

# The Canadian Integrated Program for Antimicrobial Resistance Surveillance: An approach to building collaboration for a voluntary farm surveillance framework

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## Summary

The potential public and animal health impact of antimicrobial use and resistance in food animals is a contentious issue for industry, producers and veterinarians. To build collaboration in the development and implementation of a farm-based surveillance system that protects the biosecurity and confidentiality of data providers requires extensive consultation and transparency. Taking this approach, the CIPARS Farm program developed as a national network of volunteer sentinel swine veterinarians and producers that provides trend data on antimicrobial use and resistance. These data contribute to related animal and public health policies in Canada.

## Introduction

Antimicrobial use (AMU) in livestock and associated antimicrobial resistance (AMR) has emerged as a significant global public health concern over recent decades. In 1997, the Canadian Consensus Conference on Antimicrobial Resistance provided an Action Plan (1) that outlined several recommendations to contain the development and dissemination of AMR. Among these was a recommendation to establish a national surveillance system to detect AMU and AMR; the recommendation specified that such a surveillance system include food animal agriculture. Subsequently a report of the Advisory Committee on Animal Uses of Antimicrobials and Impact on Resistance and Human Health (2) prepared for Health Canada recommended the implementation of a permanent ongoing national surveillance program to detect the emergence of AMR in indicator and pathogenic bacteria isolated from animals and food. In response, the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) was developed as a multi-component framework initiating active surveillance programs in abattoirs (2002) and retail meats (2003), focusing on the core commodities beef, pork and poultry (3). The CIPARS passive surveillance components that monitor AMR among human and animal clinical isolates of *Salmonella*, and the collection of human antimicrobial use data facilitate the integration of human, animal, and food data and therefore a greater understanding of AMR epidemiology in Canada. However, there were recognized information gaps in CIPARS, specifically, a lack of farm level AMR and end-user animal AMU data.

This paper will describe the approach taken in developing the Farm component of CIPARS including the engagement

of industry collaborators and experts, producer and veterinary data providers, to build a sustainable framework considerate of farm biosecurity and confidentiality.

## Materials and methods

Initial funding for this surveillance initiative was provided for five years under the Food Safety and Food Quality component of the Agricultural Policy Framework, which is a federal, provincial, territorial and industry action plan for sustainable agriculture in Canada. A CIPARS working group (WG) of veterinary epidemiologists was created to lead the development of a farm-based surveillance program for AMU and AMR that was national in scope. Consultations were conducted with national and provincial commodity organizations and researchers representing the beef, pork and broiler poultry sectors. Information gathered through these consultations directed a decision to pilot the concept of farm surveillance in the swine industry with the following objectives:

- To establish an infrastructure supporting a national surveillance framework for the continuous collection of data on AMU and AMR in Canadian swine herds;
- To describe trends in antimicrobial use in swine herds and antimicrobial resistance in select bacteria from grower-finisher pigs in Canada;
- To assess potential associations among on-farm AMU and AMR in conjunction with targeted research;
- To provide data for human health risk assessments.

A transparent, consultative and iterative approach was taken in designing the surveillance framework (Figure 1). The WG initiated a draft document outlining the essential elements of the surveillance framework (4). This draft framework document was then circulated to an Expert Review Panel (ERP) with expertise in veterinary epidemiology [4] and pharmacology [1], swine health [2] and production [1], the animal feed industry [1] and public health [1]. Over two review periods, panel members were asked to provide general comments on the framework design moving to specific recommendations on each aspect of the surveillance methodology.

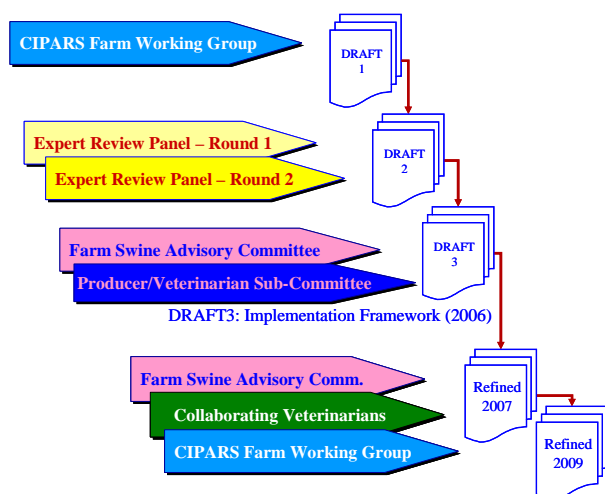
Recommendations from the ERP were provided to a commodity-specific Advisory Committee (AC) for development of an implementation framework. Core members of the AC were swine producers [5], designated by their provincial pork industry organization, representatives from the Canadian Pork Council [2], swine specialist veterinarians [4], and veterinarians from

provincial ministries of agriculture [7]. Other members on the swine AC included academics specializing in swine health, epidemiology and pharmacology [4]. Additionally, the AC included a Secretariat with representation from various federal agencies with interests in AMR surveillance: the Public Health Agency of Canada (PHAC) [12], the Veterinary Drugs Directorate, Health Canada [1], the Canadian Food Inspection Agency [3], Agriculture and Agri-Food Canada [1]. In addition, because of an intention of harmonizing with a similar initiative in the US, an expert from the US Department of Agriculture, APHIS, Veterinary Service was included in the AC [1].

A final review of the framework operational logistics was provided by an AC Sub-committee of swine veterinarians and producers. This Sub-committee provided direction on sampling protocols and data collection instruments.

Sampling protocols and questionnaire instruments were evaluated using data tracking information and data quality assessments. Subsequent program refinements were made with input from the AC, the Veterinary-Producer Sub-committee and sentinel herd veterinarians.

**Figure 1.** Surveillance framework development process



## Results

Based on recommendations made during the framework development process, the CIPARS Farm surveillance program was implemented in 2006. The grower-finisher (G-F) phase of production was selected as the livestock class of interest, because of its proximity to the consumer.

At implementation the surveillance network consisted of 108 sentinel G-F swine operations and 29 swine veterinarians in each of the major pork producing provinces: Québec, Ontario, Manitoba, Saskatchewan and Alberta. The number of sentinel sites was distributed across the provinces in proportion to each province's contribution to the number of G-F operations nationally. Supplemental provincial funding from Alberta (2007-ongoing) and Saskatchewan (2006-2007) provided 10 additional sites in those provinces.

Sentinel veterinarians were purposively selected from provincial sampling frames of swine practitioners. Veterinarians who agreed to participate were contracted by PHAC to recruit and enroll sentinel farms, and to conduct sampling visits. Contracts provided monetary

compensation for veterinarians and producers for each visit. Two supervisory veterinarians were also contracted to protect the confidentiality of data from corporate (vertically integrated) sentinel sites.

Each veterinarian selected candidate herds according to set inclusion/exclusion criteria that would provide a national network of sentinel sites representative of production systems that are typical of the Canadian pork industry (5). On enrollment veterinarians and producers signed an informed consent document, which in outlining collaborator roles and responsibilities indicated that the veterinarian would hold herd identity codes confidential. On-going sample and questionnaire data collection is conducted by veterinarians on sentinel farms according to set protocols.

Each sentinel site was sampled three times per year to reflect pig flow dynamics through G-F units. On each sampling visit, composite fecal samples were collected from two pens of close-to-market (CTM) pigs (>80 kg). A questionnaire was completed by the veterinarian and producer to collect data on antimicrobial use, animal health, biosecurity practices, herd demographics and pig inventory. Approximately half of the enrolled herds also sampled pigs on arrival to the G-F unit once per year.

Samples were submitted to provincial (Alberta and Saskatchewan) and PHAC laboratories for primary isolation and susceptibility testing of generic *E. coli*, *Salmonella* and *Enterococcus*. The Sensititre® Microbiology System (Trek Diagnostic Systems, Cleveland, OH, USA) and the National Antimicrobial Resistance Monitoring System (NARMS) Public Health plate configuration are utilized for susceptibility testing.

Data management and analysis is conducted by the CIPARS Farm Program and consultant epidemiologists. Descriptive surveillance findings were reported in the 2007-2009 CIPARS Annual Reports (3) and peer-reviewed publications (5). Herd-specific reports of 2006-2008 data were provided to collaborating veterinarians and producers.

Data are tracked on a weekly basis. Surveillance methods and data quality are reviewed and assessed by the WG annually. Program refinements are made in consultation with the AC, external epidemiologists and sentinel veterinarians.

Participation in this voluntary program has been consistent since implementation with little variation in submissions beyond that related to program refinements (Table 1).

**Table 1.** CIPARS Farm Swine program summary by year

	2006	2007 <sup>1</sup>	2008 <sup>2</sup>	2009 <sup>3</sup>
Veterinarians	29	29	29	26
Herds	108	108	108	98
Samples	462	612	483	698
Questionnaires	79	173	232	177
<i>Salmonella</i> isolates	94	110	61	124
<i>E. coli</i> isolates	2,197	1,575	1,425	1,800
<i>Enterococcus</i> isolates	867	985	1,266	1,704

<sup>1</sup> Saskatchewan funding for additional 10 herds ended in Dec. 2007.

<sup>2</sup> Discontinuation of arrival cohort sampling.

<sup>3</sup> Revised sampling: 6 CTM pens sampled per sentinel site once per year.

## Discussion

The success of this national farm-based surveillance program for AMU/AMR depended greatly on extensive consultation and transparency given the contentious nature of these issues in food animal agriculture and their potential public health impacts, and that data provider participation was voluntary. Preliminary consultations with commodity groups and provincial Ministries of Agriculture and Food provided information that led to the decision to pilot this surveillance program in swine. The Canadian swine industry had a mature certified on-farm food safety and quality assurance program (CQA<sup>®</sup>), and this commodity had not experienced a recent foreign animal disease outbreak, unlike the beef (BSE, 2003) and broiler poultry (Avian Influenza, 2004) sectors. Also the United States, a major trading partner in this commodity, had launched a similar surveillance system in swine (6).

The engagement of a commodity-specific ERP and AC ensured the surveillance infrastructure would be practical, efficient and effective. Involvement of national and provincial industry organizations and government agencies in the development phase of this surveillance initiative ensured timely and transparent communications to constituents. Major concerns for industry were related to time management, farm biosecurity, data confidentiality and the dissemination of surveillance findings.

Producer members of both committees identified veterinarians as the primary candidate group to manage and conduct surveillance field work for this program. The herd veterinarian was viewed as a trusted professional who could execute surveillance protocols in a bio-secure and confidential manner. Insight by herd veterinarians on animal health status and herd-level AMU provided an additional advantage to a "sentinel vet" model. Collaborating veterinarians have also played a key role in the development and refinement of surveillance instruments.

There is no legislated mechanism in Canada that facilitates the collection of antimicrobial usage surveillance data from the pharmaceutical industry, feed and farm supply retailers, veterinarians or producers (2), although since 2006 the Canadian Animal Health Institute has been voluntarily providing veterinary antimicrobial distribution data aggregated to antimicrobial drug class (3). Given the volunteer nature of this surveillance system, members of the AC recommended that producers and veterinarians be compensated for the time required to complete the detailed questionnaire. Situations where payment for data is appropriate and effective are limited (7) but there is evidence for the importance of monetary compensation in sustaining the participation of data providers in this particular surveillance program. Through 2009-10 there were significant declines in hog prices, slaughter volumes and exports (8). In the face of this significant down turn in the Canadian pork industry, the CIPARS Farm program continued with minimal erosion in the number of sentinel sites. The importance of compensation in maintaining on-going surveillance operations was also supported by comments provided by collaborating veterinarians.

The sustainability and relevance of a surveillance system is a function of its methodological and operational flexibility

and responsiveness (4, 7). Refinements made during the implementation year were in response to poor questionnaire compliance and data quality. Further refinements were made for the 2009 sampling year based on variance component analysis, which indicated little temporal variation. Sampling protocols changed from two pens sampled per sentinel site three times per year to 6 pens sampled per sentinel site once per year, and revisions were made to further simplify the questionnaire.

Industry concerns regarding the reporting of surveillance findings were addressed through the development of a communications plan that provides notification to core AC members prior to publication. Oversight of data management and analysis is provided by the WG; other than input from experts on the utility of different parameters in presenting data, industry is not involved in data interpretation or reporting.

In meeting its objectives, the Farm surveillance program provides AMU and AMR data that can be integrated with data and findings from the other components of CIPARS to inform animal and public health policies related to antimicrobial use and food safety.

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