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Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

2020 Executive Summary and Key Findings

TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP, INNOVATION AND ACTION IN PUBLIC HEALTH.

—Public Health Agency of Canada

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Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2020: Executive Summary and Key Findings

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) monitors trends in antimicrobial use (AMU) and antimicrobial resistance (AMR) in select foodborne bacterial species from people, animal, and food sources across Canada. This Executive Summary accompanies several other CIPARS communication products, which can be found here: Surveillance Reports. We are also launching Phase I of our interactive data displays.

Of note, in this Executive Summary, we refer to categories of antimicrobials of importance to human medicine, which were developed by Health Canada's Veterinary Drugs Directorate (Categorization of Antimicrobial Drugs Based on Importance to Human Medicine). While all antimicrobial classes are of interest, for this Executive Summary, we have focused on those in Category I, which are of "very high importance" to human medicine (e.g., third-generation cephalosporins and fluoroquinolones).

CIPARS data collection was affected by the COVID-19 pandemic; several of our surveillance components had reduced data collection or a reduced number of submitted isolates for susceptibility testing, in addition to shifts in regions or sites sampled.

Integrated antimicrobial sales data

Between 2019 and 2020, the overall sales of antimicrobials (kg) intended for use in production animals increased by 6.5% and increased by 7.5% when accounting for the number of animals and their weights (animal biomass). During the same timeframe, sales of antimicrobials (kg) for use in poultry and aquaculture decreased; sales for use in beef cattle, pigs, and veal calves increased; and sales for use in dairy cattle, horses, and dogs and cats remained stable (<1% change).

In 2020, approximately 82% of antimicrobials were sold for use in production animals, 17% for people, <1% for cats and dogs and <1% for plants/crops. Noting that there are many more animals than people in Canada, after adjusting for the underlying biomass, there were approximately 1.8 times more antimicrobials sold for use in production animals (food animals and horses) than for people.

Other findings of note: In 2020, Canada distributed the sixth highest quantity of antimicrobials intended for use in production animals compared to the 2020 data from 31 European countries. While Canadian reported sales for production animals (mg/PCU) were approximately three times higher than the European median, in terms of Category I antimicrobials, sales of third-generation cephalosporins were only slightly higher and sales of fluoroquinolones were lower than the European median.

Integration of findings across surveillance components — Sales data compared to reported farm antimicrobial use

There is interest in comparing the trends in antimicrobial sales and AMU reported on farms. For aquaculture, the trends for the farm-level AMU (which reflects all aquaculture operations) and reported sales data move in the same direction (decrease; measured by kg of antimicrobials).

For poultry, when measured by kg antimicrobials, the trends for sentinel farm-level AMU and sales data were in the same direction (decreased). However, when measured by mg/PCU_{CA}, sales for poultry increased from 2019 to 2020, whereas farm reported AMU decreased.

For pigs, when measured by kg antimicrobials, reported sentinel farm AMU increased in 2019, whereas sales decreased; for 2020, there was a decrease in farm AMU with an increase in sales. However, when using mg/PCU_{CA}, the trends for farm-level AMU in grower-finisher pigs and sales move in the same direction (increase).

Overall, sales data give indications of temporal trends, but may differ from trends in AMU on the farm, due to time-lags between purchasing by veterinarians and feedmills and then use at the farm, storage times, etc. This underscores the value in having multiple sources and types of data gathered over time for better understanding of AMU and subsequently AMR.

Integrated farm antimicrobial use and antimicrobial resistance

CIPARS integrates information on AMR, AMU and herd/flock mortality for broiler chickens, grower-finisher pigs, and turkeys.

Poultry

For poultry, the trend in resistance to 3 or more antimicrobial classes in *E. coli* decreased since 2016, including between 2019 and 2020. At the same time, overall AMU (total nDDDvetCA/1,000 animal-days at risk) decreased for broiler chicken and turkeys since 2016. This decrease occurred without any substantive reported changes to flock mortality, and reporting of diagnoses of diseases decreased or remained stable.

Broiler chickens: Resistance to ceftriaxone in *E. coli* and *Salmonella* decreased. However, there was an increase in resistance to nalidixic acid in *Salmonella* and increase in ciprofloxacin resistance in *Campylobacter* since 2018. For AMU, the number of antimicrobial classes reportedly used decreased from 11 to 9 classes (consistent with the timing of the elimination of preventive uses of Category II antimicrobials). Most antimicrobials were used for the prevention of enteric diseases. The diagnoses of septicemia and enteric disease decreased, while the diagnoses of yolk sac infection and miscellaneous bacterial diseases (mixed causes) increased, and diagnoses of respiratory disease remained stable.

Turkeys: There was a decrease in resistance to nalidixic acid and ciprofloxacin in *Salmonella,* and a decrease in resistance to ciprofloxacin in *Campylobacter* since 2018. The number of antimicrobial classes reportedly used decreased from 9 to 6 classes (consistent with the timing of the elimination of preventive uses of Category II). Most antimicrobials were used for the prevention of enteric diseases. The diagnoses of septicemia and enteric disease decreased, while yolk sac infection and miscellaneous bacterial diseases (mixed causes) increased, and diagnoses of respiratory disease remained stable.

Grower-finisher pigs

For grower-finisher pigs, the trend in resistance to 3 or more antimicrobial classes decreased for *E. coli*, *Salmonella*, and *Campylobacter*. Ceftriaxone-resistant *Salmonella* also decreased. At the same time, overall AMU decreased (nDDDvet/1,000 grower-finisher pig-days at risk) from 2019 to 2020. Of note, while doses and durations were in-line with labelled conditions of use for disease treatment and/or prevention, 4 sentinel herds reported growth promotion use of medically important antimicrobials.

Antimicrobial resistance

Salmonella from healthy feedlot cattle

In 2019, a small number of *Salmonella* Heidelberg isolates resistant to 5 or more antimicrobial classes from healthy cattle on Alberta feedlots were detected for the first time. This was not observed in 2020; *Salmonella* Heidelberg was not recovered from healthy feedlot cattle on farm. *Salmonella* was only recovered from cattle on Ontario feedlots (n = 15 isolates), and resistance was only observed to Category III antimicrobials in *S.* Muenchen (n = 5) and *S*. Uganda (n = 8).

Campylobacter from healthy feedlot cattle

The recovery of *Campylobacter* from healthy feedlot cattle decreased from 44% in 2019 to 23% 2020. Resistance to ciprofloxacin has been increasing since 2017, to 29% in 2020, yet resistance to three or more classes of antimicrobials decreased.

Salmonella Enteritidis and nalidixic acid resistance from broiler chicken

Starting in 2018 and continuing in 2019, CIPARS detected the emergence of nalidixic acid-resistant *S.* Enteritidis from broiler chicken in a small but notable number of isolates from multiple surveillance components. Noting substantially reduced sampling during the COVID-19 pandemic, CIPARS continued to detect nalidixic acid-resistant *S*. Enteritidis from retail chicken (n = 1) in 2020. There were additionally 5 isolates of nalidixic acid-resistant *S*. Enteritidis found in samples submitted from sick chickens; recognizing that sick animals do not enter the food chain. Historically, most (>95%) *S*. Enteritidis isolates from CIPARS were susceptible to all tested antimicrobials. CIPARS will continue to monitor and assist as needed in determining the role of domestic chicken as a source of nalidixic acid-resistant *S*. Enteritidis.

Detection of colistin resistance

Transmissible (resistance present on mobile genetic elements) colistin resistance is of great global concern as colistin is an antimicrobial of “last resort” for serious infections that are resistant to most or all antimicrobials. Antimicrobial susceptibility screening for colistin resistance began in 2016, and in 2020, colistin was added to the panel for routine antimicrobial susceptibility testing.

In 2020, CIPARS detected resistance in *E. coli* and *Salmonella* from 3 surveillance components. A single colistin-resistant isolate of *Salmonella* Enteritidis and Kiambu each were detected from caecal contents of healthy chickens at slaughter. Two *E. coli* isolates resistant to colistin were detected: one from healthy grower-finisher pigs on-farm and one from retail ground beef. Genetic analyses showed that the observed colistin resistance was not transmissible. Detection of colistin resistance in *S*. Enteritidis is expected, but not concerning, as it is usually intrinsic or naturally occurring. The detection of transmissible resistance in *Salmonella* from human samples is currently rare (5 isolates detected in 2020). Given the threat of transmissible colistin resistance, CIPARS will continue to monitor for colistin resistance and contextualize findings when detected.

New farm surveillance activities and reporting

Beef cattle: Surveillance of farm AMU started in 2019 and the majority of antimicrobials reported for feedlot beef cattle were administered in-feed, with tetracycline and macrolides being the predominant antimicrobial classes (when excluding ionophores). In terms of Category I AMU, there was a small amount of injectable third-generation cephalosporin and fluoroquinolone used.

In addition to core surveillance of Gram-negative enteric bacteria, feedlot surveillance also included sampling for *Enterococcus* (Gram-positive) and 3 pathogens (*Manneheimia haemolytica*, *Pasteurella multocida* and *Histophilus somnus*) associated with bovine respiratory disease (BRD). Respiratory disease (including histophilosis) and liver abscesses were the major drivers of AMU in feedlot cattle. Over half of the recovered BRD isolates were susceptible to the tested antimicrobials. Resistance to Category I antimicrobials was low.

Dairy cattle: Surveillance of farm AMU (through a garbage can audit) started in 2019. Dairy cattle were one of the only farmed terrestrial species under surveillance where the quantities of antimicrobials used for disease treatment were more than the quantities of antimicrobials used for disease prevention. With only 2 years of testing, trend analysis for AMR was not applicable. Resistance to ceftriaxone, nalidixic-acid and ciprofloxacin was only observed in *E. coli*, and resistance to these antimicrobials was not observed in *Salmonella*.

Only 2019 farm AMU data for dairy cattle were available, and the predominant AMU was injectable trimethoprim-sulfonamides and penicillins. There was some Category I AMU in dairy cattle including injection and intramammary use. Third-generation cephalosporins were the most commonly used Category I antimicrobials, followed by small amounts of fluoroquinolones and polymyxins (polymyxin B).

Broiler chickens: Like feedlot cattle, broiler chicken surveillance is expanding beyond the core surveillance of Gram-negative food-borne bacteria to include *Enterococcus* (re-implementation of a discontinued surveillance component) and adding a chicken pathogen (*Clostridium perfringens*). *Clostridium perfringens* is a cause of significant disease (necrotic enteritis) in chickens and most AMU reported in broiler chickens is for the prevention of enteric diseases.

Pilot surveillance of the Egg Layer Sector — transitioning to core surveillance: CIPARS collaborated with the egg layer sector (2020-2021) to pilot farm-level surveillance of AMU and AMR in 72 layer flocks from the 4 major egg-producing provinces: British Columbia, Alberta, Ontario, and Québec. In general, AMR was substantially lower in bacteria from egg layers than broiler chickens on farm. In 2020, the percentage of *E. coli* isolates resistant to three or more antimicrobial classes from layers was 2.5% (broiler chicken: 21%) and 24% of isolates were resistant to tetracycline (broiler chicken: 35%). Antimicrobial use records were available for 9 flocks and the only reported use of medically-important antimicrobials were bacitracin and tetracycline.