at the federal, state and local level; additional comparative analysis with public health systems in other countries; and examining governmental advisory bodies to determine the level of influence on policy development. Two immediate research questions have emerged as a result of this work. They are: 1) What is the cost per capita to provide a basic level of public health service in the United States? and 2) What systems and methods should be used to evaluate a national accreditation process and the effectiveness of a national public health system that addresses process and health outcomes?

## BIBLIOGRAPHY

- Abraham, Thomas. *Twenty First Century Plague: The Story of SARS*. Baltimore: John Hopkins University Press, 2004.
- Asch, Steven M., Stoto, Michael, Mendes, Marc, Valdez, R. Burgiaga, Gallagher, Meghan E., Halverson, Paul, and Lurie, Nicole. "A Review of Instruments Assessing Public Health Preparedness." *Public Health Reports* 120, no. 5 (September-October 2005): 532-542.
- Association of State and Territorial Health Officials. *Public Health Preparedness: How Do We Measure Success?* Washington, DC: ASTHO, 2006.  
<http://www.astho.org/pubs/Preparedness-MeasuringSuccess.pdf> (accessed August 22, 2007).
- Awofeso, Niyi, "What's New About the 'New Public Health'?" *American Journal of Public Health* 94, no. 5 (May 2004): 705-709.
- Basrur, Sheela V., Yaffe, Barbara and Henry, Bonnie. "SARS: A Local Public Health Perspective." *Canadian Journal of Public Health* 95, no. 1 (January/February 2004): 22.
- Beitsch, Leslie M., Brooks, Robert G., Grigg, Meade, and Menachemi, Nir. "Structure and Functions of State Public Health Agencies." *American Journal of Public Health* 96, no. 1 (2006): 167-172.
- Beitsch, Leslie M., Brooks, Robert G., Menachemi, Nir, and Libbey, Patrick M. "Public Health At Center Stage: New Roles, Old Props." *Health Affairs* 25, no. 4 (July/August 2006): 911-922.
- Centers for Disease Control and Prevention. "Frequently Asked Questions about SARS." April 26, 2004 <http://www.cdc.gov/ncidod/sars/sars-faq.pdf> (accessed April 26, 2008).
- Centers for Disease Control and Prevention. "HHS What We Do: The Department of Health and Human Services." <http://www.hhs.gov/about/whatwedo/html/> (accessed July 19, 2008).
- Centers for Disease Control and Prevention. "MMWR Report Update: Outbreak of Severe Acute Respiratory Syndrome – Worldwide." *Morbidity and Mortality Weekly Report* 52 (12): 243  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5212a1.htm> (accessed May 9, 2008).

- Centers for Disease Control and Prevention. "Notice of Embargo of Civets (Family: Viverridae)." January 13, 2004  
[http://www.cdc.gov/ncidod/sars/civet\\_ban\\_exec\\_order.htm](http://www.cdc.gov/ncidod/sars/civet_ban_exec_order.htm) (accessed April 27, 2008).
- Centers for Disease Control and Prevention. "The Laboratory Response Network: Partners in Preparedness." <http://www.bt.cdc.gov/lrn/pdf/lrnhistory.pdf> (accessed July 18, 2008).
- Covey, Stephen, M. R. with Merrill, Rebecca R. *The Speed of Trust: The One Thing That Changes Everything* New York: The Free Press, 2006.
- Galvani, Alison, P. "Emerging Infections: What Have We Learned From SARS?" *Emerging Infectious Diseases* 10, no. 7 (July 2004): 1351-1352.
- Garrett, Laurie. *Betrayal of Trust: The Collapse of Global Public Health*. New York: Hyperion, 2000.
- Gursky, Elin "Epidemic Proportions: Building National Public Health Capabilities to Meet National Security Threats." September 23, 2005  
[http://homelandsecurity.org/journal/Epidemic\\_Proportions\\_2.pdf](http://homelandsecurity.org/journal/Epidemic_Proportions_2.pdf) (accessed July 26, 2008).
- Health Canada, National Advisory Committee on SARS and Public Health. "Learning from SARS: Renewal of Public Health in Canada." (Ottawa: October 2003)  
<http://www.phac-aspc.gc.ca/publicat/sars-sras/pdf/sars-e.pdf> (accessed April 22, 2008)
- Heymann, David L. "The International Response to the Outbreak of SARS in 2003." *Philosophical Transactions: Biological Sciences* 359, no. 1447 (July 2004): 1127.
- Homeland Security Council. "National Strategy for Pandemic Influenza."  
<http://www.pandemicflu.gov/plan/federal/index.html#national> (accessed November 11, 2007).
- Institute of Medicine. "About the IOM." <http://www.iom.edu/CMS/AboutIOM.aspx> (accessed September 9, 2007).
- Institute of Medicine. *The Future of Public Health*. Washington, DC, National Academy Press, 1988.
- Institute of Medicine. *The Future of the Public's Health in the 21st Century*. Washington, DC: The National Academies Press, 2003.

- Iowa Department of Public Health. "Epi Manual: Guide to Surveillance, Investigation, and Reporting." SARS. [http://www.idph.state.ia.us/idph\\_universalhelp/main.aspx?system+IdphEpiManual](http://www.idph.state.ia.us/idph_universalhelp/main.aspx?system+IdphEpiManual) (accessed June 1, 2008).
- Larsen, Randall J. *Our Own Worst Enemy*. New York: Grand Central Publishing, 2007.
- Last, J. M. ed. *A Dictionary of Epidemiology*. 4th ed. New York: Oxford University Press, 2001.
- LeDuc, J. W., and Barry, M. A. "SARS, the First Pandemic of the 21st Century." *Emerging Infectious Disease*. [http://www.cdc.gov/ncidod/EID/vol10no11/04-0797\\_02.htm](http://www.cdc.gov/ncidod/EID/vol10no11/04-0797_02.htm) (accessed April 16, 2008).
- Lurie, Nicole, Nelson, Christopher, Wasserman, Jeffrey, and Zakowski, Sarah. "Conceptualizing and Defining Public Health Emergency Preparedness." *American Journal of Public Health* 97, no. 1 (2007): S9-S11.
- Meng, Dato' Chua Jui. "Opening Ceremony Speech," World Health Organization Global Meeting on SARS, Kuala Lumpur, June 17, 2003. [http://www.who.int/csr/sars/conference/june\\_2003/materials/presentations/meng/en/](http://www.who.int/csr/sars/conference/june_2003/materials/presentations/meng/en/) (accessed May 25, 2008).
- Mintzberg, Henry, Ahlstrand, Bruce, and Lampel, Joseph. *Strategy Safari: A Guided Tour Through The Wilds of Strategic Management*. New York: Free Press, 1998.
- Naylor, C. David, Chantler, Cyril, and Griffiths, Sian "Learning From SARS in Hong Kong and Toronto." *Journal of the American Medical Association* (2004), 291, no. 20: 2483.
- Ontario Ministry of Health and Long Term Care. "Ministry Emergency Response Plan (MERP)." [http://www.health.gov.on.ca/english/providers/program/emu/emerg\\_prep/emerg/emerg\\_resp\\_plan.pdf](http://www.health.gov.on.ca/english/providers/program/emu/emerg_prep/emerg/emerg_resp_plan.pdf) (accessed July 3, 2008).
- Ontario Ministry of Health and Long Term Care. *Final Report of the Ontario Expert Panel of SARS and Infectious Disease Control, April 2004*. "For the Public's Health: A Plan of Action." [http://www.health.gov.on.ca/english/public/pub/ministry\\_reports/walker04/chapter\\_4.pdf](http://www.health.gov.on.ca/english/public/pub/ministry_reports/walker04/chapter_4.pdf) (accessed May 23, 2008).
- Ontario Ministry of Health and Long-Term Care. "Descriptive Epidemiology of the Severe Acute Respiratory Syndrome (SARS) Outbreak Ontario, Canada, 2003." [http://www.health.gov.on.ca/english/public/pub/ministry\\_reports/sars\\_070106/sars\\_070106.html](http://www.health.gov.on.ca/english/public/pub/ministry_reports/sars_070106/sars_070106.html) (accessed May 2, 2008).

- Parashar, Umesh D. and Anderson, Larry J. "Severe Acute Respiratory Syndrome: Review and Lessons of the 2003 Outbreak." *International Journal of Epidemiology* 33, no. 4 (2004): 628-634.
- Parliament of Canada. "Bill C-5: Public Health Agency Act." [http://www.parl.gc.ca/common/bills\\_ls.asp?lang=E&source=library\\_prb&Parl=39&Ses=1](http://www.parl.gc.ca/common/bills_ls.asp?lang=E&source=library_prb&Parl=39&Ses=1) (accessed June 27, 2008).
- Peiris, J.S.M. and Guan, Y. "Confronting SARS: a view from Hong Kong." *Philosophical Transactions of the Royal Society B: Biological Sciences* (London, 2004) 359:1075.
- President, Directive. "Homeland Security Presidential Directive/HSPD-5." The White House, February 28, 2003: 281.
- President, Directive. "Homeland Security Presidential Directive/HSPD-21." The White House, October 18, 2007. <http://www.whitehouse.gov/news/releases/2007/10/20071018-10.html> (accessed October 19, 2007).
- President, Plan. "National Response Plan." The White House, December 2004: 1-426.
- Public Health Accreditation Board. <http://www.exploringaccreditation.org/> (accessed August 23, 2008).
- Public Health Agency of Canada. "A Public Health System for the 21st Century." [http://www.phac-aspc.gc.ca/media/nr-rp/2004/2004\\_01bk1-eng.php](http://www.phac-aspc.gc.ca/media/nr-rp/2004/2004_01bk1-eng.php) (accessed June 27, 2008).
- Public Health Agency of Canada. "Act to Establish Public Health Agency Comes Into Force." News Release. December 15, 2006. [http://www.phac-aspc.gc.ca/media/nr-rp/2006/2006\\_11-eng.php](http://www.phac-aspc.gc.ca/media/nr-rp/2006/2006_11-eng.php) (accessed June 29, 2008).
- Public Health Agency of Canada. "Fact Sheet: Progress Achieved Since SARS." <http://www.phac-aspc.gc.ca/sars-sars-gen/sars0308-eng.php?option=email> (accessed June 27, 2008).
- Public Health Agency of Canada. "Government of Canada announces details of new Public Health Agency of Canada and appoints Acting Chief Public Health Officer." News Release. May 17, 2004. [http://phac-aspc.gc.ca/media/nr-rp/2004/2004\\_01-eng.php?option=email](http://phac-aspc.gc.ca/media/nr-rp/2004/2004_01-eng.php?option=email) (accessed June 27, 2008).
- Public Health Agency of Canada. "Regions, Branches, and Centres." <http://www.phac-aspc.gc.ca/centres-eng.php> (accessed July 11, 2008).

Public Health Agency of Canada. “The Federal Strategy.” [http://www.phac-aspc.gc.ca/about\\_apropos/federal\\_strategy-eng.php?option=email](http://www.phac-aspc.gc.ca/about_apropos/federal_strategy-eng.php?option=email) (accessed June 21, 2008).

Public Works and Government Services Canada. *Commission of Inquiry on the Blood System in Canada (Krever Commission)*. <http://www.hc-sc.gc.ca/ahc-asc/activit/com/krever-eng.php> (accessed May 18, 2008).

Senate Standing Committee on Social Affairs, Science and Technology. *The Health of Canadians—The Federal Role*. October 2002. <http://www.parl.gc.ca/37/2/parlbus/commbus/senate/Com-e/soci-e/rep-e/repoct02vol6-e.htm> (accessed May 23, 2008).

Smolinski, Mark, Hamburg, Margaret, and Lederberg, Joshua eds. *Microbial Threats to Health: Emergence, Detection, and Response*. Institute of Medicine Committee on Emerging Microbial Threats to Health in the 21st Century, Board on Global Health. Washington, DC: The National Academies Press, 2003.

The SARS Commission. *Volume 1, Executive Summary - Spring of Fear*. Toronto: OMHLTC, December 2006. <http://www.sarscommission.ca/report/index.html> (accessed May 12, 2008).

The SARS Commission. *Volume 4, First Interim Report - SARS and Public Health in Ontario*. Toronto: OMHLTC, April 15, 2004. <http://www.sarscommission.ca/report/index.html> (accessed May 12, 2008).

Thompson, Donald F., Swerdlow, Joel L., and Loeb, Cheryl A. “The Bug Stops Here: Force Protection and Emerging Infectious Diseases.” Washington, DC: National Defense University, 2005. [http://www.ndu.edu/CTNSP/Def\\_Tech/DTP%2021%20Bug%20Stops%20Here.pdf](http://www.ndu.edu/CTNSP/Def_Tech/DTP%2021%20Bug%20Stops%20Here.pdf) (accessed July 20, 2007).

Trust for Americans Health. “SARS and Its Implications for U.S. Public Health Policy: We’ve Been Lucky.” <http://healthyamericans.org/reports/files/SARSreport.pdf> (accessed June 21, 2008).

U.S. Congress. “Pandemic All Hazards Preparedness Act.” <http://www.govtrack.us/congress/bill.xpd?bill=s109-3678> (accessed July 19, 2008).

U.S. Constitution. Amend. 10. [http://www.uscontitution.net/xconst\\_Am10.html](http://www.uscontitution.net/xconst_Am10.html) (accessed August 1, 2008).

- U.S. Department of Health and Human Services. “HHS Announces \$896.7 Million in Funding to States for Public Health Preparedness and Emergency Response.” News Release. July 17, 2007.  
<http://www.hhs.gov/news/press/2007pres/07/pr20070717c.html> (accessed, July 19, 2008).
- U.S. Department of Health and Human Services. “HHS Fact Sheet: Biodefense Preparedness – Record of Accomplishments.”  
<http://www.hhs.gov/news/press/2004pres/20040428.html> (accessed August 9, 2007).
- U.S. Department of Health and Human Services. “Organizational Text Chart.”  
<http://www.hhs.gov/about/textorgcht.html> (accessed July 7, 2008).
- U.S. Department of Health and Human Services. “Secretary Biography.”  
<http://www.hhs.gov/secretary/dhhssec.html> (accessed July 13, 2008).
- U.S. Government Accountability Office. *Public Health and Hospital Emergency Preparedness Programs: Evolution of Performance Measurement Systems to Measure Progress*. Washington, DC: GAO, 2007.
- World Health Organization. “About.” <http://www.who.int/about/en/> (accessed July 13, 2008).
- World Health Organization. “Governance.”  
<http://www.who.int/about/governance/en/index.html> (accessed July 13, 2008).
- World Health Organization. “Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003.”  
[http://www.who.int/csr/sars/country/table2004\\_04\\_21/en](http://www.who.int/csr/sars/country/table2004_04_21/en) (accessed April 24, 2008).
- World Health Organization. “Update 95 – SARS: Chronology of a serial killer.”  
[http://www.who.int/csr/don/2003\\_07\\_04/en](http://www.who.int/csr/don/2003_07_04/en) (accessed April 20, 2008).
- World Health Organization. *The World Health Report 2007 – A safer future: global public health in the 21st century*. <http://www.who.int/whr/2007/en/> (accessed September 23, 2007).
- Zhong, NS, Zheng, BJ, Li, Y M, Poon, LLM, Xie, ZH, Chan, KH, Li, PH, Tan, SY, Chang, Q, Xie, XQ, Xu, J, Lim DX, Yuen, KY, Peiris, JMS, Guan, Y. “Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People’s Republic of China, in February, 2003.” *The Lancet*, 362 (October 25, 2003): 1353-1358.

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