PROGRESS REPORT

ON THE 2015 FEDERAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE AND USE

PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

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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OVERVIEW

Antimicrobial resistance (AMR) occurs when microorganisms, such as bacteria, viruses or fungi, change in ways that reduce or eliminate the effectiveness of the antimicrobials used to treat infections. The microorganisms that are able to resist the treatment survive and multiply. Inappropriate prescribing and misuse of antimicrobials in human and veterinary medicine and in the agriculture and agri-food industries increase the rate at which AMR organisms develop and spread. Additional research is required to determine the impact of antimicrobial use (AMU) on aquatic environments. Poor infection control practices, inadequate sanitation and inappropriate food-handling also encourage the spread of AMR.

AMR has been identified as a global threat to human health, sustainable food production, and international development. It is the subject of significant interest to the international community and in September 2016, it became one of only four health issues ever to be discussed in a United Nations General Assembly high level meeting (the others were HIV, Ebola, and non-communicable diseases).

The Government of Canada recognizes that AMR is a complex, multi-sectoral issue that must be addressed in a coordinated manner which takes into account the social, economic and health needs of Canadians.

To focus federal attention on this issue, in October 2014, the Government released the Federal Framework for Action to coordinate the AMR activities of five federal departments and agencies. This was followed in March 2015 by the Federal Action Plan on Antimicrobial Resistance and Use in Canada, which included commitments from two additional departments. Over the past three years, these seven federal departments and agencies have been working to fulfill their commitments under the Federal Action Plan.

This Progress Report will highlight the federal government's success in achieving its objectives under the Federal Action Plan and will identify areas where continued work is required.

While the attached Technical Annex goes through the commitments made by each of the seven departments and agencies implicated in the 2015 Federal Action Plan in detail, this Report provides a more general overview of the federal government's current 'state of affairs' with respect to AMR under each priority area identified in the Federal Action Plan.

Growing Federal Collaboration Across Sectors

Activity to address AMR through the development of the Federal Framework for AMR (2014) was initiated by the Public Health Agency of Canada in collaboration with Health Canada, the Canadian Food Inspection Agency, the Canadian Institutes of Health Research, and Agriculture and Agri-Food Canada. Two additional federal entities - Innovation, Science and Economic Development Canada, and the National Research Council - joined the original five in making commitments under the Federal Action Plan in 2015.

Momentum has continued to grow, and Global Affairs Canada, Environment and Climate Change Canada, Fisheries and Oceans Canada, and the International Development Research Centre have joined the discussion, advancing our progression towards a 'whole of government' approach to the complex and multi-faceted issue of AMR.

Federal Achievements

Since its launch in 2015, federal departments and agencies have undertaken a significant amount of work to deliver on their commitments under the Federal Action Plan and have achieved some notable success.

Leadership

Domestic

Although the federal government holds some important levers to address AMR through legislation, regulation, policy work and funding, it is only by working together across jurisdictions and across sectors that we will be able to implement a strong national response to AMR. For this reason, the Government of Canada brought together federal, provincial and territorial (F/P/T) partners and human and animal health, agri-food and industry stakeholders to develop an inclusive national strategy to address AMR and to encourage the prudent use of antimicrobials. After intensive and collaborative work with F/P/T partners and other stakeholders from across the human and animal health spectrum, 'Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action' was developed. The Pan-Canadian Framework was jointly released by the Minister of Health and the Minister of Agriculture and Agri-Food on September 5, 2017.

The **Pan-Canadian Framework for Action** was developed jointly with public and private sector stakeholders to guide our collective action in tackling AMR in Canada. The Framework identifies opportunities for action and desired outcomes under the pillars of surveillance, stewardship, infection prevention and control, and research and innovation. Work is underway to develop a pan-Canadian action plan to define concrete commitments and timeframes to put the principles of the Framework into action.

In addition to the broader work to develop a pan-Canadian approach to address AMR, the Government of Canada has played a leadership role with provinces, territories and external stakeholders to advance specific initiatives in the areas of surveillance, stewardship and innovation.

International

Canada continues to play an active role in international efforts to address AMR. In May 2015, Member States, including Canada, endorsed the World Health Organization's (WHO) Global Action Plan on AMR (GAP). At the United Nations (UN) General Assembly High Level Meeting on AMR in September 2016, world leaders, including Canada's representative, recognized the GAP as the blueprint for action on AMR. In addition, Canada has endorsed Leaders' Declarations at the G7 and G20 supporting action on AMR. These international agreements provide considerable impetus for the Government of Canada as it moves forward with its One Health approach to AMR. For example:

- In October 2017, Canada became Chair of the Global Health Security Agenda (GHSA) AMR Action Package, working with key partners, including Germany, the Netherlands, Japan, Sweden, and the United Kingdom, to support the implementation of the WHO GAP on AMR. As Chair, Canada will focus members' attention on moving forward with the implementation of the WHO GAP, and supporting the efforts of low-income countries in developing their own national action plans for AMR.
- Canada is active on the recently formed CODEX Intergovernmental Taskforce on AMR, working to update the code of practice for prudent AMU in animals, and develop a guideline on integrated surveillance of AMR (along the food chain).
- As a member of the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR), Canada works with the United States, the European Union and Norway, to advance action on AMR and AMU in priority areas, including surveillance; appropriate stewardship in humans and animals; risk

analysis; infection prevention and control; and improved antimicrobial drug development pipelines.

- Canada also looks forward to working with the newly created UN ad-hoc Inter-Agency Coordination Group (IACG) to support the effective coordination of work across sectors to combat the threat of AMR. In 2017, the federal government provided $215,000 to support the World Organisation for Animal Health's (OIE) engagement in the IACG, underlining its commitment to an integrated approach to AMR with linkages to both human and animal health. In particular, Canada emphasizes the need for continued international collaboration to promote the prudent use of antimicrobials in animals. Canada continues to participate in annual data submissions (2015-2017) for the OIE Global Database on Antimicrobial Agents Intended for Use in Animals.

In November 2016, Canada announced a $9 million contribution to the WHO AMR Secretariat to support its work implementing the GAP. Canada's investment will ultimately support low- and middle-income countries to develop and implement their national action plans, and implement key AMR initiatives.

The federal government also contributed $250,000 (USD) to the World Bank to support the development of its report, 'Drug-Resistant Infections: A Threat to Our Economic Future', which outlines the economic and development consequences of the continued global spread of AMR. The World Bank report was released in spring 2017 and continues to inform policy development in Canada and around the world.

Through participation in these collaborative international initiatives, Canada has the opportunity to share its policy and technical expertise with global partners and to introduce best practices from like-minded countries into Canada.

Surveillance

Evidence-based decision-making is at the core of public policy development for health issues, including AMR. The data required to formulate this evidence is obtained through rigorous and comprehensive surveillance across the human and animal health and agriculture sectors. As part of our engagement with international partners, Canada is enrolled in the Global Antimicrobial Resistance Surveillance System and participates in the collection, analysis and sharing of AMR data at the global level.

Domestic AMR surveillance is a key priority under the Federal Action Plan. In March 2015, the Public Health Agency of Canada (PHAC) launched the Canadian Antimicrobial Resistance Surveillance System (CARSS). CARSS was created to have integrated human and animal data from PHAC's surveillance systems, including the Canadian Nosocomial Infection Surveillance Program (CNISP) and the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS), in a single annual report at the national level. CARSS provides a national picture of AMR and AMU in both humans and animals across Canada to help policy makers and stakeholders undertake evidence-informed actions to limit the spread of AMR.

CARSS Reports have been released on an annual basis since 2015.

According to data presented in the 2017 CARSS Report:

- From 2011 to 2016, Canada's AMR rates were similar to or lower than rates reported by other developed countries.
- Upward trends were seen in the rates of resistant infections in certain settings. For example, methicillin-resistant *Staphylococcus aureus* (MRSA) infections were up in pediatric hospitals; vancomycin-resistant Enterococci (VRE) blood stream infections were up in adult hospitals and the rate of drug-resistant gonorrhea rose from 2014 to 2015.
- In 2016, hospitals purchased more of certain antimicrobials of "last resort" (e.g., daptomycin) than in previous years.
- Antimicrobial distributed for sale for use in animals has decreased on a total kilogram basis since 2015.

As part of its efforts to improve its surveillance capacity outside human health care settings, the Government of Canada has undertaken a number of pilot projects to increase its understanding of community-associated AMR issues and trends and to assess the feasibility of expanding its surveillance

approach. These studies yielded valuable data that will contribute to the development of more robust community surveillance in the future.

For instance, CARSS identified the lack of data from long-term care facilities and from smaller, non-academic hospitals primarily found in rural and northern healthcare settings as a significant gap in Canada's AMR and AMU surveillance. In response to these gaps, CARSS initiated two point prevalence survey projects in the spring of 2017 to better identify the burden of top priority antimicrobial-resistant organisms and antibiotic use in a number of rural and northern communities, as well as in long-term care facilities. The findings of this project may be used to inform policy, stewardship and research initiatives, introducing further research questions and advising guidelines.

The Enhanced Surveillance of Antimicrobial Resistant Gonorrhea (ESAG) initiative was undertaken in response to the high levels of resistance to antimicrobials used for treating gonorrhea. ESAG will continue to monitor the current levels and trends of resistant gonorrhea in Canada. Surveillance of antimicrobial susceptibility data in the community will improve the government's ability to respond to emerging threats and support stewardship efforts by informing evidence-based decision making.

Systems to collect antibiotic use data from both the hospital and community settings, including data on prescriptions dispensed by retail pharmacies in Canada, antimicrobials purchased by Canadian hospitals, and diagnoses for which physicians have recommended an antimicrobial in the community are complemented by the AMR surveillance work undertaken by public and private laboratories across Canada. The federal government's National Microbiology Laboratory, for example, provides diagnostic testing and reference services to identify and characterize existing and emerging resistant organisms from human and animal sources.

Surveillance of AMU rates in both humans and animals is an important complement to surveillance of AMR infections and organisms. AMU data are critical in developing a One Health approach to combatting the spread of AMR and in analysing trends to identify potential sources for the development of a given resistance. In October 2016, the Canadian Animal Health Surveillance System (CAHSS), Agriculture and Agri-Food Canada (AAFC) and the Canadian Food Inspection Agency (CFIA) hosted the AMU Surveillance in Food Animal Production Workshop to identify gaps and to seek consensus around the path forward for AMU surveillance in animal agriculture at the farm level. Through this workshop, a working group comprised of all major livestock groups was created to identify AMU surveillance gaps and to establish AMU surveillance minimum datasets for animal agriculture. This working group last met in September 2017 and will continue to work together to identify opportunities to enhance AMU surveillance.

The CFIA has also been engaging and supporting the veterinary community through the Canadian Veterinary Medical Association (CVMA) to develop a prototype for a prescription-based AMU

surveillance system. This work complements the CAHSS initiative to gather farm level AMU data and is intended to be integrated into CARSS.

AAFC also commissioned the development of a 'roadmap' to address data and systems gaps associated with AMU surveillance in animal agriculture, which can be used as a guide to provide a harmonized and value-added approach to AMU surveillance. Discussions with industry stakeholders regarding strategies to enhance AMU surveillance are expected to continue.

Stewardship

Antimicrobial stewardship refers to coordinated interventions designed to promote, improve, monitor and evaluate prudent AMU to preserve the future effectiveness of antimicrobials and to promote and protect human and animal health. Stewardship activities elaborated in the Federal Action Plan can be divided into two broad categories: i) awareness and educational activities targeted to professionals and the public; and ii) regulation and oversight.

Awareness and Education

Actions under this category center on public and health care professional awareness, and education and treatment guidance. The federal government often plays a facilitating role in antimicrobial stewardship, bringing together organizations and experts from a variety of backgrounds to join forces and take action.

Based on increasing concerns regarding AMR in Canada, PHAC undertook an antibiotic awareness campaign in 2014-2015 directed to the general public, parents and physicians. A baseline study was done in advance of, and following the campaign, to assess the effectiveness of activities, with results showing that the campaign had significant reach. Further, smaller scale awareness activities were also conducted between 2015 and 2017.

2014-2015 AMR AWARENESS CAMPAIGN

The Public Health Agency of Canada's 2014-2015 Public Awareness Campaign used a variety of tools and vehicles to raise awareness of the issue of antimicrobial overuse and its link to antimicrobial resistance with physicians, parents and members of the general public. A suite of antibiotic awareness products were developed, including posters, brochures and a video. Uptake of messaging via social media and print media exceeded industry and Government of Canada standards, indicating broad reach.

A poster was distributed to physicians across Canada through the Canadian Medical Association, and four AMR related webinars reached 630+ health professionals.

A Ministerial roundtable (2015) and a national roundtable (2016) were held to promote multi-lateral, cross-sectoral engagement and to receive the input of F/P/T partners and external stakeholders regarding best practices and opportunities to improve stewardship. In addition, Health Canada, AAFC, the CFIA, and PHAC, both in collaboration and independently, held sessions with stakeholders and partners to discuss the prudent use of antimicrobials in animals and potential changes to the regulatory oversight of veterinary antimicrobials.

Similar to the work undertaken in the area of surveillance, the Public Health Network Council examined the components necessary for effective antimicrobial stewardship.

Regulation and Oversight

The overuse and misuse of antimicrobials in animals is a contributing factor in the development and spread of AMR among both human and animal populations.

Antimicrobial-resistant pathogens found in animals can pose serious risks to human health when they are transmitted as food-borne or water-borne contaminants. In recognition of this threat, on May 17, 2017 Health Canada announced new rules for veterinary drugs under the *Food and Drug Regulations*, to protect Canadians against AMR. The amended regulations restrict the personal importation of certain veterinary drugs for food-producing animals and require companies to follow stricter guidelines to ensure the quality of their active pharmaceutical ingredients, among other measures.

These changes complement other ongoing initiatives, such as collaborating with provincial and territorial authorities, the pharmaceutical industry, veterinarians, the livestock feed industry, food animal producers and other stakeholders to promote the prudent use of antimicrobial drugs in animals.

Regulatory Amendments to the *Food and Drug Regulations* (Veterinary Drugs – Antimicrobial Resistance) will:

- ✓ Restrict the personal importation of certain veterinary drugs for food-producing animals and increase control over importation of medically important antimicrobials, including active pharmaceutical ingredients;
- ✓ Require companies to follow stricter guidelines to ensure the quality of their active pharmaceutical ingredients;
- ✓ Require manufacturers, importers and compounders of veterinary drugs to report annual sales of medically important antimicrobial drugs to Health Canada to enable better surveillance; and
- ✓ Introduce a more flexible and risk-appropriate framework to make importation and sale simpler for low-risk veterinary health products, including products that may be used to enhance animal health/welfare and reduce the need for antimicrobial drugs.

In December 2017, Health Canada posted a Notice regarding proposed changes to the Prescription Drug List to strengthen veterinary oversight and promote the prudent use of medically important antimicrobials in animals. Medically important antimicrobials are defined as those that play an important role in human medicine. In the past, before AMR was considered a significant public health issue, some drugs containing these antimicrobials were authorized for sale as over the counter for use in animals. As of December 1, 2018, the proposed amendments will require that drugs (for use in animals) which contain a medically important antimicrobial be sold only pursuant to a prescription. These measures will require veterinarian oversight and will encourage the prudent use of these drugs. All such antimicrobial products administered in water or in feed will also include specific prudent use statements to enhance antimicrobial stewardship. Preserving the effectiveness of medically important antimicrobials is an important public health objective. Since antimicrobial-resistant bacteria may be transferred to humans from animals through the food chain and compromise the treatment of human infections, these regulatory and policy initiatives are important steps in protecting the long-term health and well-being of all Canadians.

To increase and promote better stewardship of antimicrobials for human use, Health Canada posted a Public Notice on Antimicrobial Products Labelling in November 2015, advising of its intent to enhance the education of healthcare professionals and patients and to facilitate the prudent use and prescribing of antimicrobials for human use by requiring the inclusion of AMR precautionary statements in the labelling of all antimicrobials for human use. Health Canada is in the process of requesting that drug sponsors update their product labelling with a specific focus on when and how to use antimicrobials, and promoting the choice of the correct antimicrobials to use for treatment.

Research and Innovation

Research and innovation are key factors in a comprehensive, multi-sectoral approach to AMR. Federal science-based departments and agencies undertake in-house research, collaborate with experts in industry and/or academia, and fund external research to expand the knowledge base regarding AMR and AMU, and to develop new products and approaches. The Government of Canada also collaborates with international partners to contribute to global research efforts on AMR, AMU, novel therapies and alternatives to antibiotics.

Domestic

The interdepartmental Genomics Research and Development Initiative project on AMR (GRDI-AMR) was identified in the Federal Action Plan as one of the components of the innovation pillar, along with domestic and international AMR-focused research collaborations funded through the Canadian Institutes of Health Research (CIHR), and efforts to move forward with federal vaccine research priorities.

A five-year, $20 million, GRDI-AMR project has been launched to expand understanding regarding the development of AMR and the pathways by which antimicrobial-resistant bacteria reach humans. The project is targeted for completion in 2021 and results are expected to inform policies, practices and products to mitigate the development of AMR.

GRDI-AMR uses a genomics-based research approach to develop greater understanding of how food production contributes to the development of AMR of human health concern, and explores strategies for reducing AMR in food production systems. The focus on food is because of the widespread use of antibiotics in food production, and impacts of this practice on the abundance of AMR bacteria in food products.

GENOMICS RESEARCH & DEVELOPMENT INITIATIVE PROJECT ON AMR

The GRDI-AMR project devotes $20 million over five years to research that will inform policies, practices and products to mitigate the development of AMR.
GRDI-AMR research will answer the following questions:
1. What is the relationship between specific agricultural practices and the burden of AMR in food producing animals and their environment?
2. What is the relationship between exposure to AMR of agricultural origin and the acquisition of AMR by pathogens in humans, animals or the broader environment?
3. How can genomics information be integrated into risk assessment models necessary to inform desirable policies and practices?

Investments of $107 million made by the Government of Canada through CIHR between 2012 and 2017 have contributed to strengthening research in areas such as antimicrobial discovery, target identification, alternatives, diagnostics, surveillance, stewardship and other related priorities through investigator-initiated and strategic funding competitions, including the Joint Programming Initiative on Antimicrobial Resistance (JPIAMR). Using the 2015 Federal Budget allocation of $2 million per year, ongoing, CIHR is supporting an initiative on point-of-care diagnostics.

As a key contributor to disease prevention and treatment, vaccines offer low-cost and low-risk options that increase quality of life and reduce health care costs. By enhancing the body's ability to fight harmful micro-organisms, vaccines reduce the incidence and spread of disease. This in turn reduces the opportunity for the development of AMR. A federal working group has successfully completed a project to identify a set of priorities for research and development of new and improved human and animal vaccines, with a special focus on AMR. Potential industry collaborators are invited to work with the Government of Canada on the development and commercialization of vaccines to prevent infectious diseases, with a focus on AMR and emerging infections.

The identification, characterization, and diagnostic capability development for endemic and emerging antimicrobial-resistant organisms through the development and transfer of innovative laboratory diagnostics and approaches are also important components of federal science leadership.

Health Canada is working to develop new tools and policy approaches, including new technical data requirements, which could facilitate greater access to safe, effective, and high quality therapeutic drugs and/or devices that target important pathogens for public health.

International

Canada is one of the largest financial contributors to the JPIAMR, a group comprising over 25 countries who work to coordinate international research funding and support collaborative action to fill knowledge gaps on AMR. Canada has funded multinational teams under the JPIAMR for research concerning AMR transmission dynamics, prevention, control and intervention strategies for AMR infections, and transnational AMR networks. Canada is also leading efforts to establish the JPIAMR Virtual Research Institute, a dynamic global network of research facilities that will foster knowledge exchange in the field of AMR, and is also involved in a JPIAMR project to establish international standards for farm-level AMU data reporting.

Through the International Development Research Centre (IDRC), Canada has invested $750,000 to support the International Bank for Reconstruction and Development's scoping study for a One Health response to knowledge gaps in AMR research. The objective of the project is to develop a One Health AMR research agenda for low and middle-income countries by conducting a literature review of AMR research related to human health, agriculture, water and sanitation, environment, trade, food security, economic growth, and poverty. The study will include an assessment of current knowledge gaps, as well as existing capacities and ongoing efforts, with a particular focus on the Global South. The project will also identify and prioritize the most promising research areas for further advancement of the AMR containment agenda.

The 2017 G20 Leaders' Declaration announced the development of a Global AMR Research and Development Collaboration Hub. Canada has endorsed the Statement of Intent for the Hub, and will join the Interim Board to help guide its establishment. The Hub is intended to address the threat of AMR by bringing funders together to maximize the impact of existing public and private funding, and by coordinating and leveraging additional R&D investments and activities at the national and/or international level.

Conclusion and Next Steps

The Government of Canada, through the work of seven departments and agencies, has achieved notable success in fulfilling the commitments laid out in the areas of leadership, surveillance, stewardship and research and innovation under the Federal Action Plan on Antimicrobial Resistance and Use. Four additional federal entities (Global Affairs Canada, Fisheries and Oceans Canada, Environment and Climate Change Canada, and the International Development Research Centre) are also addressing AMR and AMU under their respective mandates. As the implications of AMR and AMU for portfolios outside the human and animal health and food production sectors become increasingly clear, we anticipate other departments will also collaborate. For instance, the impact of AMR on the environment is a consideration for Fisheries and Oceans Canada moving forward.

The Government of Canada is involved in several important initiatives that were not reflected in the Federal Action Plan, including (but not limited to) the following:

- Innovation, Science and Economic Development Canada provides industry analysis through a scan of Canadian companies working in the AMR space, including companies involved in drug development and diagnostics. The industry analysis describes the R&D and innovation conducted by Canadian small and medium-sized enterprises and the partnerships being forged with global pharmaceutical companies and academia;

- PHAC CIPARS continues to pursue opportunities and partnerships to collect additional AMR and AMU data across food animal sectors in Canada. CIPARS is working with the CFIA to enable the additional collection of AMU new sources. The standardized reporting of AMU data using advanced approaches is being investigated with collaborators internationally;

- AAFC is involved in several research projects to reduce the burden of AMR in cattle and swine;

- Health Canada continues to implement regulatory and non-regulatory initiatives to support the prudent use of antimicrobials, including improvements to labelling of human and veterinary antimicrobials, and the development of new regulatory pathways to facilitate the approval of safe, effective and innovative drugs for human use. With the help of its provincial and territorial partners, the Department continues to work to enhance awareness and help stakeholders understand the changes to the Products for Veterinary Use portion of the Prescription Drugs List;

- The CFIA will continue to engage with the veterinary community to enhance Canada's AMU surveillance system and to ensure that new regulatory and policy changes for veterinary drugs administered via feed are implemented successfully. The CFIA also continues to work with

veterinarians and producers to promote preventative practices, including the development and implementation of bio-security standards, as well as the use of vaccines;

- CIHR continues to invest in health research, including research focused on prevention, control and intervention strategies for AMR infections through the JPIAMR, and on the global governance of AMR; and

- IDRC engages in initiatives to improve the prevention and control of AMR in developing countries. In April 2018, IDRC and the United Kingdom's Global AMR Innovation Fund launched the $27.5 million Innovative Veterinary Solutions for Antimicrobial Resistance (InnoVet-AMR) fund. InnoVet-AMR will support research to develop vaccines and other innovations to fight AMR in livestock and aquaculture production, particularly in low and middle income countries.

Although recent federal accomplishments and ongoing efforts are helpful in preparing Canada to respond appropriately to the ongoing threat of AMR, the challenge is far too complex and multi-faceted for the federal government to address alone.

A truly national approach to AMR requires the active engagement of a wide range of multi-sectoral partners from all levels of government and the private sector. Canada has received accolades from the international community for its integrated One Health approach to AMR, based on the active participation of partners and stakeholders from across government jurisdictions and industry sectors. As we move forward with the development and implementation of the pan-Canadian Action Plan over the coming months, provinces, territories, and public and private sector stakeholders will be invited to collaborate with the federal government in establishing and renewing their commitment to strong, specific, and coordinated action to address AMR and promote the well-being and prosperity of Canadians. The pan-Canadian Action Plan will define activities that are currently being undertaken or planned by F/P/T partners and stakeholders, and establish timelines and measurable outcomes.

Significant progress has been made in addressing the serious threat posed by AMR. However, work still needs to be undertaken by all those with a role to play to ensure we are positioned to address the remaining challenges in our response. The Government of Canada is committed to continuing to work with partners and stakeholders as we move forward with the development of the pan-Canadian Action Plan.

Technical Annex

Leadership

Deliverables from the Federal Action Plan	Current Status
PHAC lead with support from HC, CFIA, CIHR, and AAFC Engage with international partners to develop and implement a Global Action Plan on AMR. The first phase will be working towards endorsement of a Global Action Plan by the World Health Assembly. **Target Completion Date:** May 2015	**Status:** Complete In May 2015, Member States, including Canada, endorsed the World Health Organization's Global Action Plan on AMR (WHO GAP). The GAP was recognized as the blueprint for action at the September 2016 United Nations High Level Meeting on AMR.
PHAC lead with support from HC, CFIA, CIHR, and AAFC Work with federal, provincial, and territorial (F/P/T) partners and human health, animal health, agri-food and industry stakeholders to develop a pan-Canadian framework to address AMR. The first phase will be working towards identifying the incremental elements of a pan-Canadian approach for endorsement by P/Ts and stakeholders. **Target Completion Date:** Fall 2015	**Status:** Complete The pan-Canadian Framework for Action on AMR was developed jointly with all provincial and territorial governments and external partners, and was released in September 2017. It identifies the points of actions required under the four pillars: surveillance, stewardship, infection prevention and control, and research and innovation. A supporting Action Plan is under development.
PHAC lead with support from HC, CFIA, CIHR, and AAFC As part of the work under the Global Health Security Agenda (GHSA), support the development of an integrated and global package of activities to combat AMR that spans human, animal, agricultural, food and environmental sectors. This includes: that each country have a national AMR plan in place to take a comprehensive, "One Health" approach to AMR; strengthened surveillance and laboratory capacity at national and international levels; and improved	**Status:** Ongoing Canada is a leading country of *Action Package Prevent 1* on AMR, and took over as Chair of this Action Package on October 1, 2017. The focus of work is on supporting the implementation of the GAP, and in particular supporting developing countries in efforts to develop their own national action plans to address AMR.

Deliverables from the Federal Action Plan	Current Status
conservation of existing treatments and support development of new treatments, diagnostics, preventative measures and systems. **Target Completion Date:** 2019	**Next Steps:** Continue this work over the next year.

Surveillance

Deliverables from the Federal Action Plan	Current Status
PHAC lead with support from HC, CFIA, CIHR, and AAFC The issuance of the first annual CARSS Report. **Target Completion Date:** Spring 2015	**Status:** Complete The first CARSS Report was released on March 31, 2015, providing an integrated summary of AMR and AMU information from PHAC's surveillance systems and laboratory reference services. Subsequent reports were released in the fall of 2016 and 2017, with additional surveillance data and new evidence from pilot projects and studies.
PHAC lead with support from HC, CFIA, CIHR, and AAFC Expanding to a national approach through discussions with F/P/T and other external partners. **Target Completion Date:** Fall 2016	**Status:** Ongoing **Revised Completion Date:** Summer 2019 PHAC is continuing to collaborate with provinces and territories to identify priority surveillance improvements. Discussions on addressing surveillance gaps identified in the CARSS report and in the pan-Canadian Framework on AMR will continue as part of the work to develop a pan-Canadian Action Plan.

Deliverables from the Federal Action Plan	Current Status
PHAC Pilot the collection of antimicrobial susceptibility data from clinical laboratories to better understand community-associated AMR issues and trends. **Target Completion Date:** Spring 2015	**Status:** Complete PHAC conducted two pilot surveillance initiatives to address gaps in community settings. One of these, AMRNet, determined the feasibility of obtaining and analyzing existing antimicrobial susceptibility data in the community. Discussions on addressing surveillance gaps are ongoing as part of the development of the pan-Canadian Action Plan.
PHAC Review existing priority AMR organisms being monitored by Agency surveillance systems and confirm the priority microbes to be included. **Target Completion Date:** Winter 2015	**Status:** Complete A report identifying AMR surveillance requirements for priority organisms was released in April 2016.
PHAC Identify any requirements for surveillance transformation at the Agency to align with CARSS. **Target Completion Date:** Spring 2016	**Status:** Complete An AMR-AMU Surveillance Transformation Plan that identifies actions required to address PHAC's AMR and AMU surveillance gaps has been developed. These actions are being integrated into the overall governance and coordination of AMR and AMU surveillance activities under CARSS.
PHAC and HC Analyse data on antimicrobial prescriptions collected by Health Canada's First Nations and Inuit Health Branch to provide a more comprehensive picture of AMU in Canada, and include findings in the annual Government of Canada Human Antimicrobial Use Report. **Target Completion Date:** Fall-Winter 2015	**Status:** Complete The Human Antimicrobial Use Report covering data from pharmacies, hospitals and physicians, including First Nations and Inuit Health Branch data, was released in November 2015. This data continues to be included in reporting through CARSS.

Deliverables from the Federal Action Plan	Current Status
CFIA and AAFC Identify AMU surveillance data requirements for the animal agriculture sector in support of the creation of a robust monitoring, tracking, and reporting system for AMU. **Target Completion Date:** Spring 2016	**Status:** Ongoing **Revised Completion Date:** December 2018 Under the Canadian Animal Health Surveillance System (CAHSS - a federal-provincial-territorial and industry collaboration), an AMU surveillance network group has developed and agreed upon minimum datasets to support AMU surveillance. The group includes all major livestock and poultry groups, as well as government officials. Meeting discussions have been led by CIPARS, the subject matter experts, with CFIA and AAFC providing coordination and funding support. CFIA and the Canadian Veterinary Medical Association (CVMA) are also collaborating on a project to develop and deliver on AMU surveillance with practicing veterinarians. **Next Steps:** Discussions on these initiatives will be ongoing through 2018.
CFIA and AAFC Work collaboratively with veterinary associations and P/T partners to begin to quantify antimicrobial usage in livestock in other dosage forms (e.g. water and injection) and under prescription. **Target Completion Date:** Spring 2016	**Status:** Ongoing **Revised Completion Date:** December 2018 CFIA and AAFC have been collaborating with the CVMA to conduct surveillance workshops and initiatives with the veterinary community, such as updating antimicrobial prudent use guidelines.

Deliverables from the Federal Action Plan	Current Status
CFIA and AAFC Work with stakeholders to develop options for the collection and storage of AMU data for animal feeds and livestock production linking species, production classes, purpose of administration, and dosage quantities. **Target Completion Date:** December 2016	**Status:** Ongoing **Revised Completion Date:** December 2018 AAFC has engaged with industry stakeholders to identify potential options that would address data and system gaps associated to AMU surveillance in animal agriculture. A report was completed in March 2017. **Next Steps:** Discussions with industry groups will be ongoing through 2018 to identify strategies to enhance AMU surveillance.
CFIA Conduct baseline work on *Salmonella, E. coli* O157:H7 and non-O157 and indicator organisms in cattle carcasses and isolates from each positive sample preserved for molecular characterization including AMR. **Target Completion Date:** March 2017	**Status:** Discontinued Following consultation with the industry, the CFIA has decided not to proceed with the national Microbiological Baseline Study in cattle carcasses under the Pathogen Reduction Initiative. **Next Steps:** CFIA will continue to analyse bacterial isolates recovered from existing CFIA food testing programs to expand knowledge on antimicrobial resistance in various commodities and complement the existing testing conducted by PHAC via the Canadian Integrated Program for Antimicrobial Resistance Surveillance.

Deliverables from the Federal Action Plan	Current Status
CIHR lead with support from PHAC Support research on mode of transmission of resistance between organisms and the transmission of resistant bacteria among the different reservoirs (animal-environment-human). Support research and dissemination of results regarding the studies on intervention and surveillance of AMR. **Target Completion Date:** December 2019	**Status:** Ongoing The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) 3rd Joint Call: *Transmission Dynamics* was launched in January 2016. Applications were peer-reviewed in 2016 and funding began in January 2017. CIHR is funding 6 teams for a total committed investment of $2.6 million. Between 2012-2013 and 2016-2017, CIHR invested $5.3 million in research projects related to surveillance. **Next Steps:** JPIAMR – CIHR will continue to fund successful applicants until the end of the grant. CIHR will continue to accept applications for, and fund, research related to resistance transmission research and surveillance through its investigator-initiated funding competitions.

Stewardship

Deliverables from the Federal Action Plan	Current Status
PHAC Evaluate the effectiveness of the messaging used during the November 2014 AMR awareness campaign. The lessons learned from this significant investment will be used to inform future public awareness and education activities for the general public, and health professionals working in community, hospital and long-term care settings – including expanding the reach of the 2015 awareness campaign. **Target Completion Date:** Winter and Spring 2015	**Status:** Complete In July 2015, a final evaluation report of the 2014 pilot Antibiotic Awareness Campaign was released. Lessons learned were shared with external stakeholders and were used to inform the development of new Antibiotic Awareness campaign materials for subsequent years.
PHAC lead with support from HC, CFIA, CIHR, and AAFC The Minister of Health will host a Roundtable on AMR, with a focus on stewardship. **Target Completion Date:** Spring 2015	**Status:** Complete On March 31, 2015, the Minister of Health hosted a Ministerial Roundtable on Antimicrobial Stewardship with human and animal health stakeholders. The roundtable brought stakeholders together to seek their perspectives on key areas of AMR.
HC, CFIA, and AAFC Convene multi-lateral discussions with F/P/T partners, stakeholders and other interested parties to discuss and refine federal proposals for increasing veterinary oversight for veterinary antimicrobials for food animal production. **Target Completion Date:** Spring and Summer 2015	**Status:** Complete A Health Canada-led technical discussion session was held with stakeholders and in collaboration with AAFC and CFIA in March 2015, to present proposals on the prudent use of antimicrobials in food animals and potential changes to regulations governing oversight of veterinary antimicrobials. Sessions with various F/P/T partners and stakeholders were ongoing through 2015 and 2016 to discuss further details of the proposals.

Deliverables from the Federal Action Plan	Current Status
PHAC Undertake a scan of the current Canadian and international landscape of healthcare associated infections to help identify potential gaps in infection prevention and control practices. This information will also assist the Agency in identifying future AMR-related interventions. **Target Completion Date:** Spring 2016	**Status:** On hold The project was put on hold during the development of the pan-Canadian Framework on AMR. This commitment will be reassessed as part of the F/P/T discussions on the pan-Canadian Action Plan.
PHAC lead with support from HC, CFIA, and AAFC In response to calls for cross-sectoral engagement of all stakeholders in human health and agri-food sectors (e.g., government, industry, health professionals, veterinarians, licensing bodies), a series of consultations will be undertaken to take stock of existing practices relating to AMU, identify best practices for responsible AMU, and explore how to best leverage existing education opportunities. **Target Completion Date:** Spring 2016	**Status:** Complete PHAC collaborated with HealthCareCAN and the National Collaborating Centre for Infectious Diseases (NCCID) to lead stakeholder engagement and host a national roundtable on antimicrobial stewardship in June 2016. Following the roundtable, a steering committee was formed to develop a national action plan on antimicrobial stewardship in hospitals, healthcare organizations and community settings, which was released in January 2017. PHAC continues to engage with partners and stakeholders to develop continuing professional education opportunities, expand the *Do Bugs Need Drugs?* education program, co-host regional stewardship initiatives, conduct targeted awareness campaigns and support evidence development. AAFC engagement is ongoing through the National Farmed Animal Health and Welfare Council and the Value Chain Roundtables.

Deliverables from the Federal Action Plan	Current Status
PHAC To promote appropriate AMU, the Agency will update the Sexually Transmitted Infections Guidelines with current treatment recommendations, and deliver two webinar sessions to promote specific AMR-GC (gonorrhea) guidance. These webinars will be used to promote online learning activities. **Target Completion Date:** Spring 2016	**Status:** Complete Eight Sexually Transmitted Infections chapters have been updated.
HC and CFIA Work with drug sponsors to facilitate their submissions for label changes to remove growth promotion claims of medically important antimicrobial drugs and associated references in the Compendium of Medicating Ingredient Brochures. **Target Completion Date:** Fall 2016	**Status:** Ongoing **Revised Completion Date:** December 2018 In July 2017, Health Canada sent letters to all affected drug sponsors requesting revised labels for removing growth promotion claims from medically important antimicrobial veterinary drugs. As of February 2018, all affected medically important antimicrobial labels were revised to remove the growth promotion claims. The new Compendium of Medicating Ingredient Brochures with updated information was published April 1, 2018 with a transition to full implementation on December 1, 2018.
PHAC Update the 2014 *"National and International Infection Prevention and Control Key Activities and Initiatives: An Environmental Scan"* to reflect current status, including a full analysis and identification of existing gaps in promoting effective infection prevention and control practices. **Target Completion Date:** Fall 2016	**Status:** On hold The project was put on hold during the development of the pan-Canadian Framework on AMR. This commitment will be reassessed as part of the F/P/T discussions on the pan-Canadian Action Plan.

Deliverables from the Federal Action Plan	Current Status
CIHR lead with support from PHAC Support research and dissemination of results regarding research on stewardship measures. **Target Completion Date:** December 2019	**Status:** Ongoing Between 2012-2013 and 2016-2017, CIHR invested $10.1 million in research projects related to stewardship measures. In November 2016, CIHR hosted the Antimicrobial Stewardship (AMS) Expert Forum "Current and Future Directions for Innovation and Research in Antimicrobial Stewardship in Canada". The report from the forum was posted on the CIHR website in Spring 2017. In January 2017, JPIAMR launched a 5th call "Comparison of prevention, control and intervention strategies for AMR infections through multidisciplinary studies, including One Health approaches." Using funding announced in November 2017, CIHR is funding six teams for a total committed investment of $3.2 million. **Next Steps:** CIHR will continue to accept research grant applications related to stewardship measures through its investigator-initiated competitions. For the JPIAMR project, CIHR will continue to fund successful applicants until end of grant.

Deliverables from the Federal Action Plan	Current Status
HC, CFIA and AAFC Convene an additional round of multi-lateral discussions with F/P/T partners, stakeholders and other interested parties to further consider and refine federal proposals for strengthening the regulatory framework for veterinary drugs. Objectives of these discussions will be to determine how to establish effective oversight of active pharmaceutical ingredients (APIs), as well as to engage stakeholders on measures to promote the prudent use of antimicrobials and to facilitate access to alternatives. **Target Completion Date:** Spring 2015	**Status:** Complete Health Canada hosted discussions on its proposals with national organizations, such as the National Farmed Animal Health Working Group (NFAHWG) and the Council of Chief Veterinary Officers (CCVO). Stakeholders were also kept appraised of recent activities through various bilateral meetings, and regular teleconferences with provincial governments in 2016-2017. Consultations were also undertaken as part of Health Canada's regulatory proposals.
AAFC Support industry-led research to validate the efficacy of commercially available alternatives to in-feed antibiotics when appropriate. **Target Completion Date:** Summer 2015	**Status:** Complete AAFC supports industry-led research initiatives through the Agri-Science Clusters and Projects, which includes the validation of feed alternatives to in-feed alternatives to in-feed antibiotics. AAFC also conducts research on AMR in beef, dairy, poultry and swine production systems, which include the study of nutritional strategies and feed supplements in some sectors. Industry-led research projects under the AgriInnovation Program were all completed by March 31, 2018. AAFC also organized a multi-stakeholder workshop in March 2017 to inform the development of a Science Strategy on AMR. The Science Strategy on Antimicrobial Resistance was completed in December 2017.

Deliverables from the Federal Action Plan	Current Status
HC and CFIA Implement the requirement to increase veterinary oversight of medically important antimicrobial drugs used in livestock feed and in water. The approach and timing will be aligned with a similar initiative in the US. **Target Completion Date:** December 2016	**Status:** Ongoing **Revised Completion Date:** December 2018 In March 2015, a technical discussion session was held with stakeholders. Further bilateral meetings with F/P/T partners and other stakeholders were held throughout 2015-2016. The Notice of Intent to Amend the Prescription Drug List was published on December 15, 2017. The implementation date is December 1, 2018, after which all MIAs will be required to be sold pursuant to a prescription. **Next Steps:** Continued stakeholder engagement to enhance awareness and ensure animal owners and end users understand and are prepared for the changes. Implementation of a system to collect antimicrobial sales reporting data.
HC Implement measures to address own use importation of veterinary drugs, and strengthen the control over the importation of veterinary active pharmaceutical ingredients (APIs). **Target Completion Date:** 2017	**Status:** Complete *Regulations Amending the Food and Drug Regulations (Veterinary Drugs – Antimicrobial Resistance)* were announced on May 17, 2017. The AMR regulatory changes reflect feedback received during the Canada Gazette, Part I consultation, as well as extensive consultations with stakeholders over the years. They will come into force between November 13, 2017 and July 2019.

Deliverables from the Federal Action Plan	Current Status
CIHR Support research at the interface between human and animal health and the environment as part of the Environments and Health Signature initiative and through the Join Programming Initiative on Antimicrobial Resistance (JPIAMR) transnational call. **Target Completion Date:** Spring 2020	**Status:** Ongoing There were no successful applications in the Environments and Health: *Intersectoral Prevention Research Funding Opportunity* that were relevant to AMR. The JPIAMR 3rd Joint Call: *Transmission Dynamics* was launched in January 2016. Applications were peer-reviewed and results were announced in November 2016. CIHR is funding six teams for a total committed investment of $2.6 million. **Next Steps:** CIHR will continue to fund successful JPIAMR applicants until end of grant.

Innovation

Deliverables from the Federal Action Plan	Current Status
PHAC, HC, CFIA, CIHR, AAFC, IC and NRC Through the Canadian Action Plan on Vaccine Research, Innovation and Development, determine vaccine research priorities. Key stakeholders in human and animal health sectors are being engaged as part of this process. **Target Completion Date:** 2015	**Status:** Complete On May 1, 2015, the Government of Canada posted the Vaccine Research Priority List. The priority list was created through a review of the current pathogens of concern for Canada that could be prevented through vaccination. These pathogens were assessed for their burden of disease, antimicrobial resistance, and their impact on immune-compromised individuals to help refine the vaccine priorities.
CIHR Continue to build knowledge to create innovative tools and alternative therapies to prevent and limit the spread of AMR through research and development via both open competition and strategic funding through partnerships, and in particular collaborate with international groups to promote and leverage Canadian contributions within international research teams: (1) Canada-United Kingdom partnership on antibiotic resistance (with the United Kingdom's Medical Research Council) **Target Completion Date:** March 2015 (2) Joint Programming Initiative on Antimicrobial Resistance (JPIAMR): InnovaResistance: Innovative approaches to address antibiotic resistance;	**Status:** Ongoing Between 2012-2013 and 2016-2017, CIHR invested over $107 million in AMR research. CIHR launched the Antimicrobial Resistance: Point of Care Diagnostics in Human Health funding opportunity in May 2016, held the applicant-industry workshop in June 2016, peer-reviewed full applications, and began funding in January 2017. Five teams are being funded over two years for a total committed investment of approximately $1.4 million. (1) Complete – In March 2015, the funding awarded through the partnership ended. Two research projects were funded. (2) Complete – Funding was awarded to successful applicants in 2014-2015, including six teams involving Canadian researchers, for

Deliverables from the Federal Action Plan	Current Status
Target Completion Date: December 2017 (3) JPIAMR transnational call. **Target Completion Date:** December 2019	a total CIHR investment of $4 million. (3) Ongoing – The 4th call for proposals was launched April 2016. Funding decisions were announced in November 2016, with funding beginning in January 2017. CIHR invested a total of $100,000 in two working groups. In January 2017, JPIAMR launched a 5th call "Comparison of prevention, control and intervention strategies for AMR infections through multidisciplinary studies, including One Health approaches." CIHR is funding six teams for a total committed investment of $3.2 million – funding was announced in November 2017. **Next Steps:** Canada will lead the development of the JPIAMR Virtual Research Institute, and has launched Phase 2 of the Point of Care Diagnostics in Human Health initiative.
PHAC, HC, CFIA, AAFC, and NRC Under the federal Genomics Research and Development Initiative, involving eight departments and agencies, a ~$20M five year project will be launched to gain a greater understanding of the critical activities that contribute to the development of antimicrobial resistance and critical exposure pathways by which antimicrobial bacteria reach humans, which could then be used to help validate economically sustainable technologies, practices, and policies to mitigate the development of antimicrobial resistance. **Target Completion Date:** 2021	**Status:** Ongoing This project is underway. Priority isolates have been identified and to date over 5000 Salmonella genomes have been sequenced and analysed using GRDI developed tools and platforms. **Next Steps:** Continuation of extensive sample collection (from pens, catch basins, soil, waterways, waste treatment plants, surveillance programs, and historical isolates) is ongoing to refine informatics tools, inform an ontology for metadata, elucidate transmission dynamics, assess mitigation strategies, and inform quantitative risk modelling.