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HEALTH CANADA FOOD SAFETY PROGRAM: SURVEILLANCE STRATEGIES
(Prepared by Canada)

I. INTRODUCTION:

Canada's enteric disease surveillance program consists of an integrated collection of activities that collectively address the following aims:

- Determine the magnitude and monitor trends in enteric disease over time and enable comparisons with other countries
- Identify outbreaks and guide outbreak investigations
- Guide and assess the impact of food safety and other control programs
- Focus risk factor studies and other targeted research

Surveillance activities include ongoing passive disease reporting systems and active laboratory-based systems as well as rapid outbreak alerts and syndromic surveillance. Surveillance activities also integrate human data with that collected from animals, food and water in order to investigate transmission along the food chain.

II. KEY ACTIVITIES

Routine Enteric Disease Reporting in Canada

In Canada, data regarding laboratory confirmed cases of gastrointestinal illness are generated along two concurrent paths: a public health arm and a laboratory arm (Fig. 1).

Under the public health arm, laboratory confirmation of a reportable agent (Table 1) is reported to the Medical Officer of Health at the local public health unit (PHU). Detailed information about the patient and the potential risk factors is collected by the PHU and forwarded to the provincial or territorial health authority. A subset of this information is forwarded to Health Canada for inclusion in the National Notifiable Disease Database (NND).

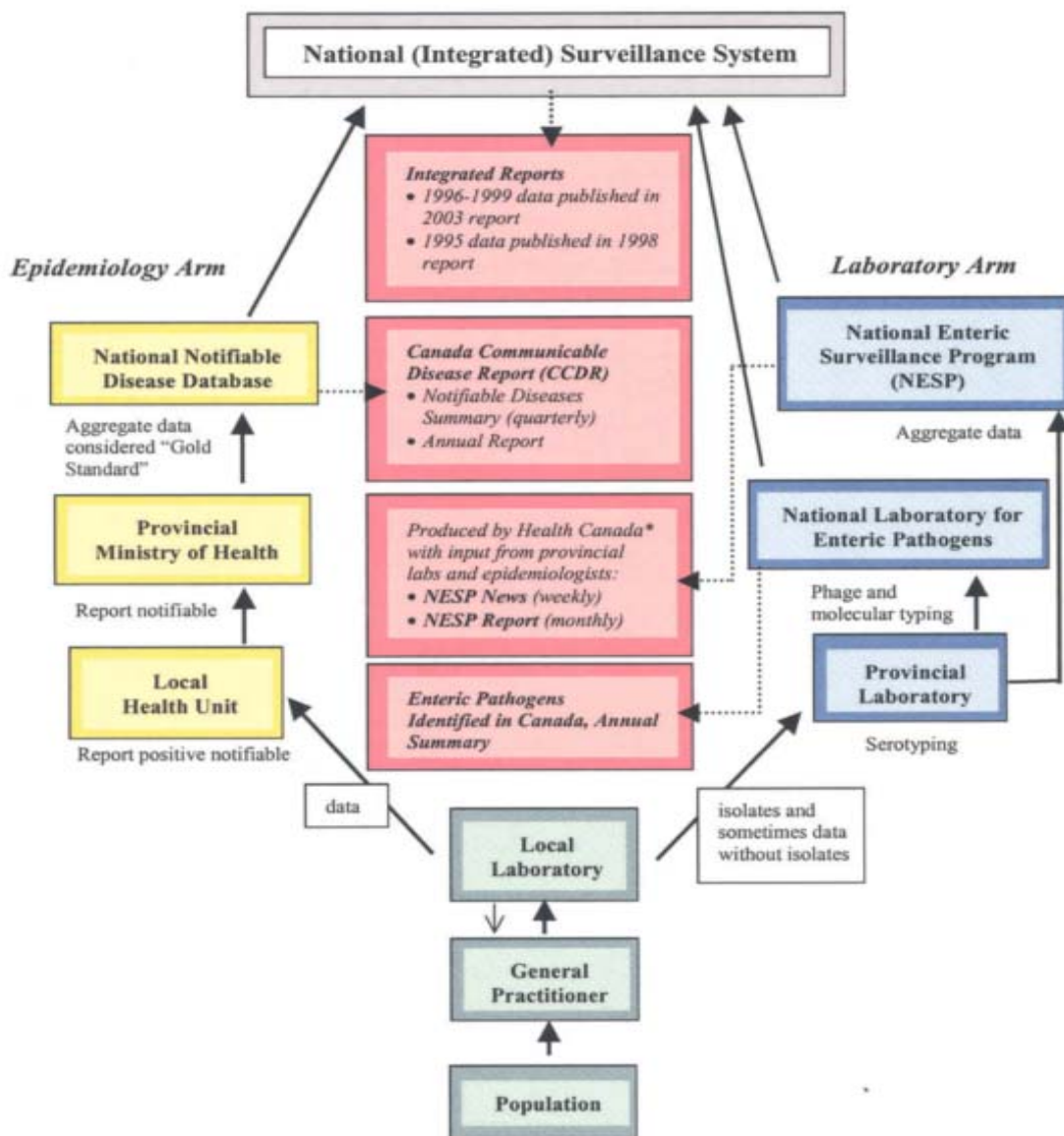
Under the laboratory arm, the local laboratory may forward a specimen or isolate to the provincial public health laboratory for confirmation or further testing (e.g. serotyping); the isolate may be sent to the National Microbiology Laboratory (NML) for additional characterization (e.g. phage or molecular typing).

Provincial laboratories report totals of new cases of a panel of enteric diseases (Table 1) weekly to the National Enteric Surveillance Program (NESP); a program administered by Health Canada's NML and Foodborne, Waterborne and Zoonotic Infections Division. Case counts by week and species (or serovar) for each jurisdiction are collated with additional information as available, related to outbreaks from public health and food safety authorities and molecular typing information via the PulseNet program. Numbers of cases are compared to expected values and any significant elevations or unusual patterns or pathogens are identified. NESP's outbreak detection algorithm is particularly useful for detecting slow developing outbreaks dispersed over multiple provinces. Findings are communicated

to public health authorities through weekly and quarterly NESP News reports and through weekly multi-jurisdictional teleconferences.

Although notification of a case of enteric disease through these systems is generally initiated by laboratory confirmation of a notifiable agent, the number of cases reported through NESP and NND tends to differ (Table 2). Cases ascertained via the public health arm of the surveillance system are more likely to be recorded in the NND as provincial legislation requires the reporting of these data to local health units. For most enteric diseases, salmonellosis being the exception, the number of cases reported by NND is higher than NESP. The reasons for the discrepancies relate to (i) not all isolates are sent to provincial laboratories (particularly *Campylobacter* sp) (ii) under-reporting; and (iii) potential over-reporting due to counting multiple specimens from a single patient.

Figure 1: Canada's national enteric disease reporting chain



*Foodborne, Waterborne and Zoonotic Infections Division and the National Laboratory for Enteric Pathogens, Health Canada.

Table 1: Diseases included in current national surveillance programs

NND	NESP
Salmonellosis	<i>Salmonella</i> sp.*
Typhoid	<i>Salmonella</i> Typhi
Campylobacteriosis	<i>Campylobacter</i> sp.*
Shigellosis	<i>Shigella</i> sp*
Verotoxigenic <i>E. coli</i> infection	Pathogenic <i>E. coli</i> *
Cholera	<i>Vibrio</i> sp.*
Cryptosporidiosis	<i>Cryptosporidium</i> .
Giardiasis	<i>Giardia</i>
Botulism	---
Cyclosporiasis	---
Hepatitis A	---
---	Rotavirus
---	Norwalk-like virus
---	<i>Yersinia</i> sp.*
---	<i>Entamoeba histolytica</i>

* sub-types for bacterial species are reported

Table 2. Average annual disease/pathogen counts (1998-2002) from the National Enteric Surveillance Program (NESP) and the National Notifiable Diseases Database (NND) and the percentage of NESP counts reported in the NND.

Disease/Pathogen	Average annual count (1998-2002)		Percent of counts reported: (NESP / NND) X 100
	NESP	NND	
<i>Giardia</i>	749	4783	16%
<i>Campylobacter</i>	1783	11840	15%
<i>Pathogenic E. coli</i> *	1384	1608	86%
<i>Salmonella</i> **	6330	5866	108%
<i>Shigella</i>	982	1187	83%

* called *Pathogenic E. coli* in NESP and Verotoxigenic *E. coli* in NND

** *Salmonella* counts include Paratyphoid (*S. Paratyphi*) and Typhoid (*S. Typhi*).

Integrated Surveillance:

The comparison of data on enteric diseases from multiple sources contributes to the understanding of disease trends and associated risk factors. The information derived from this approach can potentially better inform policy development on food borne disease reduction strategies. Health Canada's National Studies on Acute Gastrointestinal Illness (NSAGI) consists of a series of population-based studies to estimate the baseline prevalence and distribution of self-reported acute gastrointestinal illness and examine factors affecting disease reporting. The five yearly Canadian Integrated Surveillance Report collates human, animal and food data from multiple surveillance programs. The Report describes pathogenic *E. coli*, *Salmonella*, *Shigella* and

Campylobacter trends and burden of illness (hospitalizations, deaths) for multiple years and geographic areas. Similarly, the Canadian Integrated Program on Antimicrobial Resistance Surveillance (CIPARS), administered jointly with Health Canada's Laboratory for Foodborne Zoonoses (LFZ) and NML, collects and integrates representative, methodologically harmonized data on antimicrobial use and antimicrobial resistance in selected enteric pathogenic and commensal organisms from animal, food and human sources. Annual CIPARS Reports are intended to support evidence-based decision making, particularly with respect to the human health implications of antimicrobials used in food animal production.

Enteric Outbreak Alerts

The NESP and NND systems are subject to limitations in epidemiological data and timeliness of reporting which may delay outbreak detection and response. To enable more rapid detection, an electronic enteric outbreak alert system was established. The "*Alerts*" component of the Canadian Enteric Outbreak Surveillance Centre (CEOSC) is a secure web-based application which provides a forum for local, provincial and federal public health officials to share information about outbreaks or suspected outbreaks under investigation in their jurisdictions. CEOSC will also form the basis of a national outbreak database. In addition to supporting early notification of real or suspected outbreaks, the *Alerts* application facilitates recognition of geographically dispersed outbreaks that are related by a common source. *Alerts*, which requires Internet access and an email account, offers an easy to use communication tool for public health professionals to rapidly communicate outbreak notices and helps to forge an environment of collaboration among different stakeholders in the public health care system. Currently, all provincial and federal public health and food safety agencies and over 98% of public health units are enrolled as *Alerts* users and evaluations of the system's utility have been favourable.

Outbreak Detection and Response: A multi-jurisdictional responsibility

Outbreak detection and investigation is a shared responsibility of public health and health-care providers. However, the primary responsibility of an outbreak investigation and control in Canada lies with the regional or local health authorities. The provincial health authorities coordinate inter health authority outbreaks and assist with large health unit outbreaks. Health Canada coordinates inter-provincial outbreaks and assists in local or provincial outbreaks upon request by the province or territorial health departments. This process works best when there is early identification of similar cases across a jurisdiction and where there is communication across the various public health authorities. The *Alerts* application provides national public health officials with a means to identify patterns of outbreak occurrence in multiple jurisdictions and assists in developing, coordinating and implementing strategies for early intervention and response.

In outbreaks that are found to cross national boundaries, Health Canada acts as the focal point for coordinating the investigation within Canada as well as contributing to the international investigation. Health Canada also participates in international surveillance networks such as the European EnterNet program and WHO Global Salm-Surv.

Syndromic Surveillance

The reporting delays inherent in current routine case reporting systems can impede the detection and investigation of an outbreak and implementation of appropriate controls. Therefore, Canada's surveillance activities also includes an investigation of alternative methods of surveillance which are intended to support more rapid detection of excess gastrointestinal illness in communities. Such approaches would include monitoring of chief complaints from Emergency

Room visits; nurse telehealth phone-in services and 911 calls; monitoring absenteeism in sentinel locations such as schools; and monitoring sales of drugs relating to acute gastrointestinal illness.

The “Alternative Surveillance Alert Project” (A.S.A.P.) is pilot testing the efficacy of a syndromic surveillance system monitoring the sales of proprietary products for treating vomiting and diarrhea. Pharmacists are often the first point of contact for the general public in case of acute gastrointestinal illness, and pharmacy sales data trends could provide a means for early detection of disease in the community. In the A.S.A.P. pilot, major retailers provide Health Canada with daily aggregate sales data of selected products from pharmacies in the geographic areas that are connected to the retailers’ electronic point-of-sale inventory database.

Health Canada statistically analyses the product sales data for spatial and temporal trends. Existing freeware such as University of Pittsburgh’s Real-time Outbreak Detection System (“RODS”) is being adapted and enhanced for this purpose. Historical information will be used to create baselines, determine trends and dampen the ‘noisiness’ of the drug sales data. When significant aberrations from an established ‘norm’ are detected, Health Canada will inform the local PHU. The PHU’s role is to act on these warnings as appropriate in the circumstances and provide feedback to Health Canada on its utility. To further examine the validity of A.S.A.P., Health Canada will conduct a retrospective comparison of the OTC sales trend lines with the frequency of laboratory-based isolations of enteric pathogens.

Any study of the use of syndromic surveillance systems should be developed in a multi-tiered way because each of the levels has its own use for this information. An important aspect of setting up an alerting system is to determine what the appropriate response is to an alert, by the regional, provincial and federal public health. In Canada and in other developed countries where many of these types of data are in an automated form, it is generally feasible to set up a centralized data collection/analysis/reporting system. In regions where data collection might still be in paper format, innovative monitoring of local data (such as absenteeism or visits to the doctor) that reflect disease occurrence could be arranged with a system of communication based on faxes, phone or email of alerts.

Surveillance of Enteric Diseases vs Foodborne Diseases

Although routine surveillance activities and outbreak investigations of enteric illness often yield considerable epidemiological and microbiological information, confirmed routes of transmission (ie food, water, person-to-person) are not always known/reported for these illnesses. A sentinel surveillance program “C-EnterNet” will monitor human exposure to pathogens from animals, water and food sources as well as the occurrence of human enteric illness in the population through enhanced surveillance, laboratory testing and outbreak investigation. C-EnterNet will provide data and information to integrate and strengthen the science, policy, intervention, prevention, promotion and protection activities related to food-safety and enteric disease through:

1. Detecting changes in pathogen exposure levels from food, animal and water sources as well as human enteric disease related to changes in policy or practices;
2. Determining the proportion of human cases due to water, food, animal contact;
3. Providing information for early warning (pre-exposure) of problems in the agri-food chain.

III. SUMMARY/CONCLUSION

No sole surveillance data source is adequate to describe all the various aspects of enteric disease in Canada or address stakeholders’ varied information needs relating to disease detection, research, prevention and control. Surveillance systems must be consistent yet responsive to public

health needs; risk assessments which utilize surveillance data and identify information gaps can serve to improve the utility of surveillance as well as support policy making. A comprehensive picture of enteric disease in Canada requires integration of nationwide passive and active systems, ongoing and periodic sentinel surveillance programs and targeted research, rapid alerts and syndromic surveillance.