Abstract

This paper evaluates efforts to establish an integrated and functional countrywide epidemic detection and reporting system in Canada following the 2003 SARS outbreak. The purposes and products of epidemiologic surveillance are reviewed, as are the intersectoral and international dimensions of infectious disease control, and the ambiguity in Canadian law of related public health roles and responsibilities. An analysis of current networks, policies and programs, augmented by key-informant interviews, demonstrates that progress toward developing national real-time capacity in epidemic surveillance has been limited. Although a blend of disentangled and collaborative approaches to this issue was effective in developing consensus between levels of government on the need and agenda for coordinated changes in the pre-SARS era, as well as in the immediate aftermath of the crisis, the same intergovernmental strategy appears to have made little actual progress achieving such changes in subsequent years. Counterproductive respect for jurisdictional boundaries, limited resources at the Public Health Agency of Canada, and the use of weak policy instruments in pursuit of intergovernmental collaboration have done little to alter the reality that epidemic surveillance in Canada is characterized by duplication and

"*Long before SARS, evidence of actual and potential harm to the health of Canadians from weaknesses in public health infrastructure had been mounting but had not catalyzed a comprehensive and multi-level governmental response… SARS is simply the latest in a series of recent bellwethers for the fragile state of Canada's federal/provincial/municipal public health systems. 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*." (National Advisory Committee on SARS and Public Health, 2003, 11+64)

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activities ranging from detection, identification, and compulsory notification of certain diseases, to the maintenance of longitudinal disease-specific registries and the continuous or periodic population surveys, to the aggregation of data on consumption patterns and economic activity. The foremost objectives of health surveillance are similarly extensive, but, following the activities of the Public Health Agency of Canada's (PHAC), are in the main are to: monitor health trends; trigger interventions to prevent transmission or reduce the morbidity and mortality caused by disease outbreaks; identify threats to health and emerging diseases and high risk populations; improve understanding of health determinants and assess public health impacts; generate research for planning, resource allocation and service evaluation; and provide evidence for developing policies and empowering individuals.

As there is no single aim or model for health surveillance, systems must be fitted depending on the purposes they are designed to serve. Improving surveillance systems involves ensuring the use of methods with the appropriate sensitivity and specificity for the outputs desired. (e.g.: it is not an improvement to increase the specificity for an early-warning system if this introduces unacceptable delays in detecting, confirming, or reporting outbreaks). Accurate and timely facts about emerging patterns and trends of disease are vital not only for epidemic containment and pandemic control, but also for the formulation and evaluation of policies for the prevention and management of all types of communicable and chronic disease. (Teutsch & Churchill, 2000) The key point from the preceding is that surveillance is useful only to the extent that it is able to provide timely and accurate information that can guide interventions and underpin effective public health practice, planning, and evaluation at local, regional, national, and global levels.

2.2 Surveillance as an Inter-sectoral and International Responsibility

In the wake of the SARS epidemic, the importance of timely access to useful epidemiological data for effective public health action at all levels of jurisdiction was widely seized upon. It was also leveraged by a range of actors and institutions to seek the authority and resources to better coordinate their domestic and international activities with those in various other sectors, including trade, defense, transportation, food safety, and environmental protection. Canvassing the full array of subsequent proposals and connections is not appropriate here, but a brief review of three important linkages - in the areas of animal health, global public health governance, and emergency response - is needed to appreciate the extent of Canada's needs and obligations with regard to epidemic surveillance, and to set the stage for a more detailed evaluation in subsequent sections of this chapter.

As human and animal health are inextricably linked, and as agricultural practices and the global market for food products continue to contribute to the emergence of new infectious diseases at a rate of approximately one per year over the last three decades (Fauci, 2005; Morens et al, 2004), systems that integrate surveillance of disease in both human and animal populations are increasingly considered essential. The importance of effective surveillance for avian influenza, for example, has been well demonstrated in practice. A delayed response to an outbreak of an avian influenza virus of low pathogenicity in Mexico in 1992 led to its evolution into a highly pathogenic form that was not controlled until 1995. This delay resulted in a response at a considerably higher cost than would have been necessary if action had been taken when the outbreak first occurred (WHO, 2004). Delayed reporting, due in part to the limited capacity of

existing public health systems in affected countries to identify and confirm avian influenza in humans, is also widely considered to have contributed to the spread and scale of the currently expanding H5N1 influenza outbreak in both avian and human populations (FAO/OIE/WHO, 2004). Moreover, the World Bank warns that the degree of economic disruption caused by avian influenza viruses is directly related to how fast and how effectively control measures are implemented, and that detection and response delays can significantly multiply the health and economic impacts of an outbreak, particularly in developing counties (World Bank, 2004).

The main surveillance related development in the human-animal health link in Canada since SARS was the launching in October 2005 of the Canadian Animal Health Surveillance Network, a partnership between the Canadian Food Inspection Agency and the PHAC that is funded by the Federal Departments of National Defense and Public Safety. The Network's objective is to detect emerging animal disease threats in real time, with a focus particularly on animal disease with zoonotic potential, and on providing a rapid response to minimize the human health and economic risks to Canada. A combination of the laboratories of these two agencies perform expert microbiological reference testing and carry out research to improve Canada's capacity for identifying viruses and bacteria, often used to support surveillance and outbreak investigation. Much of this is done, under high-level biosafety containment, at the Canadian Science Centre for Human and Animal Health in Winnipeg, which houses both the National Microbiology Laboratory and the National Centre for Foreign Animal Disease. Testing for infectious diseases at the human, animal and environmental interface is also performed at PHAC's Laboratory for Foodborne Zoonoses in Guelph and at units in St. Hyacinthe, Quebec and Lethbridge, Alberta. The Network was designed to deliver a national early warning system, laboratory diagnosis, and information sharing on animal disease threats by the end of 2008. However, interviews (particularly those with provincial public health officials) revealed that such an achievement would be of limited practical value since the network currently relies on intermittent rather than

of technical assistance needed to improve laboratory, surveillance, and outbreak response to pandemic influenza in border areas and at national levels.

2.3 Enhancing Surveillance on the Canadian Political Agenda

Although SARS clearly raised the public and political profile of infectious disease surveillance, multiple warnings had been issued prior to 2003, and the importance of national level health surveillance information had been recognized in Canada long before then. The necessity of such information for effective policy-making, for example, was noted at least as far back as the Lalonde report in 1974. The necessity of such information for health protection was highlighted by numerous governmental audits and reports beginning in the mid 1990's. Most notable among these, prior to SARS, are the reports of the Krever (1997) and Walkerton Commissions (2002), and the federal Auditor General reports of 1999 and 2002. Recommendations related to health surveillance were also found in two major federal reports on health care released in 2002, the Standing Senate Committee on Social Affairs, Science and Technology Study on the State of the Health Care System in Canada (the Kirby Report) and the Royal Commission on the Future of Health Care in Canada (the Romanow Report). Recommendations to improve population health infrastructure and strengthen public health capacity in order to facilitate the collection and analysis of accurate and comprehensive public health information for research, evaluation, and policy purposes were also made by the CIHR Institute of Population and Public Health (originally produced in 2002, revised and republished in 2004).

The place of epidemiological surveillance on the Canadian political agenda has also evolved in tandem with advances in information technology over the last 15-20 years. Such advances have played a significant part in encouraging and facilitating the drive for improved health information, often in conjunction with the assertion that health policy and program decisions should be based on the best available evidence. In particular, electronic technologies hold the promise of timely if not real-time access to more complete and standardized information sources, sources that over time may be able to provide the longitudinal data necessary to more effectively monitor and improve population health. Responding to the opportunities inherent in new technologies, Health Canada, PHAC, and provincial and territorial health ministries have been investing since the early 1990's in the development of new electronic systems for the secure flow of information among the various sectors involved in public health, and particularly in the development of standardized networks for electronic patient health records (EHR) so that health care providers can access patients' clinical records from multiple sources. A selective review of the initiatives and products of such investments related to infectious disease surveillance will be undertaken in the following section where current public health information and infrastructure networks will be presented in more detail.

The appearance of surveillance as a significant item on the Canadian intergovernmental agenda appears linked to the crisis in the safety of the Canadian blood supply system during the mid 1990's and, more generally, to perceived gaps in Health Canada's ability to conduct public health surveillance and protect the public from preventable disease and injury. The number and severity of transfusion-acquired infections between the mid 1980's and the mid-1990's led to recommendations for enhanced health information activities in both the 1997 Report of the Krever Commission on blood safety and the 1999 federal Auditor General's report (Wilson,

2003). The Krever Commission recommended "strengthened surveillance by public health authorities at both the federal and the provincial-territorial levels of infectious diseases, including those that are blood-borne" (volume 3, chapter 39, Recommendation #49, pg. 1073). The Auditor General recommended that Health Canada strengthen its ability to conduct timely health surveillance in collaboration with provinces and territories to better protect the health of Canadians from threats such as infectious and chronic diseases and unsafe consumer products (Chapter 14).

Three years later, a follow-up by the Auditor General of Canada noted that limited or no progress had been made in resolving most of the weaknesses identified it the 1999 report, and that national surveillance continued to be weak, untimely, and incomplete (Chapter 2). Noting the lack of FPT agreement on roles and responsibilities (particularly on data sharing and common standards), and the failure to formally establish surveillance priorities or provide adequate funding to support them, the 2002 report concluded that the federal capacity to "anticipate, prevent, respond to, monitor, and control diseases" was compromised (page 1). Continued collaboration and cooperation "among all the partners in health surveillance" was recommended, particularly with regard to the Canadian Integrated Public Health Surveillance (CIPHS) program, an integrated software and database application for the standardized reporting of clinical and laboratory generated infectious disease data that continues to this day to be managed by FPT representatives. Progress by the program in contributing to a pan-Canadian public health information management solution was deemed "regrettably slow" by Ontario provincial authorities examining the SARS crisis less two years later, in 2004, principally because the implementation of the lead component of the system, the Integrated Public Health Information System (iPHIS – see the following sections for details), did not create any actual cross-jurisdictional linkages, resulting in autonomous systems operated in provincial or territorial "silos".[ii] No consideration of alternative or complimentary policy instruments or strategies was provided in the 2002 Auditor General of Canada report, which concluded that "an established approach to national health surveillance is still many years away" and expressed concern that new comprehensive approaches were being adopted without specific timelines and independent of existing surveillance activities rather than incrementally within current systems (6-7).

Similar concerns were found that same year, 2002, in two high-profile federally-commissioned reports on the financing, organization and delivery of health care in Canada, the Commission on the Future of Health Care in Canada (Romanow report), and the Standing Senate Committee Study on the State of the Health Care System in Canada (Kirby report), both of which discussed the importance of infectious disease surveillance. Whereas the Kirby Report discussed the importance of developing an integrated local infrastructure, the Romanow Report emphasized the importance of supporting international initiatives, including health surveillance in low-income countries, to reduce the risk of communicable diseases spreading to Canada. In fact, the Romanow report did not specifically discuss existing or potential national public health surveillance initiatives, instead recommending that Canada use its expertise to assist foreign governments and international agencies in the detection and prevention of the international spread of diseases, particularly by working "…with the World Health Organization to strengthen and renew the International Health Regulations on monitoring and containing communicable diseases" (240).

cooperation and the complete lack of any preparedness or any existing system to ensure an effective flow of information during a crisis. … There was a damaging combination of problems: lack of information systems, lack of preparedness, lack of any federal-provincial machinery of agreements and protocols to ensure cooperation, all possibly overlaid by a lack of cooperative, collaborative spirit in some aspects of the Ontario response. … If a greater spirit of federal-provincial cooperation is not forthcoming in respect of public health protection, Ontario and the rest of Canada will be at greater risk from infectious disease and will look like fools in the international community" (Campbell, 2004, 67-68 + 16)

"*Either memoranda of agreement or legislative arrangements should be developed among Health Canada and all P/T jurisdictions laying out protocols covering all aspects of the conduct of the management of significant outbreaks [including] adoption of highly flexible and interoperable data platforms that allow sharing of public health information.*" (Naylor, 2003, 112)

"*Many of the barriers that impeded the deployment of timely and effective surveillance during SARS are long-standing systemic issues. Left unresolved, they will impair the ability to both detect and respond effectively to a future outbreak. A robust real-time surveillance and early warning system, using global, national, and local epidemiology was lacking… It is of paramount*

In light of how the SARS outbreaks occurred, the Naylor Report also recommended federal support for nosocomial infection control and real-time alert systems linking public health and clinical information systems, including hospital surveillance as a priority program, and the reclassification of specific infections as nationally notifiable, with surveillance for them supported by mechanisms for active and passive laboratory surveillance. The negotiation of intergovernmental agreements for the collaborative surveillance of infectious diseases and response to outbreaks and other public health emergencies, the establishment of a working group to assess the capacity of existing public health infostructure to be transformed into a pan-Canadian system, and the development and funding of training programs and tools to support local public health agencies in systematically developing, implementing and evaluating crisis and emergency risk communication strategies, also featured among the key intergovernmental strategies put forward in the report. To complement surge capacities in all domestic jurisdictions as well as globally, the Naylor Commission advocated for the creation of an FPT Network for Emergency Preparedness and Response and of two fully-equipped and immediately deployable national epidemic response teams, as well as significant enhancement of the federal mechanisms for international technical liaison, particularly with the World Health Organization and the US Centers for Disease Control and Prevention.

Finally, and on the question of legislative renewal for public health, the Naylor Report advised the Government of Canada to embark on a time-limited intergovernmental initiative to review and renew the legislative framework for disease surveillance and outbreak management, and to harmonize emergency legislation governing the management of public health emergencies. It qualified this, however, by noting that if "*a coordinated system of rules for infectious disease surveillance and outbreak management cannot be established"* through existing FPT collaborations and the recommended intergovernmental legislative review, then the federal government "*should initiate the drafting of default legislation to set up such a system of rules, clarifying F/P/T interactions as regards public health matters with specific reference to infectious diseases*." (Naylor, 2003, Recommendation 12B.6, 216) The Naylor Report also urged the launching both of a comprehensive review of the application of the Protection of Information

depending on “the nature and scope of the health problem in question” (Ries in Bailey, Caulfield & Ries 2008, 10). This has resulted in a very thick legislative and regulatory framework for surveillance related activities in Canada. For example, a legal inventory updated in 2005 of all relevant federal, provincial, and territorial statutes and regulations governing infectious disease control, (excluding case law, international regulations, and the internal policies of infectious disease agencies) runs to more than 600 pages. (Lacroix et al, 2003) Much of the following information is drawn from that comprehensive survey.

With regard to public health in general, the federal government can invoke its exclusive authority over “Quarantine and the establishment and Maintenance of Marine Hospitals” (s. 91 (11)) to regulate all aspects of infectious diseases (Attaran & Wilson 2007; Ries 2005). It can also invoke its exclusive authority over criminal matters (s. 91 (27)), the census and statistics (s. 91 (6)), Indians and lands reserved for the Indians (s. 91 (24)), naturalization and aliens (s. 91 (25)), and in matters of national defence (s. 91 (7)) should bioterrorism become a concern or if support from the Royal Canadian Mounted Police or Cana

much of the foregoing was drawn conclude that what is clearly not in place at present is a "*simple, clear and transparent legislative regime*" governing the intergovernmental management of infectious disease in this country (Lacroix et al, 2005, 40).

3.0 CURRENT SYSTEMS, DESIGNS & INITIATIVES

The *de facto* Canadian operational system for the detection of domestic outbreaks consists of five components: the clinical health care system, local/territorial/provincial health agencies, federal agencies, academic/professional organizations, and collaborating governmental and private organizations and service providers. All five components of the system participate in aggregating, analyzing, and sharing surveillance data. The current Canadian approach to detection of disease outbreaks in particular is complex and involves many organizations interacting in a loosely connected, informal but increasingly collaborative manner, although clinical health care providers, local public health units, and provincial health departments and ministries remain the key levels at which detection of domestic outbreaks occurs. A complete environmental scan of all relevant actors and networks lies beyond the scope of this project (but see NCCID Foresight Exercise, 2005), and thus only those directly involved in epidemic detection and outbreak response coordination across jurisdictions, with an unambiguously intergovernmental composition or mandate, or with an actual national or international scope of operation, will be reviewed here.

It is noteworthy that despite the importance of a national surveillance network and the repeated calls for its development, the current situation in Canada continues to be one that consists of a patchwork of health surveillance systems that continues to suffer from substantial gaps, both individually and as a whole. These gaps occur across the entire spectrum of surveillance functions (data collection, transmission, aggregation, analysis, interpretation, and dissemination) and organization, and are particularly acute when it comes to data sharing agreements, information technology and management infrastructure, uniform data quality and reporting standards, emergency response coordination, and the lack of a mandatory operational common list and coding nomenclature for notifiable diseases (despite the recent release of voluntary national standards to this effect), not to mention stable funding for the development of each of these priorities. Moreover, there are at present, despite numerous recommendations to set hard deadlines, few specific timelines for the implementation of a national surveillance network or the intermediate steps required to create such a system. Indeed, fixed functional objectives or chronological targets tend often to be conspicuously absent from the formal documents and proposals of Health Canada, PHAC, and other FPT bodies, perhaps because where they have appeared in the past, they have so rarely been met. Some progress, however, has recently been made in proposing health information and technology standards, as well as in creating, or recombining and reorienting, various coordinating mechanisms for FPT collaboration on this issue. Formal legal and policy harmonization or integration, however, despite the creation of a national public health agency post-SARS, remains largely unachieved, and most day to day operations are facilitated through a variety of informal professional contacts and networks rather than through the formal agencies and mechanisms of Canadian intergovernmental relations. Paradoxically, Canadian public health officials at the local level may, as a result of the informal professional networks and automated media-scanning services described below, have better

The Pan-Canadian Public Health Network, also formed in 2005, is where FPT collaboration on the day-to-day business of public health in Canada is conducted by a number of Expert Groups. Initially promoted by an FPT Special Task Force on Public Health as "a new way for different levels of government across Canada to work together", the Network provides "policy and technical advice to FPT Deputy Ministers of Health on public health matters" as well as support for jurisdictions "during emergencies and/or crises". Governed by the provincial and territorial Chief Medical Officers and the Chief Public Health Officer for Canada, its objectives are to negotiate intergovernmental agreements on public health issues between jurisdictions, to delineate roles and responsibilities for how different levels of government will work together on public health issues, and to develop a common approach to public health legislation that will help ensure consistency in the public health laws across the country. The Pan-Canadian Public Health Network's Surveillance and Information Expert Group (SIEG) provides coordination and leadership for public health surveillance, information collection, analysis and sharing across Canada, and was instrumental in drafting a Memorandum of Understanding on the timely sharing of information in preparing for and responding to a public health emergency, although this agreement has yet to be formally approved by FPT officials.

3.1.2 Canada Health Infoway Inc.

Created with a $1.2B federal capitalization in 2001 and managed as a foundation through Health Canada by way of conditional grants, Canada Health Infoway (CHI, but hereafter "Infoway") was designed to convert the consensus that IT must be a central role approach to renewing the healthcare system into the development and implementation of a national electronic health record (EHR) system. Infoway was created as an independent, shared-governance corporation, and is based on a collaborative approach since its members are the Deputy Health Ministers from the federal, provincial and territorial governments. Infoway's mission is to develop and foster the adoption of electronic health information systems with compatible standards and communications technologies on a pan-Canadian basis, and it aims to put into place an Interoperable electronic health record system across 50 per cent of Canada (by population) by the end of 2009. It does not collect, store, or analyze any public health data.

Although Infoway was not originally mandated to develop public health surveillance solutions, when SARS and the reports that analyzed the crisis showed a need for such systems, a further funding agreement between the Government of Canada and Infoway was signed March 2004, which provided $100M for the development of health surveillance systems over a five-year investment timeframe, with a specific mandate to support the management of infectious diseases and immunization. The agreement stipulated specifically that Infoway construct a bilingual national health surveillance system consistent with EHR solution architecture and that the funds be invested in development & implementation of the solution (on an 80/20 Infoway/jurisdictions cost-sharing basis), not operation & maintenance. Interviewees reported that the move surprised many people at both PHAC and Infoway, since the expectation of many was that the former was the more logical choice to receive the new funding, since it was actively rolling out its own iPHIS platform across the country at the time. In the event, the terms of the agreement specifically excluded Infoway from investing in any existing federal public health programs or

recent electronic sources of information, all of which provide some ability to communicate and share data, although with varying degrees of accessibility, formality and depth of detail. Although a full inventory of these tools cannot be provided here, a brief sketch of those most commonly consulted by Canadian professionals involved with epidemic surveillance is provided here, including the Global Public Health Intelligence Network (GPHIN), the Program for Monitoring Emerging Diseases (PMM), and the PHAC's main information management platform for collaboration, surveillance, alerting and response, the Canadian Network for Public Health Intelligence (CNPHI).

3.2.1 The Global Public Health Intelligence Network

Developed in the mid 1990's by Canadian Health officials and now maintained by PHAC in collaboration with the WHO, The Global Public Health Intelligence Network is a secure, internet-based early-warning system for detecting potential public health threats worldwide by continual monitoring of over 10,000 global media sources in nine languages. The Network gathers relevant information by monitoring media sources throughout the world and makes this information available to governments and non-governmental organizations. The post-SARS reports all noted that the Global Public Health Intelligence Network received a Chinese-language news report with an English header of a flu outbreak in mainland China on November 27, 2002, but that the full report was never translated. The result was that Health Canada officials did not become aware of the new disease until several months later, along with the rest of the world, in

participate in on-line discussions, respond to requests for information, and collaborate together in outbreak investigations and prevention efforts.

Because individual clinicians and public health officials often post unusual occurrences of infectious disease on Pro-Med Mail, the Naylor Report concluded that the initiative constitutes an informal and useful back-up system to more official channels (Naylor, 2003, 93), and interviewees confirmed that local public health officials and hospital infection control staff frequently consult Pro-Med Mail, and that most local public health units have at least one or more staff members who subscribe or monitor Pro-Med Mail alerts. Interestingly, and perhaps tellingly, this use within the Canadian public health community was regarded by numerous respondents as crucial to their being able to stay current not only with international outbreaks, but also with domestic public health events, and particularly those occurring outside the region or province in which they work. Several interviewees also noted that they rarely rely on any single source of near real-time national or international epidemiological information, and that they regularly consult all the sources to which they have access when seeking details on any particular outbreak.

3.2.3 The Canadian Network for Public Health Intelligence

The Canadian Network for Public Health

and adverse events following immunization components, which excludes such outbreak-prone pathogens such as nosocomial and sexually transmitted infections, and syndromic surveillance information. It also lacks, unlike many existing provincial alert systems, connections with public and private non-public health authorities such as law enforcement, military, industry, and transport agencies and firms, as well as more dynamic emerging resources for decision-making such as predictive modeling and mapping and outbreak simulation tools. Broader intergovernmental and cross-jurisdictional integration, as well as more advanced collection and processing of surveillance data, and dissemination of strategic information, is thus necessary if the Canadian Integrated Outbreak Surveillance Centre is to achieve the coordination of responses necessary to meaningfully address potential health threats, and this is indeed the long-term strategic plan and vision for the network.

4.0 Descriptive Analysis: Federalism's Impact on Surveillance in Canada

The forms of federalism operating in epidemic surveillance, despite being somewhat less than a simple fit with this book's analytical framework for public health federalism, are described in Table 1. The federal/provincial relationship is largely interdependent, even if characterized by islands of independence, and is at present largely non-hierarchical. Thus the form of federalism that best describes national epidemic surveillance in Canada is a complex of mix disentangled and collaborative relations, which fluctuates according to events and to shifting priorities, and is muddled by latent and as yet unexploited potential coercive capacities. The relationship of supranational governments, specifically the World Health Organization, with the federal government is primarily collaborative with an element of coerciveness/hierarchy, particularly when it comes to standards and information dissemination. In day-to-day practice, health surveillance of infectious disease outbreaks has also recently come to be characterized by a certain degree of innovative local-local and inter-regional collaboration, in recognition of the need for functional interdependence, although these relationships are very deliberately voluntary and non-hierarchical. The distinction between routine activities and crisis response is also relevant since the degree of coordination required is far greater when responding to a public health emergency. As a result, each order tends to work relatively independently and within its formal legal jurisdiction when work is unexceptional, but tends to engage in less formalized and more interdependent behavior during a crisis, which may be regarded by lower orders as creating more coercive conditions under which a stricter hierarchy is imposed.

Table 1. Form of Intergovernmental Relationships in epidemic surveillance

	Interdependent?	**Hierarchical?**	**Relationship**
Supranational-Federal	Y, but some new international coercive powers constrain national sovereignty	N, although WHO has limited capacity to impose policy obligations on F	International collaborative, with potential for some limited int'l unilateral
Federal-Prov/Terr.	Y, but weakly, since little F interest in forcing important PT changes	N, but F likely has capacity, even if chooses not to use effectively against PT	F-P/T concurrent

(including policy making, standard setting, and program development), which often has of necessity a more collaborative intergovernmental character, and policy implementation and practice, which are ı ıctivities that may take place with minimal oversight from higher governmenta

Table 2. Roles and l lifferent orders of government in epidemic surveillance (excluding special p

		Prov/Terr		Supranational
l				
s setting				

Indeed, numerous interviewees at both federal and provincial levels noted that that MOUs (which are also on occasion referred to as Letters of Agreement, although there is no clear distinction between these with regard to legal status) appear to be the new primary approach in Canada toward ensuring intergovernmental collaboration in public health generally, and in epidemic detection and response specifically. For example, an MOU on mutual aid during emergencies, including outbreaks of infectious disease and other risks to health, was signed by provincial Deputy Ministers of Health in late 2006 and finalized the next year. That agreement, however, revolves principally around the issue of accreditation, and represents a mutual pact among provinces to recognize the professional qualifications of health professionals such that they can work outside of the jurisdictions in which they are normally employed. In contrast to the more far-reaching US Emergency Management Assistance Compact, however, the MOU on Mutual Assistance has not been accompanied by the development of a dedicated communications network to facilitate alerting, data sharing, response, and accounting activities does, and does not include any agreements relating to cost-recovery and cost-sharing. (See: www.emacweb.org Feb 28, 2009) The EMAC is also decidedly more comprehensive than the Canadian agreement in that it delineates formal

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duties

This raises an interesting departure from the conceptual model of public health federalism employed in this book, however, since it suggests that the impetus and justification for resolving an impasse in terms of domestic intergovernmental collaboration on epidemic surveillance is at least in part due to the coercive nature of the relationship between supranational and federal authorities. Indeed, the WHO now clearly constrains the scope of national sovereignty with regard to potential health emergencies (Heymann, 2006), and the obligations and operations of the revised IHR now clearly compel the government of Canada to formulate policy in an area over which it has formerly held only partial and uncertain jurisdiction. This suggests that there is now some degree of concurrent responsibility for health surveillance that spans not just the orders of domestic government, but externally to other foreign governments and agencies, as well as to international authorities. This additional level of concurrency was of course in an important sense self-imposed, given that federal negotiators and representatives at the World Health Assembly participated in the formulation and adoption of the new rules and requirements, apparently with at least tacit provincial and territorial approval, since official letters of support were said by federal officials to have been sent by a majority of the provinces and territories to the then federal minister of health, although these have not been released to the public. But it remains the case that the domestic availability of policy options is being determined at least in part by the parameters of emerging international law.

Those parameters, moreover, run directly against the character of FPT activities in this area both pre and post-SARS. Indeed, two conflicting forces currently constrain federal policy discretion and instrument choice for the creation of an integrated national epidemic surveillance system: provincial/territorial reje

Officer, in addition to not protected from dismissal without cause, has no clear authority to report autonomously and directly to the public or to parliament, both of which subject the practice of public health in Canada to what many interviewees (and nearly all of those not in the employ of the agency) regard as unacceptable as well as potentially de-legitimating levels of political interference.

To be fair, some of this lack of overarching corporate strategy within the PHAC may be due to the impetus under which the agency was created: a series of high profile health crises (including the tainted blood scandal, numerous water and food-borne disease outbreaks, and the SARS epidemic), each of which sparked high-profile investigations. Although the conclusions of the reports generated by such investigations contributed to the federal government decision to create PHAC, the weakness of such reports is that their very comprehensiveness generates a long list of deficiencies and a complicated, often overlapping, set of recommendations designed to be implemented as a whole. Given the lack of financial and strategic clout at the PHAC, however, as well as the need to demonstrate competency through the rapid production of deliverables, the agency was somewhat predictably forced to select a small number of narrow key issues for priority focus, to the detriment of much system-level thinking or systematic reform planning. Moreover, because most policy change is incremental, but even incremental change in public health in Canada is largely in the hands of provincial and territorial deputy ministers of health, the ability of PHAC to search for common problems and propose comprehensive solutions is further constrained. The concentration of public health policy power in the hands of non-federal political leaders operating under very little public scrutiny is thus itself a key obstacle to the achievement of anything other than minor incremental changes to the key public health policies, practices, and institutions.

5.1 Policy & Economic Effectiveness

It thus remains the case that, in practice, few significant improvements have been made to the

much real operational authority, since nearly all sensitive international communications continues to occur through Health Canada's International Affairs Unit rather than at PHAC. On a related note, the only public indication that work has commenced on an assessment of national ability to comply with the new international regulations, due by June 2009, was made available in a summary of the "Surveillance Strategy Framework 2007-2012" (itself not made public). The summary, which appears to be a point by point response to the scathing 2008 report by the federal Office of the Auditor General, announces the anticipated release of an "Action Plan" on "how Canada plans on meeting its international obligations under the IHR" in December 2009. (PHAC 2008) Interviews confirmed that PHAC quietly began a review of the agency's readiness, as well as provincial, territorial, and major international points of entry capacities to comply with the new surveillance requirements, in 2008. Interviews also however revealed evidence that the federal government has been and remains aware of the gap between its new international commitments and its ability to comply with them, since it actively limited communication and consultation between the International Affairs unit of Health Canada and the PHAC when it came to Canadian representation at the World Health Assembly meetings in 2007, at which the entry into force of the revised IHR was discussed. In fact, the federal Ministerial decision was initially to send a very small team to Geneva for those meetings, one that excluded even the Chief Public Health Officer of Canada and all of the provincial and territorial Chief Medical Officers of Health, although the former did in the end get invited to be part of the Canadian delegation. This suggests a considerable awareness at the federal level of the extent of the lack of policy effectiveness in the area of outbreak surveillance, as well as a deep reluctance to include high profile or non-federal authorities within traveling negotiating delegations, presumably since they may be more likely to mention existing weaknesses in the Canadian network to an international audience. The disconnect between the domestic reality and the projection of Canadian image internationally is further demonstrated by PHAC's collaboration with WHO in developing a tool for assessing legal capacities to comply with the IHR, and the agency's involvement in applying the tool in various been Caribbean region countries, all while glossing over the weaknesses of Canada's own legal infrastructure to meet the new global epidemic surveillance standards.

by March 2009 a privacy framework, a data sharing agreement for emerging diseases, and national surveillance principles. This deadline was not met.

Although it is very difficult to disaggregate from the operating budgets of various agencies and offices of intergovernmental affairs the amount of public money that has been spent on national epidemic surveillance coordination activities since 2003, interviewees' estimates were most often in the range of $20-30 million (all direct FPT sources combined, but excluding exclusively provincial or territorial capacity or infor

agency's fledgling autonomy and authority, by shifting the mandate for developing a national infectious disease surveillance IT solution to Infoway. Whatever the merits of the iPHIS and Panorama systems as they currently exist, it was clear in 2004 that the former had many advances and advantages (not the least that it was the product of former FPT collaborations, and that the intellectual property rights for the system were and remain owned by the PHAC), and that the latter would have to start from scratch and duplicate much of the iPHIS work on standards and platform development, which would subsequently become the property of a commercial contractor, IBM.

A further demonstration of the extent to which PHAC was marginalized by Infoway, and was unable to defend itself, is the fact that when it became clear that Panorama would be lacking an alert functionality by the end of the 2007 commercial contract deadline, work on developing the alert module was halted altogether, and negotiations began between IBM and PHAC on integrating Panorama with CIOSC, the existing national alert system. The intellectual property rights to CIOSC, however, were held by PHAC, which sought to open a discussion of the royalties such integration might generate. Talks stalled almost immediately, and coordination with Infoway faltered. To resolve the impasse, Infoway unilaterally (that is, without consulting with PHAC) negotiated with IBM approximately $3 million worth of concessions on behalf of PHAC.

Moreover, Infoway appears to have imposed further costs on the PHAC given how it is structured. Since it is composed largely as an informatics group, and as such possesses little in the way of population health knowledge or of the means and ends of surveillance, it quickly became apparent that the formation of advisory committees, staffed by substantial numbers of federal and provincial agency employees available to consult with Infoway managers and programmers, would be necessary. However, it was those agencies and ministries, rather than Infoway itself, that were required to absorb the costs related to such consultations, and the PHAC is estimated to have provided human resources support to Infoway equivalent to $1M per year from 2003 onwards.[vi]
Finally, all of this occurred simultaneously with significant reductions in federal Treasury Board funding for existing PHAC program support, and not

reporting), which is the only module the province was directly involved in developing and pilot testing. It is highly unlikely that Ontario will choose to adopt any other modules any time soon[vii], and many other jurisdictions appear to be similarly reticent, or committed to adopt only the modules most suited to the gaps in their existing system. Nova Scotia, for example, even suspended its plans for a scoping project to estimate and fix the costs for implementing Panorama, for what appears to be at least three years, by removing in mid-2007 the requirement for these from a Request for Proposals that it had made public earlier that year. In fact, at the time of writing, Newfoundland & Labrador is the only jurisdiction that is preparing to adopt both the Communicable Disease Case Management and the Outbreak Management modules, which were the functional areas that served as the very raison d'être for development of Panorama. That province is not yet, however, preparing to adopt the Notifications module, which means that even if the two modules prove to be a success within that province, the information captured will not be automatically available to any other jurisdictions, and will thus have to be transferred manually at the discretion of provincial officials. This is precisely the same situation that existed when SARS struck, and exactly the weakness that Infoway was supposed to overcome.[viii]
The fundamental point here is that Infoway has generated a product, but a product that may or may not meet public health needs and thus leaves very uncertain provincial and territorial uptake and national readiness, as well as the policy and economic effectiveness of the substantial investments required for its development and implementation.[ix] In this regard, it is particularly revealing that Infoway's initial mandate was to have its infectious disease surveillance solution implemented and fully functional in 50% of the country by the beginning of 2009, despite the fact that iPHIS had achieved that mark by the end of 2005, when Ontario implemented the system province-wide.[x] Instead of building on an existing system that had taken a decade to put into place across half the country, with a reasonable goal of achieving implementation or at least interoperability in the coming years for the other half, Infoway's decision to start from scratch on a new platform thus essentially set back the clock, perhaps by yet another decade, due to the disincentives to being an early adopter of such technologies. Indeed, each jurisdiction is free to choose which, if any, of Panorama's modules it want to pilot or implement, on any timeframe it chooses. As a software application package only, but one that was designed expressly to be state of the art, Panorama requires advanced information technology and communications hardware (including broadband connections, a major issue for remote and northern public health units) and is as yet not backward compatible with an estimated 75% of the computer systems and databases currently in use in local public

collaborative federalism as the dominant approach to the matter. Unfortunately, since there is only a very sporadic and diffuse public interest in this sphere, transparency on the matter is also very low, with no public interest groups coalescing around the need for improved epidemic surveillance, and low general awareness of the gaps, needs, and quality of recent policy responses. Moreover, what public concern does exist related to epidemic surveillance appears to be much more focused on the protection of the privacy of personal health information rather than on the effectiveness of national capacities. [xi]

Policy making for effective national epidemic surveillance may thus be a species of "policies without publics", which are characterized as being both "particularly problematical for democratic governance", and as having a high potential to "fall flat due to lack of momentum" (May, 1991, 196 & 198), both of which are substantiated by this research. This is further exacerbated by the muddled legal roles and responsibilities for conducting health surveillance and sharing information, which disperses accountability among government orders for the ongoing failures and structural weaknesses described above. Indeed, although in principle most lines of formal political accountability within the federal government point to the PHAC (and, by virtue of the status of that agency within the government of Canada, to the federal minister of health), such lines are at law and in surveillance practice rather unclear. Democratic accountability for the failure to specify roles and responsibilities, and for the state of national epidemic surveillance capacity, thus remains overall very low, and may result, in the event of another emergency or crisis such as SARS, in the same sort of confusion and lack of cooperation that led to the type of suboptimal response, at all levels of government, to that situation in 2003.

The form of intergovernmental relations that was thus such a failure during SARS – a largely disentangled type of collaborative federalism showing high respect for formal jurisdictional divisions and provincial unilateralism – remains the strategy today when it comes to public health reform generally and the development of a national epidemic surveillance system specifically. The federal government appears intent to avoid taking any measures that may be perceived as an invasion of provincial public health sovereignty, and provinces at present retain ownership of all information captured by health professionals in their employ, subject to non-compulsory requests from federal authorities. Moreover, the manner in which provinces have been able to band together to impose constraints on the use of federal spending to develop and implement new public health initiatives raises questions about the effectiveness and equity of such investments. Indeed, although such projects are generally subject to ongoing ad-hoc cost-sharing negotiations, most end up with some form or another of a per capita disbursement formula. This sort of equal targeting of funds may be the most politically palatable, but it is far from ideal from a public-health perspective, since surveillance is a weakest-link type of public good, which means that investment in capacity building should reflect system needs by being concentrated in the areas and regions where there are the greatest deficiencies or risks, rather than dispersed equally across the provinces and territories regardless of their current capacities.

Experts questioned about potential future intergovernmental progress on epidemic surveillance were in the main pessimistic that much will change, despite their own convictions that the magnitude of the infectious disease threat and the urgency of the task of creating a national system justify an alteration of the form of federalism operating in the area public health reform. Much of this pessimism seems related to the current venues for ongoing intergovernmental

6.0 CONCLUSIONS

"*Provinces and territories are deeply suspicious of the feds, and the feds are deeply contemptuous of the provinces and territories. They both have a case.*"

Thus the response to the SARS crisis is considered by many to be the "wake-up call that was never answered" (Foresight, 2005, 21), since if ever the necessary reforms and renewals were going to happen, they stood the best chance of emerging and being consolidated during the 2003-2008 time period that was the focus of this research. That disentangled collaborative intergovernmental relations have not lead to a functional and integrated national epidemic surveillance system, despite the fact that there are now national standards for notifiable diseases surveillance and reporting, and despite the priority accorded by nearly all FPT players to integrating such activities and data across the country and with other national public health agencies and with international bodies, is more than ample evidence that a new approach is required.

The irony of such a conclusion is unfortunately rich, since the decade preceding the SARS crisis (1992-2002) was characterized by relatively cooperative FPT relations which made of it a relatively productive period for public health innovation and diffusion of policy, practice, and technology. As one expert interviewed pointed out: "*There had been much less fed bashing during the 1990's, and as a result, people just quietly went ahead and did it and shared it* [conducted health surveillance, informally transferred data, and contributed expertise to the development of health surveillance information systems platforms such as GPHIN and iPHIS]". The window of opportunity to implement the fruits of this period of collaboration, however, may be closing, and the opportunity to achieve national surveillance integration wasted, despite the fact that Canada has made important contributions to global public health surveillance and has witnessed important sub-national innovation (particularly in BC, Alberta, Ontario and Quebec).

Moreover, the policy trends that bring with them a few minor promising indications, notably the allocation from the 2006 federal budget for pandemic preparedness of resources necessary to fund approximately 30 new public health positions within provincial ministries/agencies (most of whom are supposed to be epidemiologists charged with forming the foundation for surge capacity and pandemic influenza response, including surveillance and communication duties), are largely more of the same sort of time-limited ersatz collaboration that this chapter has demonstrated have failed to achieve their stated goals. The same can be said of the 2007 announcement of an additional $35M (out of another $400M for pandemic preparedness provided to Infoway from the federal budget) to be dedicated to Panorama implementation in the provinces and territories, since this amount is clearly insufficient relative to the task at hand.[16]

More damning still is that few jurisdictions appear to be currently interested in adopting the Panorama modules that are crucial to the creation of a truly national capacity to detect, monitoring, and respond to outbreaks of epidemic prone diseases. Overall then, little progress has been made towards the creation of an effective national epidemic surveillance system since SARS. Worse still, there may be sufficient evidence to predict that organizational shifts and investments since 2003 are likely to further delay the implementation of an integrated operational countrywide solution, not implausibly for as long as another decade.

Whether the ripples from increasing academic, public, and public health community scrutiny of the effectiveness of public health reforms post SARS, and from the voluntary imposition of demanding new international regulations for national surveillance activities, become waves of change further down the domestic orders of government will depend in large measure on the

federal government's choice of policy strategies over the next few years.[17] The potential strategies range, in order of increasing policy coerciveness, from issuing guidelines (an option that is the least intrusive on provincial jurisdiction), to seeking intergovernmental agreements, to providing conditional funding, to adopting new regulations or legislation (Wilson et al, 2008). The evidence presented in this chapter suggests that a combination of the first three strategies has been pursued in the post-SARS period, and will continue to be pursued, but that that combination has been of only limited effectiveness. Resorting to new federal statutory law appears unlikely for the foreseeable future, particularly given the demonstrated preference of the Harper government for decentralized approaches that eschew a strong federal role for national social or health policy programs. [18]

Another possible federal unilateral approach could seek to exercise administrative control over certain elements of surveillance policy implementation through its own network of PHAC field offices across the country (the six existing but very low profile regional stations), in combination with the agency's regulatory powers. Indeed, the groundwork for passing new federal regulatory law, under the PHAC authorities contained in Bill C-5 passed in 2006, is currently being explored, but little additional information is currently available about the scope and content of the project. Moreover, this would be a significant about-face for the agency, which thus far in its history seems hampered both by provincial reluctance (and de facto ultimately beholden to the Provincial Assistant Deputy Ministers of Health, since the Pan-Canadian Public Health Network is not ultimately a decision-making body, but an advisory one) as well as by bureaucratic politics within the federal government, and notably by its lack of independence from Health Canada and the federal Minister of Health.

In the short term then, and with the objective of securing the transfer of epidemiological information relevant to the confirmation and control of public health emergencies, and beyond the insufficient implementation monies already committed by Infoway, the federal government should consider more aggressive and creative strategies for restructuring intergovernmental relations so as to improve the protection of the public's health. As noted in the aftermath of SARS: "*A federally-imposed system might instead be viewed as a necessary last resort if collaborative and consensus-building mechanisms fail*." (Naylor, 2003, 165)

The current low level of federal leadership, using weak policy instruments and a non-coercive approach to intergovernmental relationships, has failed to create an effective national system of public health surveillance. Given the overlapping constitutional jurisdictions over this area of public health practice, and the fact that national effectiveness ultimately depends on robust local and PT capacities, the Government of Canada may want to consider a federal trust model. Such an approach could combine guidelines with unconditional funding (at a minimum level of the $100-200 million per year recommended in the Kirby and Naylor Reports, and separate from both other block grant programs or equalization envelopes), in order to apply the maximal political pressure on provinces and territories to use that money to integrate their health surveillance systems with federal authorities. A matching grants format could also be fruitfully adopted over the medium to long term, in order to limit the provincial a

Whether a federal trust model will be sufficient to overcome the deterioration of Canada's public health systems as a result of chronic under-resourcing over the last several decades, and to accelerate development of an effective nation-wide epidemic surveillance network, remains at present an open question, and one that cannot be adequately answered in the absence of more contemplation and research on the details of such a policy. Based on the findings here, however, a trust model stacks up well against collaborative federalism, the limits of which appear to have been reached when it comes to epidemic surveillance integration. Although the history of a blend of disentangled and collaborative approaches to the issue was effective in developing consensus between levels of government on the need and agenda for coordinated changes in the pre-SARS era (Wilson, 2001) as well as in the immediate aftermath of the crisis, the same intergovernmental strategy appears to have made little actual progress in the years since 2003.

Moreover, the emergence of regional and cross-border relationships between local public health units in different provinces and in various US states, as well as the failure to secure full provincial/territorial buy-in for the most recent federally-sponsored information technology application for capturing and reporting surveillance data (Canada Health Infoway's Panorama system), and the success of a network of a user-developed platform for voluntary multi-jurisdictional data sharing and collaboration based on existing public health information systems (the Canadian Network for Public Health Intelligence), indicate that dramatically scaling up shared targeted financing for bottom-up innovations built upon current public health practices and information systems rather than comprehensively from scratch, may offer the most promise for the development of national surveillance capacity.

Addendum

More recent public health crises have shed additional light on the research and analysis offered here. The outbreak of food borne listeriosis in Ontario in the spring of 2008, and the global influenza A (H1N1) outbreak that was initially detected in Mexico in the spring of 2009, have been the most visible tests of intergovernmental relations in the field of health protection since the creation of the Public Health Agency of Canada. Some regard listeria as the first major test for the public health system's emergency readiness, as well as a better test than H1N1 since an influenza pandemic is anticipated and numerous protocols exist for its management. (Wilson & Keelan 2008) The listeria outbreak, on the other hand, not only originated within Canadian borders and thus challenged current surveillance and response mechanisms, but was also an unexpected event and thus a better indicator of the effectiveness and flexibility of the current set of FPT arrangements in public health.

Although it is too soon at the time of writing to conclude with much certainty about whether FPT cooperation in the face of H1N1 will be effective, there are indications that health protection activities at the federal and provincial levels have been both relatively well coordinated as well as transparent, albeit as a result of the informal mechanisms for communication and exchange described above. Unfortunately, the listeria outbreak demonstrated the opposite, and illustrates that the core conclusion presented above is valid: confusion over roles and responsibilities during a public health crisis, and especially information sharing, continue to be major obstacles to health

protection and timely response. What is particular about the listeria outbreak, or in other words where the findings of the Ontario report depart from the analysis presented in this chapter, is that the problem with information flow on this occasion was from Ottawa to the province rather than the other way around. According to the report, the federal food inspection agency, despite requests from the Ontario Ministry of Health, withheld and delayed information sharing that may have allowed a wider distribution of contaminated products and thus a greater exposure among the general public. (Ontario 2009) This suggests that any MOU or other agreements or arrangements for data sharing not only need to be urgently completed, as recommended above, but also that that must be bi-directional, in the sense that the federal government (and its agencies) must be held to the same obligation to the provinces/territories that it is asking them to make, which is to transfer all necessary data for evaluating and responding to a public health crisis in as timely a fashion as possible.

Moreover, although the federal Health Emergency Plan was activated in response to H5N1, and CEPR ran 24/7 for a month early in that outbreak, that plan was not engaged during the listeria outbreak, and neither the PHAC nor the Chief Public Health Officer of Canada took a lead role in publicly responding to the outbreak. Listeria was thus a prototypical example of why a strong federal public health presence is needed, and why the weaknesses of that agency as it currently operates puts Canadian lives at risk. The listeria outbreak, in addition to causing illness and deaths, crossed over multiple concurrent policy fields (food safety, agriculture and public health), had important economic consequences, and engaged political interests at both provincial and federal levels. There were therefore many reasons for, and opportunities to, subordinate the role of the public health agency and, consequently the importance of public health concerns, during the management of the outbreak. Although the Naylor report recommended that the PHAC and the CPHO should be "a leading national voice for public health, particularly in outbreaks and other health emergencies, and a highly visible symbol of a federal commitment to protecting and improving Canadians' health", the lack of leadership shown by the agency and its head is evidence of the claims above about its lack of autonomy and its susceptibility to political interference.

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End Notes

[1] In anticipation of potential jurisdictional complications in complying with the new requirements

international statistical classification for disease and clinical codes, including at WHO, Health Canada, and PHAC), the SNOWMED CT nomenclature is proprietary (which means that a license must be purchased in perpetuity in order to continue to use it) and is not yet fully available in French. The HL7v3 messaging standard, furthermore, has been associated with such high implementation costs that plans to conve

stakeholder involvement in current and future epidemic surveillance policy development, as well as efforts to reinforce public awareness that the specific nature and purpose of access to personal information by public health officials during an outbreak or other emergency is to protect the health of the public, without abandoning all safeguards on individual rights, privacy being just one of these.

[12] Electronic health record systems also raise important questions with regard to database storage and management, data access and ownership, and secondary use of such information.

[13]It is this lack of uniformity that explains the point made earlier that it is currently very difficult to take surveillance data out of the context in which it was collected and aggregate it in relevant ways, since measurement and reporting variability severely restricts the ability to pool and interpret data into any sort of useful national picture of public health trends.

[14] It is revealing in this regard to recall, as one expert put it, that it took 15 years to put into place country-wide in principle standards for infectious disease definitions and notifications accepted, even though, because the federal government does not consider that it has the authority to mandate such standards, they remain voluntary, and variability among the lists of notifiable diseases thus persists across provinces and territories.

[15]Apart for outbreak surveillance, one need only consider the conspicuous absence of federal or provincial government support for any proposals for surveillance of mental illness, musculoskeletal disease, or dental disease, in order to appreciate the full extent of this point.

[16]Interviewees suggested that the real Panorama implementation costs for entire country are likely closer to $500-750 million, if the estimates and actual costs in BC and Ontario of bringing iPHIS online are any indication, although provinces and territories may still balk since this does not include recurring annual operations and maintenance costs.

[17] Another motivating factor could be the potential exposure of government to civil liability suits if the next public health crisis is fumbled, particularly given the common critical refrain of three federal and one provincial Auditor General reports instructing public authorities to remedy their deficiencies in epidemic surveillance and response. (See, e.g.: Ries, 2005) It is of note that one of the three elements of the US reservation to the revised Internati

