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PROCEEDINGS AND RECOMMENDATIONS OF THE EXPERT WORKING GROUP ON EMERGING INFECTIOUS DISEASE ISSUES

Lac Tremblant Declaration

Health Canada Santé Canada

Canada

Proceedings and Recommendations of the Expert Working Group on Emerging Infectious Disease Issues

Lac Tremblant Declaration

December 1993

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Introduction

The HIV pandemic has demonstrated that the world is rapidly becoming a global community. Global interdependence, massive internal and external population movements, rapid transportation, increasing trade, and changing social and cultural patterns expose large populations to new and different pathogens and pose new threats to their health and well-being. National boundaries no longer offer isolation or protection from infectious diseases, toxic chemicals and hazardous products.

Several decades have passed since leading authorities declared that the end of infectious diseases was in sight. Yet, infectious diseases remain the leading cause of death worldwide. Dramatic changes in social structure within rapidly expanding mega-cities, technologic and environmental change, and diminished effectiveness of certain approaches to disease control raise the spectrum of an expanding infectious disease threat and perhaps an era without effective antibiotics.

Emerging infectious diseases include diseases that are increasing or threatening to increase in the coming years. Evolutionary changes in existing organisms may result in the appearance of new diseases. Ecologic change may lead to the spread of known diseases into new geographic areas with susceptible populations. The development of antibiotic resistance in known infectious organisms coupled with failure to invest in public health measures for previously controlled infectious diseases may lead to the reemergence of conditions that will challenge the health of all Canadians.

There is a growing worldwide concern regarding emerging infectious diseases. In response to these concerns, the Board on Health Sciences Policy of the U.S. Institute of Medicine convened a 19-member multidisciplinary committee to conduct an 18-month study of emerging microbial threats to health. Their findings have been published in *Emerging Infections, Microbial Threats to Health in the United States*, Institute of Medicine, National Academy Press, Washington, D.C., 1992.

Following discussions with the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), the Laboratory Centre for Disease Control (LCDC), Health Canada, organized an internal working group to review this issue of emerging infectious diseases. The working group noted the urgency of the topic and the need to consider its relevancy in Canada.

As a result, LCDC convened a multidisciplinary Workshop on Emerging Infectious Disease Issues on December 7-9, 1993, at Lac Tremblant, Quebec. Approximately 40 Canadian scientists representing many disciplines were invited to participate in this Workshop as members of an Expert Working Group on Emerging Infectious Disease Issues. The participants included provincial and federal public health authorities, clinicians, infectious disease experts, veterinarians, biologists, and microbiologists.

The following objectives were achieved at this Workshop:

- A consensus was developed on the relevancy and importance of emerging pathogens in Canada;
- Specific areas of concern were identified and recommendations were made for the possible emergence of new pathogens that might threaten the health of all Canadians; and
- Canada's participation in newly developing global surveillance networks to detect emerging pathogens was discussed.

The long-term goal of the Expert Working Group on Emerging Infectious Disease Issues is to ensure that Canada has state-of-the-art surveillance and control programs to meet the challenge of emerging infectious diseases. These efforts must be integrated with the international community.

The proceedings and recommendations are summarized in this document.

Discussion Process

Following a series of general presentations, the 40 participants were assigned to multidisciplinary groups according to their expertise and preferences. The topics addressed by the groups were as follows:

Policy and Program Issues

- Public Health Initiatives; Cost; Budget Implications
- Jurisdictions and Decision-Making Process — Federal/Provincial/Municipal
- Communications; Barriers
- Public Expectations; Perceptions
- Research; Training
- Planning for National Surveillance

Organisms

- Zoonoses
- Vectors and Vector-Borne Diseases
- Case Studies (Multidrug-Resistant TB; Meningococcal Disease)
- Microbial Adaptation and Change
- Drug-Resistant Infections
- Parasitic Infections
- Respiratory Infections (Influenza)

Control/Strategy Issues

- Vaccines: Preparedness and Barriers
- Legal Liability: Federal/Provincial
- Risk Assessment
- Therapeutics; Blood Supply

Macro Issues

- Immigration
- Occupational aspects
- Environment; Poverty
- Lifestyle; Behaviour
- Human Demography
- International Travel and Commerce
- Technology and Industry
- Economic Development and Land Use

Surveillance/Diagnosis

- Laboratory Networking; Diagnostic Capacity; Audit; Quality Assurance
- Syndrome and Pathogen Surveillance
- Food; Water
- Nosocomial Infections
- Pesticides
- Ethics; Confidentiality
- Information; Access; Sharing; Dissemination; National/International

The chairperson of each group recorded the main points of the discussion and reported the conclusions and the rationale for the proposed recommendations. Each group's recommendations were consolidated into a single document that was circulated to all participants for additional comment after the meeting.

Background

The U.S. Institute of Medicine (IOM) Report

Dr. Robert Shope
Yale University

During 1991-92, the Board on Health Sciences Policy of the IOM convened a 19-member multidisciplinary Committee to conduct an 18-month study of emerging microbial threats to health. In October 1992 the Committee's findings were published in *Emerging Infections, Microbial Threats to Health in the United States*, IOM, National Academy Press, Washington, D.C., 1992.

The study by the IOM was conceived in the context of the growing numbers of HIV-positive persons and uncertainty on the part of both scientists and the public as to how and why AIDS had come to North America. There were other events indicating that the United States was not prepared to anticipate and prevent new and re-emerging diseases. The major premise in the report was that anticipation and prevention of infectious diseases was possible, necessary and, ultimately, cost-effective.

The IOM was chartered in 1970 by the U.S. National Academy of Sciences which, in turn, was chartered by the U.S. Congress. The role of the National Academy of Sciences is to advise the U.S. Government. The study was conducted by a committee of 19 scientists who were selected by the IOM. They represented disciplines from the fields of epidemiology, virology, immunology, food safety microbiology, food toxicology, public health, molecular biology, cell biology, economics, microbial genetics, parasitology, infectious diseases, microbial pathogenesis, medical entomology, and systematics and bacterial physiology. Most of the social sciences were not included.

Every effort was made on the part of the IOM to avoid vested interests or, at least, maintain a balance of biases. The study was funded by agencies of the U.S. Public Health Service, including the National Institute of Allergy and Infectious Diseases, the Centers for Disease Control and Prevention, the U.S Army, the Rockefeller Foundation, the Markey Trust, and Lederle Laboratories. None of these organizations had representatives on the committee.

The charge of the Committee was to identify significant emerging infectious diseases, determine what might be done with them, and recommend how similar future threats might be confronted to lessen their impact on public health. The recommendations are limited to the United States, but the Committee believed and hoped that they could be applied more widely by other countries. Infections do not recognize national boundaries, and the people of the U.S. wish to work with others to improve their mutual security vis-à-vis infections.

How are emerging diseases defined? Emerging diseases were construed to include re-emerging diseases, i.e., diseases that have been a problem in the past and have again become prevalent. Emerging diseases are infectious diseases that are increasing in incidence. The concept recognizes the fact that there are often many more infections than there are overt illnesses. With any one given agent, there is usually an iceberg phenomenon. The definition includes not only emerging diseases but also emerging infections.

The Committee met four times and convened four task forces that considered the following areas: viruses, parasites and fungi, bacteria and rickettsiae, and policy options.

The final report was compiled by the staff of the IOM, with the assistance of a science writer/editor.

The final draft of the report was reviewed by a subcommittee and an outside, anonymous group of experts totally unrelated to the membership of the original Committee.

The executive summary of the report contains the key recommendations but the background material is contained in three chapters. Chapter 1 is a history of emerging infections and spans the centuries from plague to smallpox, through the influenza of 1918, and up to October 1992. With the eradication of smallpox, the control of poliomyelitis and childhood infections, and the development of new vaccines, antibiotics and pesticides, many persons feel that infectious diseases are a thing of the past and that efforts should be directed towards other "more important" diseases, such as cardiovascular disease and cancer. The report also documents the loss of financial support in the United States for surveillance, for some U.S.-supported overseas infectious disease laboratories, and for the public health infrastructure in the U.S.

Chapter 2 describes the factors involved in the emergence of infectious agents. These factors include human demographics and behaviour, technology and industry, economic development and land use, international travel and commerce, microbial adaptation and change, and the break down of public health measures. The report has a list of diseases that the Committee considered were emerging or re-emerging.

Chapter 3 provides the rationale for the recommendations found in the executive summary.

During the 14 months since the publication of the report, a number of important events have reinforced its findings. In North America, there was an outbreak of parasitic (*Cryptosporidium*) diarrhea in Milwaukee. *Escherichia coli* O157 gastroenteritis outbreaks were reported in Washington State and elsewhere. The new pulmonary syndrome caused by hantavirus was recognized in southwest United States and elsewhere. There is a new cholera epidemic in India, Bangladesh, and Indonesia, affecting all age groups; a yellow fever outbreak in Kenya; and an outbreak of Venezuelan encephalitis in Mexico after an absence of 20 years. In Egypt there is a large outbreak of Rift Valley Fever, a disease which had been absent from that part of the world for more than a decade.

The report contains 15 recommendations in the following areas: disease surveillance, nosocomial infections, data collection and analysis, research on emergence factors, research on applied control, public health manpower development, surge capacity for vaccines, pesticides and antimicrobial drugs, research on personal behaviour, and worldwide monitoring for infectious diseases. While the specifics of some of the recommendations may not apply in Canada, the generic issues are common to the two nations.

In the United States, the number of the vaccine manufacturers has decreased due to economic and legal reasons. The domestic commercial infrastructure has been replaced to some extent by international companies. This situation creates some level of international dependency and some risk of loss of access to vaccine supplies in times of emergency.

The report has some areas of omission. The Committee had very little representation in the area of human behaviour, and behaviour modification is a prime intervention technology for many of the emerging infections, such as HIV and tuberculosis. The Committee also agreed not to include biologic warfare in its discussions. It intentionally de-emphasized the role of global warming because the Committee did not feel that it was an immediate cause for concern. There is a belief in some quarters that with further research and mathematic models, the occurrence of future emergence of a specific agent or agents can be predicted. With few exceptions, this belief is false. What can be predicted with certainty is that some event will occur; there will be emerging infectious disease problems. Experience has shown that what event and when and where it is going to happen can not be predicted. So the majority of the Committee's recommendations are aimed at surveillance and preparedness to react when something happens.

The majority of the recommendations in the report challenged the U.S. Centers for Disease Control and Prevention to respond. Their response has been both rapid and vigorous. In addition, the National Institute of Allergy and Infectious Diseases, the Fogarty International Center, and the U.S. Army Research and Development Command have responded with action plans.

It has been proposed that WHO assume a role in global monitoring. There is strong support among U.S. scientists for this role. A Canadian domestic and international plan complimentary to the U.S. response would be mutually reinforcing. Scientists in the United States would welcome the interaction with Canada.

The WHO Perspective

Dr. G. Torrigiani
Director, Division of Communicable Diseases
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In developing countries, communicable diseases have always been recognized as public health problems. In the industrialized countries of North America and Europe, communicable diseases have decreased dramatically in recent years due to improved environmental conditions, the introduction of antibiotics, and the implementation of effective public health interventions, such as immunization. The successes have left the wrong impression, i.e., that communicable diseases are a problem of the past.

In recent years, some "old" communicable diseases, such as tuberculosis, are reappearing in countries where they had previously practically disappeared. Other diseases, such as dengue, which were limited to restricted geographic areas are spreading to new districts. In addition, new diseases are being identified.

Increased travel and migration are, in some ways, responsible for the reappearance of forgotten diseases. It is no longer possible to control a disease in one country if the same disease exists in another country. A worldwide approach is needed to control communicable diseases. There is a need for an early warning system in both developing and developed countries. An active global surveillance program must be established to define existing patterns of diseases and identify new diseases that represent a threat to global public health.

Dr. J. LeDuc, who is focussing on emerging communicable diseases, will provide additional information regarding the organization's activities in this area.

Dr. J. LeDuc
Division of Communicable Diseases
WHO

WHO is developing a new program for global monitoring of emerging infections, and there are several critical elements both in surveillance and response that will be the focus of this monitoring. Any surveillance network will depend on having access to sick people. Monitoring those patients that are ill must be backed up with laboratory-based diagnostics. While surveillance of clinical syndromes is important, laboratory confirmation of the common diseases is also helpful, so that uncommon conditions can be recognized. Baseline information concerning the epidemiologic situation is essential. Knowledge of the epidemiology of common conditions allows the recognition of uncommon illnesses. It is critical to supplement surveillance with a good communications network. The entire monitoring network requires communication capabilities between surveillance sites, a response capacity to the shared information, and a coordinating mechanism for the network itself to secure sufficient funding and provide adequate personnel training. WHO is an appropriate agency to undertake this role, and WHO recognizes that creation of this network is an important priority.

There are several networks of WHO collaborating centres that already exist with area experts around the world. These resources will be an essential part of the network. Some of these centres include arbovirus and hemorrhagic fever laboratories, zoonoses centres, bacterial diseases centres, polio, influenza and many others.

The arbovirus and hemorrhagic fever network is one of the most developed. All of the participating centres have access to patients; they all have access to laboratory diagnostic tests; and many of them have a referral network already in place. There is a network of communications and response through the WHO Headquarters and its Regional Offices. However, some of these collaborating centres have not been used and supported adequately. There is a need to re-examine each lababratory's potential capability to strengthen the network.

WHO, in collaboration with the Rockefeller Foundation, held a meeting of the directors of approximately 35 laboratories around the world, including Canada (LCDC), at CDC in Atlanta. One of the objectives of the meeting was to identify centres that were able to collaborate in this network. Another objective was to initiate communications between the participating centres. The arbovirus network is now well advanced and beginning to serve the role envisioned. Other networks will be developed in the future.

Goals of the WHO program that are near completion include improved coordination of WHO's surveillance effort with other existing programs within WHO, including the Global Program on AIDS and the Expanded Program on Immunization. Communication systems that are available include electronic mail and Internet links. Emerging diseases can be published rapidly in the WHO *Weekly Epidemiological Record (WER)* and CDC's *Morbidity and Mortality Weekly Report*, when appropriate.

WHO's long-term objective is to have a dynamic, interactive group that is prepared to recognize unusual events, communicate their observations, and respond through investigations and appropriate interventions. Training opportunities and enhanced career paths must be developed so that trained and skilled personnel will be retained.

WHO prepared a questionnaire for the network of arbovirus collaborating centres and found that three-quarters of them are directly associated with local Ministries of Health; 60% are associated with hospitals; and about 90% have their own serum banks. All of them have cell culture capability and the skills and resources necessary to isolate viruses. While most have access to suckling mice, only about a third have the specialized techniques necessary for isolating dengue and other flaviviruses. All of these laboratories have some training capability for students. Three-quarters of them make selected diagnostic kits for local use. About 80% reported that they would be willing to provide WHO with IgM-positive control serum, a critical reagent for diagnostic test development. About three-quarters currently participate in a surveillance system on a national level, and virtually all of them said that they would be willing to collaborate with WHO in developing a global surveillance system. About 70% currently receive the *WER*. All of the laboratories could perform enzyme immunoassays and most had hemagglutination and complement fixation tests available, but less than half had the capacity to perform radioimmunoassay. With cell culture capability, most of them also could perform plaque reduction neutralization tests, gel diffusion assays and mouse neutralization tests. With regards to molecular biology skills, most of them have polumerase chain reaction (PCR) capability.

With respect to diagnostic reagents routinely available for flaviviruses, less than 60% had reagents to diagnose yellow fever. Some of the laboratories in East Africa, where recently there was an on-going yellow fever outbreak for at least six months and perhaps substantially longer, could not diagnosis yellow fever, even though this is an area where yellow fever is known to exist. About two-thirds can diagnose Japanese, tick-borne, West Nile and St. Louis encephalitis. Only 9% of the global network had the reagents to diagnosis some of the more exotic viral illnesses, such as those caused by bunyaviruses, including Congo Crimean hemorrhagic fever, Rift Valley Fever, and sand fly fever. Approximately 44% reported the capacity to identify hantaviruses, although the number of laboratories that can actually perform the appropriate tests may be far fewer. With respect to the arenaviruses and the filoviruses, one-quarter of the laboratories claimed to be able to diagnosis Lassa fever. Only 24% said that they could identify New World arenaviruses while 12% reported that they could diagnose Marburg and Ebola diseases.

This network of laboratories is global in distribution and represents the most important national resource in many areas in the world. In addition, 62% of these laboratories also serve as HIV centres, rabies centres and polio virus centres. Many are also part of the influenza network.

With regard to bacterial diseases and antibiotic sensitivity, WHO wishes to ensure that member laboratories participating in this network have access to a computer program called WHONET, which is now in the third iteration. WHONET is a cost-effective mechanism for the country level that can be run on a personal computer to help clinical laboratories within hospitals monitor their antibiotic resistance patterns to provide solid surveillance data. However, there is a need to think beyond antibiotic resistance to bacterial diseases and consider both viral diseases and malaria as well. The same system may be used to monitor resistance to all pathogens.

With respect to active surveillance for disease prevention, there are few programs in place that were actually organized for this purpose. Perhaps the influenza network is an example. In this network, influenza strains are monitored on a global basis as a result of CDC's active financial

involvement. This system is now working well and producing good data in a timely fashion to allow the formulation of the next year's vaccine.

However, as far as serologic monitoring is concerned, there is no current global system.

CDC's Response

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There is considerable complacency in the United States regarding most infectious diseases. Infectious diseases, however, have not disappeared; indeed, infectious disease threats are increasing and the IOM has addressed this issue on three recent occasions. In 1987, the IOM critically reviewed the U.S. capacity to address tropical infectious disease problems but the report did not receive much attention. Nevertheless, in recent years, the CDC has been increasingly called upon to respond to tropical disease issues at a time when the cohort of professionals trained in tropical infectious diseases is not being replaced. Recently, three cases of endemic malaria acquired in New York City were reported, in addition to several hundred imported cases in North Carolina.

In 1988, the IOM published *The Future of Public Health*, which documents the erosion of the public health infrastructure in the U.S. This report was not aimed specifically at infectious diseases but it addressed the loss of core infrastructure by local and state health departments. This report received much attention, but no specific response to strengthen the public health infrastructure for communicable diseases resulted from it.

A more recent IOM report on emerging pathogens, published in 1992, has precipitated considerably more activity. Emerging viruses in several continents, including the isolation of hantavirus causing an often fatal pulmonary infection in the southwest U.S., has created considerable concern among experts in infectious diseases. As a result, the CDC has been developing a response to identify future directions for confronting infectious diseases.

Many recent public health problems were not recognized in a timely fashion. For example, a large outbreak of *E. coli* 0157 disease, including 60 cases of bloody diarrhea and associated hemolytic-uremic syndrome (HUS), was detected retrospectively in Nevada. A mother of a child with HUS read about the previous Washington State outbreak in the newspaper and alerted the Nevada Health Department, which then issued a press release. The extensive cryptosporidiosis outbreak in Milwaukee was detected when it became apparent that anti-diarrheal medications were being sold out in the pharmacies. This outbreak resulted in an estimated 400,000 persons ill with diarrhea, approximately 4,400 hospitalizations, and 44,000 out-patient care visits.

After the IOM report, CDC assigned five scientists with different backgrounds to develop a comprehensive response to the threat of emerging infections. Many infectious disease experts were consulted both inside and outside the CDC, along with representatives from the public health community. The resulting plan underwent several revisions based on very detailed comments of the reviewers. State public health professionals, state epidemiologists, and state public health laboratories were asked to review the drafts. The final version will be completed early in 1994*.

CDC has stressed the critical role of partnerships. Rather than creating centralizing infrastructures, it is important to build around an alliance of loose networks.

There are four goals in the CDC plan. Strengthening domestic and international infectious diseases surveillance probably is the one that has received the most attention. The other

* Since this meeting took place, CDC has published the final version of the U.S. plan: Centers for Disease Control and Prevention. *Addressing emerging infectious disease threats: a prevention strategy for the United States.* Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Services, 1994.

goals include integrating laboratory science with epidemiology and improving public health practice; providing public health information and communicating prevention strategies; and assuring adequate infrastructure at local, state and federal levels.

The ability to detect a new disease or situation depends on the capacity to identify and monitor the current situation. CDC will attempt to establish a capacity within the existing infrastructure that will recognize an unusual event when it happens.

CDC has proposed ways to strengthen domestic surveillance. One way involves the issue of notifiable disease surveillance and the need for financial assistance for the state health departments. Financial support has eroded; CDC currently provides federal support for surveillance and prevention programs in states for tuberculosis (TB), HIV, sexually transmitted diseases and childhood vaccine-preventable diseases. Most other infectious diseases rely on local and state budgets for support and receive no federal funding. A recent survey revealed that over a quarter of the states have no professional person dedicated to surveillance or investigation of foodborne or waterborne diseases. In many locations, health department personnel are not available outside of usual working hours to facilitate reporting by clinicians.

New approaches are necessary, including such methods as automated reporting from laboratories. Some forms of automated reporting from patient hospital records may be useful. The U.S. has not fully utilized surveillance based on sentinel physician reporting. To develop the basis for an enhanced physician-based sentinel surveillance system, CDC plans to establish several networks with clinicians, such as pediatricians and infectious disease specialists to investigate emerging pathogens of public health importance.

CDC has proposed the establishment of 10 population-based epidemiologic research programs geographically situated around the U.S. These programs would link to both state health departments and university centers and provide information on the incidence of specific emerging pathogens. Prevention strategies would also be piloted through these programs.

CDC is also committed to support more effective approaches to international surveillance. No place in the world is free of infectious disease and no national border guarantees the exclusion of infectious diseases. For example, six months after the new *Vibrio cholerae* O139 strain was reported from India, the United States identified its first imported case. This strain is not detected by the usual diagnostic tests, and persons are not protected by the cholera vaccine.

The first priority is to establish improved mechanisms for timely and systematic information exchange between the public health agencies of different countries. This ability is not fully developed at present. The need to improve sharing of information on antibiotic resistance patterns is a good example.

Secondly, for surveillance to be effective, a combination of epidemiology, laboratory expertise and access to clinical care units must be incorporated in medical research programs conducted in developing countries. The CDC has established Field Epidemiology Training Programs, similar to its domestic Epidemic Intelligence Service training programs, in many countries around the world. The FETPs may have access to patients and epidemiologic analytic capabilities; however, they often have no diagnostic capability and no laboratory back-up. In addition, CDC has international research field stations where CDC assigns one or more staff members to work with national counterparts with links to the Ministry of Health. These field stations usually focus on a particular health problem.

The second goal of CDC's plan integrates laboratory science with epidemiology to improve public health practice. CDC will propose the re-establishment of an extramural program that spans a broad range of activities from basic epidemiologic research to public health education. For example, the U.S. needs to improve its response capability in vaccine production. It takes about seven or eight months now to prepare the yearly influenza vaccine, and it may be feasible to reduce this time period.

The third goal targets prevention and control of emerging infectious diseases. Use of diverse communication methods for wider and more effective delivery of critical public health messages is emphasized. In addition, the need to establish mechanisms and partnerships to ensure the rapid and effective development and implementation of prevention measures is highlighted.

The fourth goal addresses issues related to local, state, and federal infrastructures, particularly personnel and physical resources. Training programs that emphasize the diagnosis of infectious diseases are proposed.

Ten years ago much of the CDC-based laboratory training was discontinued. There is a national laboratory training network at CDC that offers regional or local training. However, reduced on-site training at CDC precludes establishing the close liaison that CDC used to have with public health laboratory personnel from the states and other countries. CDC would like to facilitate increased communication, including the establishment of a public health, microbiology fellowship program with the possibility of rotations at local/state laboratories as well as at CDC.

The plan concludes with an emphasis on the critical role of partnerships, nationally and internationally.

State of Canadian Public Health Surveillance: Current Status, a Federal Perspective

Dr. J. Losos
Director General
LCDC

In Canada, National Disease Surveillance is carried out through a number of passive systems that include legally notifiable diseases, laboratory-based information and special databases. Some active surveillance systems include a number of sentinel systems involving pediatric hospitals and public health units across the country. These data are augmented by existing data sources, hospital statistics, disease registries, and information obtained from patient billing systems.

Recording notifiable diseases on a national basis is based on provincial and territorial systems and is mandated by legislation codified under the Statistics Canada Act. Not long ago the data were provided by the provinces to the federal level as aggregate data. Together with the provinces, through consensus processes, such as the Advisory Committee on Epidemiology and the Technical Advisory Committee of Public Health Laboratory Directors, national surveillance has now started to shift towards the use of common case definitions and case-by-case reporting.

The formal legislative mechanism for national surveillance, including new mechanisms and central systems, is established by federal-provincial or other types of agreements, such as special contractual arrangements. The purpose of surveillance systems for the provinces is to provide data for provincial public health needs. The federal level attempts to facilitate provincial surveillance through consensus building and common case definitions.

Provincial data are collated at the federal level to provide national data and information for dissemination. In support of this role, federal laboratory reference services complement provincial laboratory capacity. This surveillance system provides the type of public health assessment throughout the community that assists in public policy development and serves as a basis for program delivery and evaluation. A good surveillance system can be used to identify public health hazards through systematic data collection, field investigations, and regulatory monitoring. The information generated by the surveillance systems can be used to assess and manage the identified public health risk.

The level of risk of identified hazards must be analyzed and managed. The information must be disseminated in a timely fashion to those who need to know. The data must be used to set standards and develop guidelines for providing public health services. In addition to public health networks, the surveillance system also includes the health care system itself, private industry laboratories, and a network of regulatory laboratories in various places around the country that daily monitor product safety through post-marketing surveillance, e.g., for medications. The universities in Canada contribute vital information regarding risk assessment through studies they carry out. At the moment, other participants in national surveillance include various professional associations, such as the Infectious Diseases Society, the Paediatric Society, and the College of Family Physicians.

Many of the problems encountered in national surveillance are associated with jurisdictional issues. The national system is complex; there are so many participants and so much capability. It is

often difficult to coordinate a variety of approaches. The various authorities/jurisdictions become very obvious in a crisis situation. During the recent crisis caused by an outbreak of domoic acid poisoning due to contaminated mussels, Agriculture Canada, Health Canada, Fisheries and Oceans and the provinces demonstrated that an efficient interplay is possible. Nevertheless, jurisdiction can be a problem and systems can be renegotiated or redesigned for better surveillance irrespective of jurisdiction. For example, the Medical Research Council (MRC), Health Canada and their public health network should establish an interface where population studies and population surveillance combine with biomedical basic research.

Another problem related to jurisdictions involves incompatible computerized systems. This problem is rapidly being resolved as people realize that having full information depends on compatible systems. Creating interfaces between computer systems is now easier.

Another area involves limited resources. There are limits on LCDC's infrastructure. LCDC still is very limited in some of its capacity to carry out needed surveillance, but in recent years it has become more proactive in support of national surveillance. Technologic depth in central agencies and also in provinces may be very limited where only one-half of a technician is available in some areas. It may be very difficult to mobilize surveillance resources to obtain data on some new virus, such as hantavirus. Resources are often redirected from on-going surveillance to cover new concerns. Additional problems associated with Canada's surveillance systems will be discussed in the following presentation.

State of Canadian Public Health Surveillance: Current Status and Problems

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Surveillance may be defined as the systematic collection, analysis, and interpretation of data and dissemination of the resulting information to all who contribute to its generation.

Surveillance information is often used for consensus building, developing guidelines, establishing policies, and evaluating public health and clinical interventions. Targeted research might involve surveillance methods.

Epidemiology is the discipline that is used to develop and analyze surveillance data to produce the information utilized by many other disciplines. In Canada there is a scarcity of epidemiologists. LCDC trains field epidemiologists that are the equivalent of the Epidemic Intelligence Officers of CDC. Many of these have assumed positions in public health and LCDC maintains contact with them. Providing training in epidemiology to medical and graduate students remains a problem.

Federal and provincial authorities involved in surveillance agreed on case definitions and surveillance methods, which were published in 1991. Although these national guidelines were published and circulated, not all provinces and other jurisdictions follow them.

LCDC maintains a complete aggregate database and partial case-by-case database of nationally notifiable diseases and produces analyses and commentary on the epidemiology of these diseases. Although LCDC collects considerable quantities of data, it has reached the limits of its capacity to analyze and utilize these data. Most of the data received by LCDC is communicated electronically, but there are still systems that record and transmit data on a case-by-case basis on conventional forms. In addition, there is at least one database, i.e., tuberculosis, that is not maintained by LCDC.

There are several other unique surveillance systems. The LCDC sentinel surveillance system includes nine health units and covers about 10% of the Canadian population. This surveillance system can be used for surveillance of specific diseases, such as hepatitis. A surveillance system was designed and implemented for the specific purpose of monitoring vaccine-associated adverse events. A system to monitor sexually transmitted diseases in the Northwest Territories collects demographic, disease-related and behaviour information. These data are returned to the communities involved for use by the local board of health.

There are a number of targeted surveillance activities. For example, a system for viral respiratory disease collects information from positive reports of influenza, parainfluenza and respiratory syncytial virus. There is also an annual influenza serosurvey, which is not population-based.

Our systems are relatively passive and timeliness of data collection and the subsequent analysis are problems. There are difficulties in analyzing the data and utilizing it for specific action. Currently, LCDC's constituency does not demand enough from the available systems but it is very likely to do so in the near future.

There is a need to define the diseases of interest for public health action. Should systems focus just on specific diseases or monitor certain syndromes? Since resources are not sufficient to collect all data on all conditions, priority areas need to be identified. In the larger provinces some working groups are in place to address priorities for surveillance. Some are more successful than others. When priorities are identified, the systems needed by the provinces, territories and federal levels can be better defined.

The utility of national surveillance depends on adding value at the federal level and providing information back to the provinces with "value added". It is necessary at the federal level to develop national consensus on defining the list of diseases for national surveillance and, in each case, to evaluate why the data are collected and how value is added to justify the effort made in collecting the basic data. Little value is added when the resources to analyze the data are not sufficient. One very important aspect of surveillance involves the use of the information. What interventions or control strategy will change as a result of simply monitoring the prevalence or incidence of a particular disease?

The Canadian bacterial diseases network is concerned with bacterial diseases of importance in the country. The network feels it should focus more expertise on the gram-positive bacteria, especially methicillin-resistant *Staphylococcus aureus,* which has become such a worldwide problem. Canada still has an opportunity to contain this organism. There is concern about penicillin-resistant *Streptococcus pneumoniae,* which has increased from less than 5% to 20% in some areas of the United States. Low levels of penicillin resistance are being detected in Canada. Independently, in one week in Ontario, there were three reports from community hospitals in Ontario of cases of penicillin-resistant pneumococci.

The Canadian bacterial diseases network feels that other pathogens also require additional attention, including enterococci and chlamydia. Disease prevention, "drug-bug" interactions, and new approaches other than the pursuit of new antibiotics to treat specific infections need to be discussed. There were also other issues identified by a questionnaire that was sent to members of the network. These included the need to understand better the immunity to bacterial pathogens, such as by defining protective epitopes in bacteria, and a need for more emphasis on the gram-positive pathogens and their toxins.

Infections as well as diseases must be considered because many, many infections occur without obvious disease. If surveillance focuses solely on disease, then there is a danger of missing emerging infections. An emerging problem could be a disease or infection that was present at a low level which then emerged by amplification. It could also be a new agent, although totally new agents must occur very infrequently.

There are many "exotic" diseases that seem remote and of little concern to domestic public health. Should surveillance be preoccupied with remote exotic disease that might increase over the next decade or focus on conditions that are more common and likely affect the health of a number of Canadians?

Awareness may determine whether infection or disease is emerging. The hantavirus in the four-corners area of New Mexico might not have been called an emerging disease in 1993 if it had been diagnosed with some regularity in 1990-91. Although an outbreak has occurred, it is not clear yet whether the prevalence of the pathogen is increasing. Future years will define its trend but our awareness has defined it as an emerging infection.

State of Canadian Public Health Surveillance: Current Status, a Provincial Perspective

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There are five levels of routine disease reporting: local, regional, provincial, national and international. In some instances, laboratories have a parallel reporting mechanism that is captured in the provincial public health system.

At the local level, the case is identified and detailed data are collected. This level includes physicians, laboratories, infection control personnel in hospitals, public health nurses, and others (including the public).

In the formal system, the local level sends reports to the regional or health unit level. An informal network that permits rapid communication of information outside the routine reporting channels is also very important. At the regional level, analyses are carried out, additional details are obtained, and field investigations are initiated. The regional level constructs the regional epidemiologic picture and is the gateway for public health surveillance. The provincial level receives regional reports and constructs regional and provincial analyses.

Most systems include all four surveillance methods: passive, active, sentinel and survey. For passive surveillance purposes, each province has a list of legislated notifiable diseases. Some provinces include legislation to require reports of **rare** or **unusual diseases or syndromes**. Legislation increases the likelihood that a specific disease will be reported; however, a good working relationship with contributors to the reporting networks is essential to maintain a high degree of participation and reduced delays in reporting.

For passive surveillance, most provinces rely on reports received from laboratories. The best source for laboratory-based information is hospital or public health laboratories. While reporting from physicians may be spotty, completeness of reporting increases for interesting (uncommon) diseases. The better the working relationship/networking at the local level, the better the reporting. Reporting is improved whenever there is feedback of information to the contributors.

Routine passive surveillance is computerized in some provinces; in others, local public health staff telephone the laboratories and institutions for additional reports. Reported data are usually collated weekly, monthly or more frequently as necessary. Analysis of data is usually performed at the regional or provincial levels with feedback of reports to the local level.

Active surveillance is not common in the provinces since it generally requires more resources and is usually reserved for specially identified diseases, or for rare or interesting conditions. Active surveillance is usually initiated when something new, rare or serious occurs, e.g., meningitis due to group C, or the occurrence of a case of polio. It usually involves a selected group of reporters with special expertise, interests or responsibilities; is often time limited (e.g., related to outbreaks of disease); and is usually implemented by the surveillance staff through active surveying or telephoning of the participants in the network. Regular contact with the reporting network is absolutely essential.

Sentinel clinics or physicians may be utilized for specific purposes and some provinces incorporate sentinel surveillance as part of the routine surveillance system. Identified clinics or physicians agree to seek out and report specific diseases or conditions usually for a defined period of time. Success is often dependent on the particular condition being monitored. Clinical, public, scientific or media interest in the condition improves participation. Sentinel systems require close, intense follow-up by the surveillance staff.

Surveys are performed infrequently in most provinces unless there are sufficient resources and a high level of interest in a particular disease.

In Canada, passive surveillance of notifiable diseases, active surveillance of identified diseases, and field investigation of identified conditions are generally well done. Computerization, familiarity with the list of notifiable diseases, and local networking support passive surveillance. A high level of interest in newly identified diseases

provides good detailed information for active surveillance. Local cooperation is generally high for field investigations of outbreak or rare disease situations. How well these approaches to surveillance are implemented varies from province to province, depending on the level of cooperation and networking at the local level and between all levels in the system. The degree of independence of the regional level from the provincial levels may increase or decrease participation. In addition, the professional capacity/expertise available at each level will influence the performance of the network. Common goals and expectations improve performance.

General areas for improvement in surveillance include active surveillance, information sharing, cooperation, coordination of effort and improved data collection, storage and analysis. Cooperation among nurses, physicians, laboratories and institutions may improve with less specialization and better management of liaisons.

For the identification of emerging pathogens, a high index of suspicion is required based on previous knowledge of disease patterns. Small changes in the routine pattern of reported diseases, coupled with increased frequency of monitoring and analysis by dedicated staff may indicate an emerging pathogen. It will be necessary to strengthen formal and informal information sharing, cooperation between all groups, increased feedback of information and investigation of all leads and suspicions for an emerging pathogen. Increased resources, including trained personnel, as well as national distribution of appropriate expertise and leadership at all levels of the system will be necessary to improve provincial capability for rapid collection and analysis of data. There is a need for an increased ability to support rapid field investigations at the national level.

State of Canadian Infectious Disease Research: An Overview

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At a recent meeting of the New York Academy of Medicine on multiple drug-resistant bacteria, including tuberculosis, it was noted that hospitals that share patients with organisms resistant to antibiotics will quickly develop significant problems due to the spread of such organisms from one hospital to another. For example, in intensive care units, 30% of *Klebsiella* organisms are resistant to cephazidine, while 45% to 50% of enterococci are resistant to vancomycin. Methicillin-resistant *S. aureus* (MRSA) now constitutes 20% to 60% of all *S. aureus* isolates in New York City hospitals.

Canada has an opportunity to prevent the development of a similar situation because of its communication networks and cooperative action between provinces, especially in laboratory science and infectious diseases.

A recent report prepared by Dr. Lindsay Nicolle on a meeting between the Canadian Infectious Diseases Society (CIDS) and the Canadian Bacterial Diseases Network discusses what might be done in Canada in response to emerging infections. The meeting did not consider viral infections. There is a need to focus more attention on the gram-positive bacteria, especially with regard to MRSA, which can still be contained in Canada. The report noted the concern regarding penicillin-resistant *S. pneumoniae*, which has increased from less than 5% to 20% in some areas of the U.S. with some high-level penicillin resistance. In Ontario there were three unsolicited reports of penicillin-resistant *S. pneumoniae* that eventually led to the identification of five cases, two in St. Thomas, two in Kingston and one in Peterborough. Multidrug-resistant enterococci and the exo- and enterotoxins of gram-positive cocci require more research and more expertise to be developed in this area.

CIDS needs to be more involved with epidemiology, especially hospital-based epidemiology. CIDS is developing a sub-committee to address nosocomial infections and the special issues associated with infection control in the hospital setting.

Other pathogens that require more attention include *Chlamydia*, *Helicobacter*, and *Ehrlichia*. There is a need for new approaches in disease prevention that look more closely at "drug-bug" interactions, synthetic peptides, and new classes of drugs. Presently, there are no new classes of drugs under development. When vancomycin resistance is introduced by enterococci to staphylococci, there will be no new antibiotics for therapy. Five to 10 years are required to develop new classes of therapeutic agents. There is a need to develop the databases for determining where investments should be made for future vaccine development. There is a need to develop a better understanding of host responses, the possibility of utilizing monoclonal antibodies, new vaccine delivery systems, and vaccines to heat-shock proteins.

Infections due to the use of various bio-materials continue to represent significant health care costs. Infection in implanted prosthetic devices is still the major cause of failure of such devices. Perhaps impregnated antimicrobial or anti-adhesion agents may prevent such infections.

There is a need for improved diagnostic techniques. There are limitations with current PCR techniques. The use of mass spectrophotometry and monoclonal antibodies merits more investigation. Home test kits for upper respiratory tract infections and possibly sexually transmitted diseases would be helpful. The cost-effectiveness of currently used diagnostic tests needs to be examined in view of current economic constraints. In the coming years hospital operating costs must be reduced by about 15% to 20% with corresponding decreases in funds available for laboratory operations.

A questionnaire sent to CIDS members identified other priority areas for infectious disease research, including better understanding of immunity, such as defining protective epitopes in bacteria, more emphasis on gram-positive pathogens and their toxins, and more attention to emerging pathogens, such as enterococci, MRSA, hepatitis, cytomegalovirus and sexually transmitted diseases.

The IOM Report: Implications for Canada

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During the next five years at least 10 and perhaps as many as 50 significant new public health emergencies will occur in Canada. This can be predicted with considerable confidence. Governments and society must respond to each of these emergencies with specific information and direction. Among these will be a few false alarms. For example, newspaper headlines announce that the rapid spread of HIV infection among women is creating "a major health crisis". However, on review the four infected women all had been primarily exposed to infected men with risky behaviors that placed them in a high-risk group with no subsequent secondary spread. Although these headlines generate a high level of awareness, the information may be misleading and it creates a lack of credibility for science and for public health. Leadership must respond with alacrity and propose definitive responses to each emergency.

The pace of change of human demographics, human behaviors, and technologic advances continue to accelerate. For example, most pineapples imported into Canada no longer come from Hawaii. Now they arrive from one of several developing countries with the possibility of introducing gastrointestinal pathogens. How do we plan for these changes?

The initiatives taken by the IOM in the United States have been well described in its recent publication "*Emerging Infections: Microbial Threats to Health in the United States*". Infections may be newly emergent due to changes or evolution in existing pathogens, the spread of known pathogens to new geographic areas or human populations, or the resurgence of infections due to their acquisition of resistance or to breakdowns in public health. The World Bank has recently published "*World Development Report 1993*", which may become as important a landmark document for the developing world as the Alma Alta Declaration on primary care in 1978. The Report argues that from an economic perspective, investing in health, particularly the prevention of infectious diseases, tobacco control, and a few other key interventions,

is a primary responsibility of government and public health systems. These will create significant returns not only in improved health but will also enable enhanced economic performance. For example, every dollar invested in smallpox eradication during the 1970s has returned at least $65.00 annually in terms of reduced costs of control and disease burden. All societies are still benefitting from that investment.

To address the challenges posed by emerging and re-emerging infections, Canada can draw upon the inherent strengths of its health care system, its network of public and hospital microbiology laboratories, its universities, its specialized research funding agencies, such as the MRC and the International Development Research Centre, LCDC, and CIDS and its membership of highly trained specialists in infectious diseases. The latter consists of over 200 individuals to whom are referred most of the acutely ill patients with serious infections within their jurisdictions. They have epidemiologic and laboratory expertise and share a concern for the issues of emerging infections.

The tenuous relationship between research and infectious disease control is a concern. Here is an opportunity for national leadership. MRC has a responsibility to the Canadian society as well as to Canadian science to ensure that gaps between research and disease control are addressed. LCDC is also committed to a similar objective. Many scientists carry out significant research with human pathogens but fail to participate effectively in research related to strategies to reduce disease burden on society. A significant proportion of microbiologic research, particularly that carried out within federal institutions, should be directed at initiatives to enhance human health.

Self-interest groups, i.e., advocacy groups of individuals who are or may be adversely affected by known or ill-defined conditions suspected to be infectious, should be encouraged to develop. HIV-affected individuals have been most successful at mobilizing their communities in support of prevention and research efforts.

Policy makers must also be encouraged and informed to be pro-active. For instance, the scientists and infection specialists who are members of CIDS should take the initiative to identify policy makers who have a basic interest in health problems and issues. They should work closely with such individuals to provide them with the necessary information to influence policy decisions.

Both federal and provincial public health resources should allocate a budget for policy research that would include epidemic modelling. Expert groups should be continually examining the cost-effectiveness of initiatives to control emerging pathogens. For example, MRSA can be controlled with appropriate public health initiatives. What is the cost of failure in this area? How can this be adequately portrayed to ensure that appropriate policies are developed and implemented? Links between policy and its output need to be clearly stated.

A body of credible Canadian leadership should continuously, through appropriate surveillance systems, collect, analyze, and respond to infectious disease threats. This will include an early warning system that will be prompt, provide timely investigation, and integrate expertise from all different groups necessary to respond in the most appropriate manner to real or imagined threats.

Surveillance in Canada needs to achieve networking that links laboratories, clinicans who see patients, and epidemiologists in a partnership that shares information with the knowledge that there will be a response from the public health system. Hospital infection control needs to be a part of this with an infusion of energy and expertise with national leadership, for this area to function expeditiously as an important cost-effective initiative.

The role of the federal government will become more apparent as appropriate leadership emerges within Health Canada. Although leadership is required in all provincial jurisdictions, federal leaderhsip must not be completely decentralized. Standards should be set for all provinces. An ongoing federal investment in public health is essential. Strategies and resources to improve the public health infrastructure with accompanying federal commitments will be necessary. Scientists and physicians with appropriate training in epidemiology, communication skills, and management are required to make a major commitment to the health of the public. Too often individuals have chosen public health not as their first choice but because it provided a less stressful area of work than medical practice. This is no longer an acceptable level of expectation or performance. Governments must recruit and develop the best minds in Canada for public health. Excellence is absolutely necessary for the future if emerging pathogens are to be controlled.

Emerging infections will require an array of resources, both human and fiscal. Being prepared

will ensure that the Canadian society will have confidence in its governments and its institutions. Anything else will only lead to inappropriate expenditures of government funds on false alarms and on widespread infections that could have been curtailed if identified early in their development. Can we, as individuals with current responsibilities for leadership in these areas in Canada, respond adequately to the challenge?

General Recommendations

General Comments

Emerging infectious disease issues are important for the health of all Canadians. Different strategies will be required to protect the public health from exotic pathogens and organisms that are endemic within the country. Canadian surveillance systems must be able to detect and respond rapidly to emerging and re-emerging infections. Due to changes in organisms, antibiotics and the environment, new or old pathogens will emerge or re-emerge.

LCDC must take a leadership role to ensure the development of different strategies. Elements in these strategies include priority setting, partnership formation, disease focus, effective communication, developing healthy levels of suspicion among clinical practitioners, developing an effective alarm response, promotion of interfaces among public health institutions, laboratories, hospitals, practitioners public health practitioners and long-term care institutions.

Data collection must focus on identified priorities with appropriate and timely analysis for widespread use.

To increase the likelihood of early detection of emerging disease, Canada must move beyond the traditional system of notifiable disease surveillance. New strategies should include sentinel practising clinicians, clinics, hospitals and laboratories, cluster analysis, targeting groups at high risk, surveillance for anomalies, alarm systems, pattern recognition and improved information exchange.

The Canadian response must be rapid and comprehensive across jurisdictions and boundaries, and flexible. The response must involve detection, analysis, action, optimal communication and evaluation.

LCDC must take a leadership role in establishing cooperative agreements with the academic sector as genuine partners in collecting, collating, and analyzing data to ensure effective, timely dissemination of information. LCDC should use its collective expertise for data collection and draw upon the skills of the academic sector to ensure timely analysis. Both add value to the intellectual property resulting from combined collection and analysis of data.

The Canadian national surveillance systems are young and evolving as they move from predominantly passive to active systems. Nevertheless, regional reporting networks could be improved starting with improved data collection at the local level. The links between clinicians, hospitals and local public health units must be built, strengthened, and maintained. There is a need for faster transfer of information from provincial to federal levels. An infrastructure to promote day-to-day communication and information exchange must be put in place. Without rapid information exchange, rapid response to a crisis situation is unrealistic.

Issues to be addressed include the following:

- Improving clinician reporting. Without comprehensive clinician reporting, an individual practising clinician may not recognize that she/he is dealing with an emerging disease. Pooled data from multiple sources will facilitate the identification of trends that suggest an emerging problem.
- Identifying alternative approaches. Specific surveillance and reporting protocols are needed for identifying and reporting syndromes that might represent emerging pathogens. Centralized and linked computer systems must search actively for emerging patterns of syndromes. The type of sentinel surveillance system will vary according to the issue and must be as flexible and responsive as the pathogens themselves.
- A national database. Provincial acceptance of a national, computerized database, access to the

data, transfer of local data to the national level, involvement of all levels of contributors, mechanisms for feedback to contributors, priority setting — all are issues for further national discussion.

- Providing a direct link between surveillance, analysis, dissemination of information and action. The basic fuction of any surveillance system is to provide information for public health response capabilities.

Recommendations

1. A national strategy for surveillance and control of emerging and resurgent infections should be developed. Specifically, the Expert Working Group on Emerging Infectious Disease Issues recommends that LCDC, in partnership with provincial, national and international authorities:
   - Develop and utilize a common framework to identify and prioritize emerging and resurgent infections, with respect to implementation of prevention and control programs.
   - Support and enhance the public health infrastructure necessary for surveillance, rapid laboratory diagnosis and timely interventions for emerging and resurgent infections.
   - Coordinate and collaborate in establishing a national research agenda for emerging and resurgent infections.
   - Identify a national authority responsible for making public health decisions related to vaccine-preventable diseases, including vaccine development, production, stock piling and utilization.
   - Strengthen the capacity and flexibility to investigate outbreaks of potential emerging and resurgent infections in Canada.
   - Implement surveillance of potential bloodborne emerging and resurgent infections.
   - Develop a centralized electronic laboratory reporting system to monitor human and non-human infections.
   - Continue to develop and distribute guidelines for standard practices and responses to emerging and resurgent infections.
   - Develop an enhanced capability for recognizing emerging and resurgent infections in unique populations.
   - Train primary care physicians, distribute course material on infectious disease epidemiology, create on-site short-term training modules in applied epidemiology and microbiology to facilitate the prompt recognition of emerging and resurgent infections.
   - Develop a capacity for population-based surveillance, including occupational and behavioral components.
   - Utilize all related databases, including economic and demographic data to enhance public health surveillance.
   - Participate in the efforts of WHO to develop global surveillance for emerging and resurgent infections.
2. A national strategy for the public communication of information relating to emergent and resurgent infections should be developed. Specifically, the Working Group recommends that LCDC, in partnership with provincial, national and international authorities:
   - Develop approaches to provide timely, accurate and useful information in a cost-effective manner about emerging and resurgent infections to the general public and all health care personnel so that all Canadians are prepared to respond effectively to threats to public health.
   - Enhance global communication with respect to emerging and resurgent infections by the development of a clearinghouse for reporting and accessing information on international collaborations.
   - Enhance liaison and communication with other government departments and national and international organizations.
   - Coordinate and distribute information on emerging and resurgent infections from food and animal sources.
   - Develop an "*Emerging Infections Bulletin*" on LCDC's computer bulletin board with hard copy distribution capability.
   - Ensure that all communication systems provide timely feedback to all who

contribute to the surveillance of emerging and resurgent infections.

3. An expert working group should be established to examine matters of ethics and jurisprudence in the area of surveillance and public health interventions.

4. Sufficient resources should be ensured for primary prevention programs, including immunization, such that they do not have to compete for the same pool of resources as secondary and tertiary medical therapies.

Specific Recommendations

1. LCDC, in partnership with provincial, national and international authorities, should:
   - Establish an advisory body to develop a strategic plan for a national response to emerging and resurgent infections.
   - Coordinate national surveillance systems of emerging infections to ensure appropriate linkages and avoidance of duplication.
   - Develop a national inventory of expertise and capacities in the field of emerging and resurgent infections.
   - Identify sources of funding for enhanced, extended or new surveillance systems for emerging and resurgent infections identified as priority public health issues.
2. LCDC should actively develop research and training capacities, including:
   - developing an alliance with research agencies, provinces and industry, and others to create a cost-shared mechanism for research initiatives, such as evaluation of surveillance systems, evaluation of interventions and economic impact,
   - supporting research to understand microbial population dynamics, including possible mechanisms for the resurgence of infectious agents, and
   - strengthening applied public health training in collaboration with the academic sector.
3. Regarding the introduction of specific organisms into Canada, LCDC should develop a national consensus on the medical evaluation of migrants to deal with personal, public health and health care issues in order to promote the health of migrants and the protection of the health of the community.
4. LCDC should address biosecurity issues of food and water control such that:
   - there be continued and enhanced initiatives to use country and commodity-based risk assessment to determine the degree and nature of surveillance for imported food products.
   - there be continued development and reinforcement of cooperative food surveillance and testing using Hazard Analysis Critical Control Point protocols between Agriculture Canada, Fisheries and Oceans, and Health Canada in both national and international arenas.
   - for waterborne pathogens, public health authorities, community physicians and laboratories will be informed of unusual syndromes in order to alert them to potential problems.
5. LCDC should develop surveillance, prevention and control programs for drug-resistant organisms with the following components:
   - a coordinated approach to data collection and dissemination of information with respect to anti-microbial resistance to therapeutic agents,
   - international liaison to share antimicrobial resistance information, and
   - the development of expertise related to antimicrobial resistance mechanisms.
6. LCDC should address nosocomial infections, such that:
   - infection control programs in Canadian institutions are supported, promoted as a priority, and declared essential for the public health.
   - there are strong interfaces at the provincial level between the hospitals and communities for enhanced infection control.
   - drug-resistant organisms arising in health care settings and in communities are

recognized as a major issue for hospitals, day-care settings, nursing homes, schools, prisons and the community; are satisfactorily addressed by infection control programs; and are declared a priority.

- an initiative to coordinate the various interested parties, including all relevant professional associations, is implemented to develop a proper strategy for nosocomial surveillance, including the evaluation of drug-resistant organisms.

7. LCDC should address zoonoses, such that an effective means of information sharing be established between all the interested groups, i.e., veterinary medicine, Agriculture Canada, regulatory bodies, Canadian Cooperative Wildlife Health Centre, public health.

8. LCDC should address vectors, vector-borne diseases and the use of pesticides, such that:

   - Canada maintains a capability in medical entomology.
   - there is support to create and facilitate linkages with international resources in medical entomology on issues related to vector-borne diseases potentially entering Canada.
   - the nature and extent of vector control and pesticide use in Canada is determined and the findings are communicated to the public health community.

9. LCDC should address parasitic agents, such that accessibility to laboratory facilities with good quality timely service in the diagnosis of parasitic diseases is maintained in Canada.

10. LCDC should develop new strategies for early detection of emerging and resurgent infections at sentinel sites in clinics, hospitals and laboratories, and improve dissemination of information to all parties. Groups at high risk should be targeted and enhanced pattern and anomaly recognition encouraged.

11. LCDC should develop policies of operation (what goes to local, regional or reference laboratories, etc.), general guidelines for processing specimens for particular diseases, the elements of a good quality control program, proficiency surveys and programs, standard data collection policies, and appropriate specimen retention policies.

12. LCDC should recruit academic institutions to undertake epidemiologic analyses.

13. LCDC should provide the *Canada Communicable Disease Report* to public health professionals, health care workers and other interested groups at no charge.

14. LCDC should develop practices and guidelines to ensure confidentiality of data and patient identity and communicate them widely.

NOTE: