

EXECUTIVE SUMMARY

Mandate of the Committee

The National Advisory Committee on SARS and Public Health was established in early May 2003 by the Minister of Health of the Government of Canada, the Hon. A. Anne McLellan, in the circumstances surrounding the outbreak of Severe Acute Respiratory Syndrome [SARS]. The Committee's mandate was to provide a "third party assessment of current public health efforts and lessons learned for ongoing and future infectious disease control." Committee members represented a multitude of disciplines and perspectives from across Canada. Several were directly involved in responding to SARS in different capacities. We reviewed source documents, conducted interviews, and engaged consultants to undertake surveys, additional interviews, and analyses to illuminate aspects of the SARS experience. Advice was also sought from a constitutional legal expert. Over 30 non-governmental and voluntary sector stakeholders submitted helpful briefs and letters.

SARS in Canada

SARS is a droplet-spread viral illness, apparently caused by a novel coronavirus. Emerging in China in November 2002, SARS spread across the globe over the course of several weeks. About 8,500 persons worldwide were diagnosed with probable SARS during the epidemic, and there were over 900 deaths. SARS remains a challenge to diagnose and manage because its symptoms resemble those of many other respiratory infections. SARS was managed primarily by supportive measures for those affected, with isolation and infection control precautions in hospital, as well as tracing and quarantine of contacts. Diagnosis rested on the clinical syndrome, a link to known cases of SARS, and a process of exclusion. Available laboratory tests were not consistently helpful during the acute phase of the illness.

Outside of Asia, Canada was the country hardest hit by SARS. As of August 2003, there had been 438 probable and suspect SARS cases in Canada, including 44 deaths. The majority of SARS cases and all deaths were concentrated in Toronto and the surrounding Greater Toronto Area [GTA]. The toll on health care workers was high: more than 100 became ill and three succumbed.

Public health and health care workers in Ontario and British Columbia did an admirable job of containing SARS. Health care workers caring for SARS patients were at heightened risk for contracting a new and dangerous disease, and worked under physical and psychological stress. Lack of certainty about diagnosis and treatment added to the clinical challenges. SARS also placed unprecedented demands on the public health system, challenging regional capacity for outbreak containment, surveillance, information management, and infection control.

A great many systemic deficiencies in the response to SARS were identified as the Committee went about its task. Among these were: lack of surge capacity in the clinical and public health systems; difficulties with timely access to laboratory testing and results; absence of protocols for data or information sharing among levels of government; uncertainties about data ownership; inadequate capacity for epidemiologic investigation of the outbreak; lack of coordinated business processes across institutions and jurisdictions for outbreak management and emergency response; inadequacies in institutional outbreak management protocols, infection control, and infectious disease surveillance; and weak links between public health and the personal health services system, including primary care, institutions, and home care.

Emerging Infectious Diseases, Globalization, and Bioterrorism

SARS is only the most recent example of emerging infectious diseases—diseases that are newly identified, or that have existed previously but are increasing in incidence or geographic range. Since 1973, more than 30 previously unknown diseases associated with viruses and bacteria have emerged. Examples include: Ebola virus (1977); Legionnaire's disease (1977); *E. coli* 0157:H7-associated hemolytic uremic syndrome (1982); HIV/AIDS (1983); Hepatitis C (1989); variant Creutzfeldt-Jakob disease (1996); and H5N1 Influenza A or avian flu (1997). West Nile virus infection is an example of a disease that has increased its geographic range. As well, some known infectious diseases, such as tuberculosis, have re-emerged in vulnerable populations.

According to World Tourism Organization data, approximately 715 million international tourist arrivals were registered at borders in 2002. Human migration has been a key means for infectious disease transmission throughout recorded history. However, the volume, speed, and reach of travel today have accelerated the spread of infectious diseases.

Compounding the challenges of dealing with emerging and re-emerging infectious diseases, is the threat of the accidental or intentional release of biological agents as highlighted by the intentional release of anthrax spores in the USA in the Fall of 2001.

Public Health in Canada: Organization and Jurisdiction

Among the functions of public health are health protection (e.g., food and water safety, basic sanitation), disease and injury prevention (including vaccinations and outbreak management), population health assessment; disease and risk factor surveillance; and health promotion. The public health system tends to operate in the background unless there is an unexpected outbreak of disease such as SARS or failure of health protection as occurred with water contamination in Walkerton, Ontario (2000) or North Battleford, Saskatchewan (2001). An effective public health system is essential to preserve and enhance the health status of Canadians, to reduce health disparities, and to reduce the costs of curative health services. Public health also plays a key role in disaster and emergency response.

Primary responsibility for public health services is at the municipal or local level, through about 140 health units and departments that serve populations ranging from 600 to 2.4 million people, with catchment areas from 4 to 800,000 square kilometres. The next level of organization is provincial or territorial. At the provincial/territorial [P/T] level, staff engage in planning, administer budgets, advise on programs, and provide technical assistance to local units as needed. The P/T-level capacity for coordination and technical support of local health agencies varies sharply from one province to the next.

Two provincial models are noteworthy. British Columbia established its Centre for Disease Control in 1997 to take responsibility for provincial-level management of infectious disease prevention and control, including laboratories. Quebec established the National Public Health Institute in 1998 by transferring in staff from several regional public health departments and the ministry; it oversees the main public health laboratories and centres of expertise. The Quebec Institute has a mandate that covers prevention, health promotion, healthy living, workplace health, and chronic disease prevention as well as infectious disease control.

Federal activity is concentrated in the Population and Public Health Branch [PPHB] of Health Canada. PPHB is headquartered in Ottawa, with regional offices across Canada. It includes Centres for Infectious Disease Prevention and Control, Chronic Disease Prevention and Control, Emergency Preparedness and Response, Surveillance Coordination, and Healthy Human Development. PPHB also oversees the National Microbiology Laboratory in Winnipeg and the Laboratory for Foodborne Zoonoses in Guelph. Other branches in Health Canada and other government departments and agencies are involved with public health to a variable extent.

From a constitutional perspective, public health is primarily a provincial concern. However, the federal government has authority to legislate aspects of public health owing to its powers over, variously, the criminal law, matters of national concern for the maintenance of "peace, order and good government", quarantine provisions and national borders, and trade and commerce of an interprovincial or international nature. Behind the formal division of powers is an essential tension in the Canadian F/P/T fabric: much administrative responsibility rests with the P/T level, while revenue generation and therefore spending capacity is concentrated at the federal level. In the latter respect, Ottawa does not currently make any earmarked transfers to other governments for public health. PPHB instead operates a \$200 million per annum program of grants and contributions directed to non-profit and non-governmental organizations.

Public Health Capacity and Funding

There have been many calls to strengthen public health infrastructure in Canada over the last decade. For example, in late 1993, given the global spread of HIV, Health Canada organized an Expert Working Group on Emerging Infectious Disease Issues. This 'Lac Tremblant' group called for "a national strategy for surveillance and control of emerging and resurgent infections", support and enhancement of "the public health infrastructure necessary for surveillance, rapid laboratory diagnosis and timely interventions for emerging and resurgent infections", coordination and collaboration in "setting a national research agenda for emerging and resurgent infections", "a national vaccine strategy", "a centralized electronic laboratory reporting system to monitor human and non-human infections", and strengthening "the capacity and flexibility to investigate outbreaks of potential emerging and resurgent infections in Canada". A decade later, very similar recommendations are repeated in our report.

In 1998, Mr. Justice Horace Krever provided a general call to improve public health in his report of the "Commission of Inquiry on the Blood System in Canada". An F/P/T report on Public Health Capacity was prepared at the request of the F/P/T Conference of Deputy Ministers of Health, and presented to them in June 2001. It highlighted the weaknesses in public health infrastructure across Canada, pointing to disparities in capacity from one province to the next; concerns about the relative low priority given to longer-term disease and injury prevention strategies; weaknesses in human resources for public health; and growing recruitment/retention difficulties. In 2002, the Romanow Commission recommended a national immunization strategy, a physical activity strategy, and strengthening prevention programs. The Standing Senate Committee on Social Affairs, Science and Technology chaired by Senator Michael Kirby also reported in 2002. The Senate Committee called for the federal government to commit \$125 million annually towards chronic disease prevention. It also cited inconsistent funding, poor coordination among jurisdictions, and an overall lack of accountability and leadership, in recommending additional funding of \$200 million annually to enhance public health infrastructure across Canada.

Given variation in accounting, it is difficult to generate a precise estimate of current public health spending in Canada. We roughly estimate total public health expenditures in Canada (2002 - 2003) to range from \$2.0 to \$2.8 billion depending on the definition used. Total health spending in 2002 was \$112.2 billion for the

public and private sectors combined, and \$79.4 billion for the public sector alone. Public health therefore accounts for 1.8% to 2.5% of total health expenditures, and 2.6% to 3.5% of public expenditures. Provincial spending clearly varies, but so do methods of accounting at the provincial level.

International Models

Australia and the USA are federations with constitutional division of powers similar to Canada. The US Centers for Disease Control and Prevention [CDC] has an international reputation for excellence in public health. Over 2,000 of the approximately 8,600 full-time equivalent employees work outside the CDC headquarters in Atlanta; this includes postings to 47 state health departments.

Although it is best known for investigating disease outbreaks, the CDC is actually a broad public health agency; and much of its budget is directed to an extensive system of federal grants and transfers to states and municipalities in support of public health infrastructure. The CDC works with states to set and monitor standards. It oversees a national health alert and surveillance system, a national workforce development and continuing education initiative for public health practitioners and related laboratory personnel, and a public health information network. The CDC's National Public Health Laboratory System develops policies and public-private partnerships for improved and timely reporting of laboratory results.

In Australia, the federal government pays for half of public health services—30% via direct expenditure and 22% via transfers to states and territories. Joint public health activities are coordinated through the National Public Health Partnership under the auspices of the federal and state/territorial health ministers. The Partnership has clear priorities such as: improving public health practice; developing public health information systems; reviewing and harmonizing public health legislation; implementing public health workforce initiatives; strengthening national public health research and development capacity; enhanced coordination of national public health strategies; and developing standards for the delivery of core public health strategies. Federal transfers occur through Public Health Outcome Funding Agreements that have targets and reporting requirements. A national program for public health education and research funds Australian tertiary institutions to strengthen post-graduate education and training.

The USA and Australia, as well as the UK, each have a coherent chain of policy, stretching from legislation, national goals and priorities, national strategies, programs to sustain the public health infrastructure (including human resources), means of reaching agreement between stakeholders, and specific funding programs. There are targets with timelines and accountability mechanisms. In contrast, Canada does not have national health goals, a related strategy, or programs of federal transfers to facilitate implementation of a national strategy.

A New Canadian Agency for Public Health

The current federal arrangement puts public health professionals inside a very large department with a highly process-oriented culture geared to meeting the political issues of the day. Vesting those functions in an arm's-length agency would enhance the credibility and independence of federal activities in public health, and offer more flexibility in terms of employment and partnerships with NGOs. An agency could also better foster a collaborative F/P/T culture rooted in shared expertise among public health professionals. The creation of an agency cannot depoliticize interactions among jurisdictions, but it can reduce the chances that the health of Canadians would inadvertently be held hostage in a jurisdictional disagreement among levels of government. Among our key recommendations therefore is that the Government of Canada create a new Canadian Agency for Public Health, led by a Chief Public Health Officer of Canada.

A Canadian Agency for Public Health is arguably best structured as a *Legislated Service Agency*, analogous to the Canadian Food Inspection Agency, the Canadian Institutes of Health Research, or Statistics Canada. The Chief Public Health Officer of Canada would be the chief executive of the new federal agency and report directly to the federal Minister of Health. The Chief Public Health Officer of Canada would also issue an annual report on the state of the public's health and the public health system.

Public health agencies, centres, and institutes around the world vary in their scope. It is premature for the Committee to recommend precisely which activities and programs should be included at this point, beyond indicating our support for a strong and integrative organization. A systematic review is required to establish the scope of the new agency. A more effective approach to continuing challenges in First Nations and Inuit health must be considered as part of any scoping process.

Centralizing the agency in a single new location would be disruptive for existing staff and fail to capitalize on the full range of opportunities for partnership in P/T and municipal jurisdictions. We recommend instead selective expansion of activities in Ottawa, Winnipeg, and other existing sites, along with deliberate devolution of some core functions to new locations across Canada. An effort should be made to co-locate federal agency hubs with provincial and regional centres of excellence in public health. Activities in these sites would thus become mutually reinforcing, and help foster a common F/P/T culture focused on protecting the health of Canadians.

We also recommend that, as an early priority, the new agency initiate the collaborative development of a national public health strategy. The strategy should include specific health targets, benchmarks for progress towards them, and collaborative mechanisms to maximize the pace of progress. In developing a national strategy, the new agency must not only work with P/T jurisdictions and other federal departments and agencies, but consult widely with stakeholders in the broader health community. The current program of transfers to NGOs should also be reviewed and aligned with the national health strategy.

The Committee further recommends the prompt creation of a National Public Health Advisory Board to advise the Chief Public Health Officer of Canada on the most effective means to create and implement the above-noted national public health strategy. The nomination process should build pan-Canadian collaboration by involving existing F/P/T networks and advisory committees. Members would be appointed to limited terms by the federal Minister of Health.

Many core functions of the new agency can be developed simply by transferring in current activities and capacity. Relevant core functions directly within PPHB currently cost about \$187 million per annum (2002 budget). Adding in extant grants and contributions that amount to contracted-out functions, we reach \$225 million as a rough estimate of spending on core functions within PPHB. About \$75 million of the costs of operations in other branches of Health Canada could also fall within a new agency's mandate, for a notional total of \$300 million spent in 2002.

The Committee has recommended that the current core functions be expanded to include greater investments in: disease surveillance systems; health emergency preparedness and epidemic response capacity; a major and urgently-needed program of development of public health human resources; substantial augmentation of research spending; enhancement of federal laboratories;

capacity-building partnerships with provincial and hospital laboratories pending other F/P/T investments; and coverage of relatively neglected areas such as environmental health, mental health, injury prevention, and public health ethics.

These activities will require gradual increases in budget for core functions. The additional spending is projected to reach \$200 million dollars per annum within 3 to 5 years. A proportion of these new monies for core functions would flow to extramural partners, e.g., in support of research programs allied with the Canadian Institutes of Health Research [CIHR], for salaries of federal personnel seconded into P/T public health agencies as per the CDC model, and to create new academic, institutional, and NGO partnerships for human resource development.

Federal Funding to Renew Public Health across Canada

A stronger federal presence in public health, vested in a new agency with enhanced intramural and extramural capacity, would only go partway to remedying the deficiencies evident during the SARS outbreak. Public health in the first instance is a local enterprise. Provinces and territories in turn must fund, support, and coordinate local activities through their own agencies and ministries. As a corollary, the containment of SARS was clearly dependent on local and provincial efforts in Ontario and British Columbia. Even greatly enhanced technical support and outbreak investigation by a federal agency will be somewhat irrelevant if the local and regional capacity for outbreak response is weak. The public health infrastructure needs strengthening at all levels, and this in turn suggests the need for earmarked federal funding that is not currently provided.

Public health did not figure directly in the two F/P/T Health Accords reached in September 2000 and February 2003. The first Accord provided \$23.4 billion in new federal funds for the six-year period from 2000-01 to 2005-06. The second provided for \$34.8 billion (\$30.9 billion new monies) in federal funds for health for the five-year period from 2003-4 to 2007-8. While billions of dollars were earmarked for personal health services, the two Accords together appear to include over \$20 billion in non-earmarked transfers that could be used by P/T jurisdictions in part for spending on public health infrastructure.

The availability of these funds underscores our assumption that any new federal spending on public health should be matched in some respects by P/T spending. But without earmarked federal monies for public health, P/T spending will be drawn, as always, to personal health services and opportunities for leverage and coordination will be lost.

As an alternative to new federal transfers, some may argue that the federal government should simply pass legislation that imposes obligations on provinces and territories with respect to disease surveillance or public health emergencies. Arguments in constitutional law can indeed be made for more federal intervention in public health. However, federal legislation that sought to conscript P/T personnel or unilaterally regulate their activities would lead to unfunded mandates and F/P/T political and legal confrontations.

Thus, following the Australian and US models, the Committee is recommending a comprehensive set of funding arrangements and processes designed to facilitate F/P/T collaboration. The goal of these transfers is to create a seamless multi-tiered public health system, knitted together by inter-governmental agreements and harmonized legislation or regulation.

The Committee explicitly rejected the concepts of either passive transfers without accountability or block funding that could become a flashpoint for F/P/T disagreement. Instead, we have endorsed a depoliticizing strategy in which new federal funding flows through the new agency to P/T and municipal jurisdictions, targeting programs and activities according to agreements among public health professionals. The Committee firmly believes the new agency's impact will be strongly dependent on its ability to flow federal funds in support of front-line (local) and P/T public health agencies. Absent an ability to fund or co-fund programs with those governments and agencies that have primary constitutional responsibility for public health, a new federal agency will almost certainly be resented as an irrelevant job creation program staffed by technical experts who are better at talking to each other than supporting serious front-line work. And absent meaningful and earmarked federal funding, Canada's public health infrastructure will remain a flimsy patchwork.

The Committee has therefore recommended three programs of transfers with a total value that will rise, over the course of several years, to a target level of \$500 million per annum: \$300 million per annum for a Public Health Partnerships Program to build general capacity in public health at the local/municipal level; \$100 million per annum targeted at communicable disease surveillance and control with a particular

emphasis on P/T level or second-line capacity; and \$100 million per annum to bolster the currently underfunded National Immunization Strategy. These funds could be combined and managed according to the Social Union Framework Agreement, thereby giving more flexibility for federal and P/T officials to align transfers with both P/T needs and the national strategic plan for public health.

Communicable Disease Control and Health Emergency Management

Health surveillance involves the tracking and forecasting of important health events or determinants through the continuous collection of relevant data, and the creation and dissemination of reports, advisories, alerts, and warnings as needed. The 1999 and 2002 reports of the Auditor General of Canada raised serious questions about the F/P/T collaborative framework for infectious disease surveillance and outbreak management. Although some progress has been made, these concerns—both as regards detection of emerging infectious disease threats and communication of alerts regarding such threats—have been underscored by the SARS experience.

Thus, the Committee has recommended that F/P/T governments urgently strengthen surveillance programs. Action would focus first on communicable diseases, and then be extended to non-communicable diseases and relevant population health factors. These surveillance programs must be coupled to short-term investments in support of hospital infection control.

Some legal issues in surveillance also require short-term attention. The *Personal Information Privacy and Electronic Documents Act* [PIPEDA] will come into full force on January 1, 2004. It is not clear if PIPEDA applies to health care providers. To the extent that PIPEDA does apply, its restrictions on the non-consensual use of health information could inadvertently interfere with disease surveillance activities that pose no particular threat to privacy. PIPEDA's application to the health sector accordingly requires an urgent review, culminating in separate federal health information privacy legislation, amendments, or clarifying regulations.

F/P/T collaboration in emergency preparedness and response is more advanced than in health surveillance and outbreak management. This collaboration was triggered by tragic terrorist attacks on the USA in September 2001. Since March 2002, an F/P/T Network for Emergency Preparedness and Response has been

working on matters such as leadership and coordination; surge capacity; training and education; surveillance and detection infrastructure (including laboratories); supplies; and communications. We have recommended acceleration of support for the Network's activities with a special focus on communicable disease control.

The Committee sees an urgent requirement for multi-jurisdictional planning to create integrated protocols for outbreak management, followed by training exercises to test the protocols and assure a high degree of preparedness to manage outbreaks. To create surge capacity, the F/P/T Network for Emergency Preparedness and Response has already been working towards establishment of Health Emergency Response Teams [HERT]. The HERT model has been developed as a multidisciplinary group of clinical and support personnel for "all hazards". The SARS experience highlights the need to mobilize selected groups of skilled personnel into epidemic response teams within the HERT framework.

To accelerate collaborative activities in infectious disease surveillance and outbreak management, we have recommended the creation of a new F/P/T Network for Communicable Disease Control. This new F/P/T network would reinforce the collaborative activities of the F/P/T Network for Emergency Preparedness and Response.

The new F/P/T Network for Communicable Disease Control (and the associated funding arrangements) would be Canada's second line of defence against 'the next SARS'. The new F/P/T network would create connections not only among strengthened provincial and regional centres of excellence in infectious disease control. It could also link these P/T nodes or hubs and the relevant centres and laboratories in the new federal agency. As noted, we recommend an approximate target of \$100 million per annum in earmarked funding inside the new agency's envelope for transfers to build the required capacity at the P/T level and maintain the new F/P/T network. The flow of federal funds must be tied to intergovernmental agreements and initiatives to secure standardized business processes and a harmonized legislative framework for disease surveillance and outbreak management.

Some federal funding and concerted action to ensure national preparedness should begin as soon as possible given the forthcoming winter season of upper and lower respiratory diseases; specific recommendations for short-term action are included in our report.

As noted earlier, SARS has also raised concerns about the legislative framework for health emergencies management in Canada. Since the Fall of 2001, all jurisdictions have been reviewing and upgrading their emergency planning and preparedness frameworks. However, the F/P/T legislative frameworks for health emergencies have not been analyzed for comparability and interoperability. We have recommended a general intergovernmental review to harmonize F/P/T public health legislation, with specific attention to public health emergencies within extant emergency legislation.

A related concern is lack of clarity about jurisdiction when a health threat affects multiple provinces. The federal *Emergencies Act* (R.S. 1985, c. 22 (4th Supp.)) confers very wide powers on the federal government and can only be invoked in the face of a truly grave national threat. The federal government otherwise has uncertain authority in the face of a multi-provincial outbreak. This situation is particularly problematic as the World Health Organization [WHO] moves to establish International Health Regulations that set expectations for member states as regards surveillance, reporting, and outbreak management. We recommend that consideration be given to a federal health emergencies act to be activated in lockstep with provincial emergency plans in the event of a pan-Canadian health emergency.

Last, the Committee determined that neither Health Canada nor most jurisdictions and institutions have developed sophisticated frameworks for risk communication during a public health crisis. The CDC has a comprehensive crisis communications training program that, in our view, bears close study and early adaptation by Canadian governments and institutions.

Public Health Partnerships Program

While priority must be given in the short term to infectious disease surveillance and outbreak management capacity, the broad range of public health functions also requires support and coordination. In many local health units, the same personnel help fight an outbreak one day and inspect restaurants or deliver a health promotion seminar the next.

We accordingly recommend that a new Public Health Partnerships Program be established under the auspices of the Canadian Agency for Public Health. The new partnerships program would flow funds through specific agreements with P/T public health officials, aimed at reinforcing core public health functions at the local level and collaborative arrangements across jurisdictions. This

option is used by the USA and Australia to improve basic public health infrastructure. Funding for programs can be directed at, for example, specific health protection and disease prevention programs, information systems, laboratory capacity, training, recruitment and retention, and emergency response capacity. The programmatic option can be combined with cost-sharing, e.g., some programs could offer a percentage of the cost, up to a defined maximum, with the province or territory finding the balance. Such targeted transfers with associated accountability mechanisms are useful ways to align funding and policy direction. They also reduce the risk that existing spending would simply be displaced.

Spending through the new partnerships program would be increased over several years to a target of \$300 million per annum, and aligned with the national public health strategy.

National Immunization Strategy

Since the 1990s, there has been interprovincial diversity in the publicly-funded programs and legislation pertaining to immunization and vaccination. The current arrangements compromise purchasing power, limit the security of vaccine supply, and put providers in the untenable position of having to recommend vaccines to persons/families who cannot afford them.

Four new vaccines are currently unfunded in most P/Ts—conjugate pneumococcal vaccine, conjugate meningococcal vaccine, varicella vaccine and acellular pertussis vaccine. An F/P/T expert group proposed in 2001/02 that the federal government pay for the new vaccines while P/Ts cover the costs of administration. To support their case, those involved produced documentation showing meaningful health and economic benefits from more complete coverage and upgrading of vaccination strategies.

The 2003 federal Budget provided only \$45 million over five years (\$5 million in year one, and \$10 million a year thereafter) “to assist in the pursuit of a national immunization strategy.” As noted, the Committee believes that \$100 million per annum should be earmarked for a major reinvigoration of the National Immunization Strategy under the auspices of the new Canadian Agency for Public Health. This amount would cover about 50% of the steady-state cost to P/T jurisdictions for purchasing the new vaccines. Some of the funds should also be used to improve tracking systems for vaccination coverage.

Public Health Human Resources

The 2003 federal Budget allotted \$90 million over five years for health human resources, but no funds were earmarked specifically for the public health workforce. A clear shortfall in public health human resource planning and development was recognized in the 2001 *Survey of Public Health Capacity in Canada*. The Committee found few definitive data on public health human resources, but those data raised concerns.

Community medicine specialists serve as medical officers of health in local public health agencies, and provide specialized expertise for the provincial and federal governments. Public health physicians are needed in rural areas, the Atlantic provinces, the northern territories, and areas served by Health Canada's First Nations and Inuit Health Branch.

Experts estimate that there are approximately 12,000 public health nurses in Canada. The Canadian Nurses Association estimates that Canada will be short 78,000 registered nurses by 2011. Some experts suggest that Canada is already short 16,000 nurses. Unfortunately, information about the nursing workforce is not collected in a way that makes it possible to extract definitive data on public health nurses.

Medical and PhD-trained microbiologists are in very high demand; current output is too low. There is also a shortage of infection control practitioners [ICP]. ICPs are mostly either nurses (88%) or laboratory technologists (10%) who learn on the job. Forty-two percent of Canadian hospitals fail to meet the current US standard of one ICP per 250 active care beds and 80% cannot attain the new Canadian standard of one ICP per 175 active care beds. Fewer than 60% of Canadian hospitals have a qualified physician serving as infection control director. Canada also needs more epidemiologists with an orientation to field investigation and outbreak response.

In short, on multiple levels, be it staffing for core public health functions or at the interface of clinical and public health activities, there is an acute shortage of highly qualified personnel.

The Committee has recommended that F/P/T governments move expeditiously to develop and implement a national strategy to renew and sustain public health human resources. The strategy should be based on a partnership (after the Australian model) involving governments, academic stakeholders, institutional partners, and professional

associations. A budget for this purpose has been built into our projections for new spending by the Canadian Agency for Public Health. The strategy should not only aim at making Canada self-sufficient as regards public health personnel; it should also explicitly aim at enhancing inter-jurisdictional collaboration on a continuing basis.

Public Health Laboratories

Canada's medical laboratories are operated variously by investor-owned corporations, non-profit hospitals and health regions. All provincial governments except New Brunswick operate public health laboratories. Ontario's provincial laboratory could not meet the demands for SARS testing; rapid and impressive steps were therefore taken by laboratory workers in various hospitals in Toronto to establish diagnostic capacity for the coronavirus. Unfortunately, as hospital laboratories took over testing for SARS, the ability to monitor data at the national and even provincial level was undercut because of poor information systems and the lack of data sharing protocols. Linkage of already-limited epidemiologic data to laboratory test results became even more challenging.

This experience underscores our general observation that Canadian laboratory activities in infectious disease testing and outbreak response are not well-coordinated or adequately linked to clinical and epidemiologic data. As recommended in the Lac Tremblant report a decade ago, Canada should initiate an active and collaborative laboratory surveillance system to anticipate, detect and respond to infectious disease threats.

Such a system necessitates better integration of front-line laboratories into the public health system. Steps in that direction have been taken by the Canadian Public Health Laboratory Network [CPHLN]. The CPHLN is coordinated by the directors of the provincial and national laboratories and some federal public health leaders. CPHLN membership should either be extended to major hospital laboratories or these hospitals should be incorporated into provincial networks represented in CPHLN. The Committee's spending projections incorporate additional support for provincial public health laboratories and for the CPHLN to draw in a wider range of laboratory partners. We have also recommended an F/P/T collaborative review of various aspects of the public health laboratory system.

Research

Multiple governments and agencies have now invested millions of dollars into SARS research. For example, the CIHR has taken a lead role in organizing the national SARS Research Consortium. Funding partners in the Consortium include a range of federal and provincial agencies, as well as private sector partners. The Consortium intends to support work in diverse areas, such as diagnostics, vaccine development, therapeutics, epidemiology, databases, public health, and community impact.

However, the immediate research response to SARS was uneven. Research into the cause of SARS, the characterization of the agent, the development of diagnostic tests, and generation of initial clinical descriptions was conducted and communicated relatively rapidly. Research on the immune response with the goal of developing a SARS vaccine has progressed well. Scientists in Vancouver and Winnipeg were among the leaders internationally in sequencing the SARS coronavirus. This success arose from prior collaborative arrangements and capacity. It underscores the importance of support for fundamental research and the need for research networks that are operational in advance of an outbreak.

On the other hand, research on many fundamental epidemiologic and clinical aspects of SARS has lacked cohesion. Scientists in Hong Kong were able to produce seminal epidemiologic and clinical descriptions while responding to a larger epidemic than Canada's. Our incapacity arose in part from previously-identified issues of leadership, coordination, data collection and management, data sharing, and weak mechanisms to link epidemiologic and clinical to laboratory data.

The lack of capacity also reflects training and funding priorities, as well as problems of coordination. The CIHR's submission advised that its investment in infectious disease research "flows primarily to support biomedical research (84%), and the emphasis on biomedical research in this field is stronger than in the CIHR's overall portfolio (72%)." The CIHR is now attempting to build stronger clinical and epidemiologic research capacity in infectious diseases, but has highlighted a lack of coordination among federal and other agencies in developing a research agenda and capacity.

The Committee has recommended that the new Canadian Agency for Public Health and the F/P/T Network for Communicable Disease Control must give special priority to linking research in government and academic institutions with a focus on infectious diseases. It must build in

advance the teams and business processes for rapid epidemic or outbreak investigation, and thereby strengthen Canada's ability to respond to the 'next SARS'.

More generally, Australia, the UK, and the USA all have embedded a strong research and science component in their public health activities. A new Canadian agency must therefore combine enhanced intramural R&D capacity with extramural funds that will allow contracting out of R&D functions through partners such as the CIHR. Parallel investments by provinces are also required. Intramural R&D activities at the F/P/T level should be linked to academic health institutions and major municipal health units through co-location, joint venture research institutes, cross appointments, joint recruitment, interchange, networks and collaborative research activities.

Regional and Clinical Issues

During the first wave of SARS in Ontario (SARS I), the government declared a provincial emergency and mandated reductions in elective and ambulatory hospital activity. Outbreak management was overseen by a Provincial Operations Centre. Multiple institutions were involved in caring for SARS patients. During a second wave of SARS (SARS II) from the third week of May to the end of the outbreak in July, the caseload was strategically concentrated in four designated institutions, and outbreak management was overseen by a SARS Operations Centre established within the Ontario Ministry of Health and Long-Term Care.

In Ontario, confusion arose at times as to who was in charge of the outbreak response. GTA hospitals had difficulties implementing some of the directives issued by the provincial government. No Toronto hospital had made infectious diseases a program priority, and there was no regional framework for outbreak management to coordinate responses across institutions or health service sectors. Occupational health and safety issues were a recurrent source of tension within institutions. Family physicians perceived that authorities moved slowly in advising them on precautions to be taken in their offices, or giving them support and supplies. There were no regularized processes for sharing and compensating staff appropriately during an emergency such as SARS. In the public health sphere, informants criticized the lack of coordination across the four involved local units, the weak analytical capacity of the Ontario Public Health Branch and its limited role in supporting or coordinating the outbreak responses.

Respondents later highlighted weaknesses in systems for communicating infectious disease alerts from public health agencies to the operational levels of the health system (i.e., hospitals, long-term and home care facilities, ambulance services, family physicians). The process for issuing alerts was apparently more successful in British Columbia, thanks to the provincial Centre for Disease Control. Post-SARS, clinical and public health leaders in the Toronto area were unambiguous in supporting an integrated and regional system of surveillance, reporting, and outbreak management for infectious diseases.

Physical plant limitations were a particular challenge for hospitals. Only 3.8% and 1.0% of Toronto/GTA acute and non-acute care hospital beds, respectively, are in single, negative pressure rooms. Of 28 Toronto/GTA hospitals with emergency departments, 6 lack infection control areas. About 18% of monitored intermediate/critical care beds in Toronto/GTA are equipped for infection control. Only 30% of hospitals with autopsy suites reported that their facilities conformed to US CDC guidelines. Furthermore, in early March 2003, just prior to SARS, medical bed occupancy in Toronto/GTA averaged 95%.

The impact of provincially-mandated restrictions on hospital activity during SARS I was largest in April, when ambulatory procedure volumes dropped 56% in the GTA hospitals and 70% in Toronto hospitals, compared to April 2002. Levels rebounded in May. The different strategy used in SARS II had a much smaller impact on ambulatory procedure volumes, with the GTA hospitals only 1% below, and Toronto hospitals 5% below the prior year. Urgent and emergency surgery volumes were maintained. Consultants estimated that the volume of deferred elective surgery was over 6,600 inpatient cases and almost 18,000 ambulatory procedures. More than half of the inpatient elective surgery backlog occurred in April 2003 during SARS I. The ambulatory procedure backlog was even more concentrated, with 85% occurring in April.

The Committee's primary focus is on broad F/P/T structures, policies, procedures, and funding. However, given the very long list of issues that emerged from the specific circumstances of the SARS outbreak, we elected to make a limited number of recommendations for the consideration of P/T ministries of health, health regions and hospitals, and provincial and local public health agencies. These recommendations range over matters such as physical facilities in emergency departments and hospitals, regional outbreak management strategies, integrated emergency planning, improved continuing

education on infection control, and enhanced linkages between public health and segments of the personal service system (hospitals, home care agencies, primary care).

International Aspects of SARS

SARS has illustrated that we are constantly a short flight away from serious epidemics. Strengthening the capacity of other nations to detect and respond to emerging infectious disease is a global responsibility for a country with Canada's resources and also a matter of enlightened self-interest. The Committee has recommended that the Government of Canada should build health R&D activities into its programs of international outreach. In particular, the new Canadian Agency for Public Health should have a mandate for greater engagement internationally in the emerging infectious disease field, and support projects to build capacity for surveillance and outbreak management in developing countries.

During the SARS epidemic, WHO facilitated collaboration among researchers, promulgated template case definitions, and issued various alerts. WHO established contact with affected countries and offered epidemiologic, laboratory, and clinical support. It also began issuing travel advisories for the first time, acting as a trans-national clearinghouse to assess the safety of international travel and, by extension, the effectiveness of outbreak management efforts in different countries.

In June at the WHO Global Meeting on SARS in Malaysia, it became clear that many countries had adopted their own case definitions for SARS. The Committee believes that further attention is needed to determine the respective roles of a body such as WHO and its member states in defining a new disease such as SARS.

Several Asian jurisdictions faced even greater challenges from SARS than did Canada. Many observers felt that Canadian officials failed to connect closely enough with officials in Hong Kong, Singapore, and China, and missed opportunities to learn from other countries.

Health Canada regularly transmitted information to WHO during the SARS outbreak, but data were limited during the early weeks of the outbreak owing to the absence of formal reporting processes among municipal, provincial, and federal governments. Protocols for data sharing must be established not only for more effective outbreak management, but to ensure that Canada can maintain the confidence of the international community during an outbreak.

Submissions to the Committee from the travel industry indicated significant gaps and inconsistencies with respect to information on SARS available to passengers and staff. The new agency must ensure that there is an effective communication strategy for infectious diseases with contact points for the travel industry.

On April 2, 2003, WHO issued a travel advisory recommending the postponement of all but essential travel to Hong Kong and China's Guangdong province. Previously, only individual countries had issued travel advisories. On April 23, 2003, WHO added Toronto, Beijing, and China's Shanxi province to the list of areas that travellers should avoid. The advice against non-essential travel to Toronto was scheduled to be in place for three weeks before reappraisal, but withdrawn on April 29 after Canadian protests. Controversy about the WHO travel advisory was augmented by inconsistency in categorization of Toronto between WHO and the US CDC, the weak evidence for the travel advisory criteria themselves, and limited warning from WHO of the forthcoming advisory. Assuming that WHO will continue issuing advisories, processes for developing evidence-based criteria and giving notice to affected countries must be developed by agreement among member states.

For many years, Health Canada's Travel Medicine Program has issued advisories to Canadians traveling abroad on risks such as disease outbreaks and natural disasters. Health Canada created its own scoring system to determine travel advice concerning countries affected by SARS, but its evidentiary basis appears no stronger than the contested WHO criteria. Moreover, travel advisories issued by Canada for Hong Kong were at times more severe than the WHO travel advice for Hong Kong. The Committee has therefore recommended that Canada's own practices in issuing travel advisories should be revisited, ideally in the context of a multilateral re-assessment of the basis, nature, goals, and impact of advice to travellers.

In 2002, Health Canada informed airport authorities that it would be transferring airport quarantine responsibilities to the Canada Customs and Revenue Agency. Customs staff were never trained to do the job. During the SARS outbreak, Health Canada amended the *Quarantine Act* Regulations to include SARS but only a tiny contingent of quarantine officers was on hand to enforce the new regulations. Airport authorities expressed concern about Health Canada's ability to mobilize knowledgeable quarantine staff to the airports, to provide logistical support, and to manage the relevant communications. In the case of cruise ships, Health Canada's protocols for screening, handling of suspected SARS cases, and decontaminating ships were not released until mid-June,

after the outbreak had waned. The Committee has recommended that the Government of Canada ensure that an adequate complement of quarantine officers is maintained at all ports of entry, and that better collaboration with port authorities and personnel be established to clarify responsibilities in the event of a health threat.

Screening of incoming and outbound air passengers relied on information cards with screening questions and secondary assessments as needed, as well as a pilot project using thermal scanners in Toronto and Vancouver. As of August 27, 2003, an estimated 6.5 million screening transactions had occurred at Canadian airports to aid in the detection and prevention of SARS transmission. Roughly 9,100 passengers were referred for further assessment by screening nurses or quarantine officers. None had SARS. The pilot thermal scanner project screened about 2.4 million passengers. Only 832 required further assessment, and again none were found to have SARS. In other countries, the yields for airport screening measures were similarly low.

We have accordingly recommended that the Government of Canada should review its travel screening techniques and protocols with a view to ensuring that travel screening measures are based on evidence for public health effectiveness, while taking into account the financial and human resources required. While formal screening thus far appears relatively inefficient and ineffective, the Committee has recommended that the Government of Canada provide travelers in general with information about where and when health threats exist, including precautionary measures and first steps to take in case of suspected infection. A partnership with the travel industry would facilitate this process so that information could be provided at the time of bookings.

Conclusion

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 killed 44 Canadians, caused illness in hundreds more, paralyzed a major segment of Ontario's health care system for weeks, and saw in excess of 25,000 residents of the GTA placed in quarantine. Psychosocial effects of SARS on health care workers, patients, and families are still being assessed. However, the economic shocks have already been felt not only in the GTA, the epicenter of SARS, but across the country.

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The National Advisory Committee on SARS and Public Health has found that there was much to learn from the outbreak of SARS in Canada—in large part because too many earlier lessons were ignored.

A key requirement for dealing successfully with future public health crises is a truly collaborative framework and ethos among different levels of government. The rules and norms for a seamless public health system must be sorted out with a shared commitment to protecting and promoting the health of Canadians. Systems-based thinking and coordination of activity in a carefully-planned infrastructure are integral in public health because of its population-wide and preventive focus. They are also essential if we are to be effective in managing public health emergencies. Indeed, Canada's ability to contain an outbreak is only as strong as the weakest jurisdiction in the chain of P/T public health systems. Infectious diseases are an essential piece of the public health puzzle, but cannot be addressed in isolation, particularly since in local health units, the same personnel tend to respond to both infectious and non-infectious threats to community health. The Committee has accordingly recommended strategies that will reinforce all levels of the public health system as well as integrate the components more fully with each other.

The fiscal and strategic approaches set out in this report are consistent with international precedents and, we believe, the expectations of Canadians. Until now, there have been no federal transfers earmarked for local and P/T public health activities. Public health has instead been competing against personal health services for health dollars in provincial budgets, even as the federal government has increasingly earmarked its health transfers for personal health service priorities. Public health costs are modest—perhaps 2-3% of health spending, depending on how one defines numerators and denominators. The actual amount of new federal spending that the Committee has recommended would reach \$700 million per annum by 2007 at the earliest. This is what F/P/T governments currently spend on personal health services in Canada between Monday and Wednesday in a single week.

The SARS story as it unfolded in Canada had both tragic and heroic elements. Although the toll of the epidemic was substantial, thousands in the health field rose to the occasion and ultimately contained the SARS outbreak in this country, notwithstanding systems and resources that were manifestly suboptimal. The challenge now is to ensure not only that we are better prepared for the next epidemic, but that public health in Canada is broadly renewed so as to protect and promote the health of all our present and future citizens.