Strengthening Governance of the Antimicrobial Resistance Response Across One Health In Canada

**VOLUME I:
FINAL REPORT**

June 2021

A Message from the Steering Committee

As a Steering Committee representing the One Health antimicrobial resistance (AMR) community, we are honoured to submit this report to the Public Health Agency of Canada in fulfillment of our mandate to develop at least two feasible, credible, and sustainable governance model options to strengthen the AMR response in Canada across One Health, without recommending a preferred option.

Over the course of this project, and despite the many challenges imposed by the COVID-19 pandemic, hundreds of stakeholders from across the human health, agri-food/animal, and environmental domains actively contributed to our year-long consultation process. Hearing their passion and insights, we are confident that strengthened governance of AMR is needed in Canada and would be generally welcomed across the One Health AMR community. Stakeholders are looking forward to the upcoming Pan-Canadian Action Plan and demonstrating how Canada is advancing the fight against AMR. They also anticipate contributing to and benefiting from the increased coordination that a governance mechanism would bring.

In responding to what we have heard about how this governance could and should function, we have reflected two different approaches to accelerating the work necessary to respond to the ever-increasing threat of AMR. We see merit in both of the proposed models — each is credible and feasible, and either will lead to improved and increased action. The choice of model by the Public Health Agency of Canada, working with others, will be informed by their assessment of which model better responds to the complex One Health AMR environment in Canada and builds the public trust that is required to move the AMR agenda forward.

Despite the importance of selecting a model, stakeholders are looking for a timely response that builds on the project's momentum and recognizes the urgency of getting on with implementing the resulting governance structure and moving the AMR response forward.

COVID-19 has reinforced the importance of a robust pandemic preparedness plan. AMR has been characterized as a slow-moving inexorable pandemic – and we suggest now is the time to build on the lessons learned and prepare in order to reduce the impact on Canadians in the years to come. The degree of consensus that has been achieved among a disparate stakeholder group illustrates for us the power that a small group of experts — with the support of project resources to conduct background research, facilitate conversations, and keep the project moving forward — can bring to bear on complicated issues like AMR.

While we considered it essential to consult broadly and repeatedly over the course of the project, it has also raised expectations within the stakeholder community that something will come of this. It is with their sense of urgency and optimism that we submit our report. We thank the Public Health Agency of Canada for the privilege of doing this work.

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Table of Contents

Volume II: Supplementary Documents

Executive Summary

This report is the result of a request by the Public Health Agency of Canada (PHAC) to develop feasible, credible, and sustainable governance model options to strengthen the AMR response in Canada across One Health, without recommending a preferred option.

Under the leadership of a steering committee comprised of Canadian AMR and policy experts from across One Health (Appendix A), the project undertook extensive consultation and completed a thorough literature review.

Appendix B identifies the hundreds of stakeholders who reviewed consultation documents, participated in town halls, and provided written feedback over three consultation phases: candidate functions, possible organizational forms and structures, and draft model options.

As can be expected, there was a wide range of perspectives and ideas. However, we heard a general consensus across the stakeholder community: properly addressing AMR in Canada will require a strategic, coordinated, and highly collaborative approach that encompasses all aspects of One Health across all sectors and regions. It must also respect the federated nature of government in Canada and work within the mandates, structures, and priorities of multiple jurisdictions (including Indigenous jurisdictions) with varied and changing priorities.

Factors that are important in considering the feasibility and credibility of any proposed model are described; these factors are a subtle blend of *what* the model does (what we called core

functions) and *how* it works (what we called design principles, which guide how the entity is designed, staffed, led, and operated). These factors dictate that any model must:

a) Accelerate the Canadian AMR response by both:

▶ Creating connections and fostering knowledge-sharing across One Health and across Canada
▶ Increasing the capacity of the AMR community to accelerate action and deliver meaningful solutions

b) Facilitate participation and a willingness to collaborate across all One Health domains, fostering trust and legitimacy through clear and transparent communications.

c) Respect the ongoing AMR work happening across the One Health sectors, augmenting the work that is currently underway while minimizing the disruption and duplication that the introduction of a new governance structure could bring.

d) Apply an equity lens, inclusive of the linguistic, gender, geographic, economic, and cultural diversity across Canada.

e) Integrate an Indigenous lens into the fabric of the organization.

f) Foster the use of current evidence in decision-making.

g) Be attractive and accountable to funders.

h) Position the organization to absorb COVID-19 lessons as they emerge.

Two model options are proposed. Either will strengthen One Health AMR governance across the country while complementing and leveraging the current and emerging efforts of existing networks and organizations and building additional collaborations to generate and maintain momentum on AMR. We considered but ultimately are not proposing a model that is a hybrid of these two.

The first model has been dubbed "the AMR Network."

This model appeals to those who view the AMR ecosystem in Canada as complex, both in terms of the diversity of stakeholders involved and the range of actions that are required to address the issue at hand. Acknowledging the immense amount of work that is already underway in Canada, as well as the different economic incentives at play across the AMR community, this model would produce a network that enables and empowers its members to work on the things that they value while also contributing to overarching network goals. In doing so, this model will enable new work that transcends disciplines, sectors, and geographies. This model has greater potential to reduce the 'silo within silo' challenge by fostering an open culture that creates a mechanism for including sectors that are not well represented in existing collaborations. Any member can invite someone else to participate, either as a member or as part of an Action Group.

The AMR Network is predicated on the view that the problem of AMR is owned by a broad constituency and that a single point of control is therefore unrealistic and potentially ineffective.

To function optimally, a network leveraging the distributed collaboration model must have a clearly articulated goal, employ non-hierarchical oversight, encourage coordinated autonomy, achieve trust and legitimacy, and be nimble and flexible in the face of emergent pathogens and ever-shifting priorities. It must also be well resourced with a strong secretariat to ensure that the collective work of the network members is properly advanced.

The advantages of this model include:

► Giving the experts control of priorities — it's the members, not an oversight body, who make decisions and drive action.

► Connecting individuals and organizations from across sectors, disciplines, and regions who would otherwise have difficulty collaborating.

► Enabling a high degree of nimbleness and flexibility, allowing members to pursue interesting opportunities as they emerge, while ensuring the Action Groups have the facilitation and project management resources needed to succeed; this is particularly important in AMR, where novel pathogens can create crises that require a broad-based response.

► Being more likely to provide room for the meaningful inclusion of Indigenous Peoples, equity-seeking groups, and structurally marginalized populations.

► Providing a mechanism for explicit discussion of intellectual property rights and how they are addressed in the context of each specific Action Group.

► Having the ability to support a number of different initiatives, which may be of differing priorities in different jurisdictions across the country and among different stakeholders, while reducing duplication because of increased connection, trust, and cooperation between members.

At the same time, this model has risks and disadvantages:

▶ Networks can be less efficient than more directive models. There is a risk that decentralized accountability for results, combined with the more diffuse decision-making authority, may lead to initially slower outcomes.

▶ Networks can also take more time to get everyone working together collaboratively across the multiple different spheres, requiring patience on the part of the funders and stakeholders.

▶ There is a need for an effective collaborative leadership function so that the efforts of the membership add up to more than the sum of its parts.

▶ Without effective leadership, the network could devolve into a chaotic or non-functional 'talk shop,' minimizing the volume of useful action.

▶ While this model is likely to be seen as highly legitimate and is preferred by many stakeholders since it enables a greater sense of ownership for members, it may be considered less favorable by those outside of the network and by those looking for a model where decision-making is more structured and a path to action is more clear.

The second model has been dubbed "the AMR Centre."

This model adopts a classic top-down approach — a familiar and easily understood model. The Centre model enables decisive action to make meaningful impact in a select number of priority areas and drives change via its own staff, equipment, and infrastructure, as well as through strong partnerships and contracts with leading experts and institutions.

The AMR Centre model provides a number of advantages:

▶ The AMR Centre enables a comprehensive approach to selecting its priorities, choosing to make meaningful impact in a select number of priority areas. It will drive change in those areas through its own staff, equipment, and infrastructure; through strong partnerships; and through contracts with leading experts and institutions.

▶ It is positioned to become the focal point for AMR activity in Canada through regular initiation of large projects — via internal staffing and competitive project funding grants — with pan-Canadian mandates that focus on the selected priority areas.

▶ Offers a vehicle through which PHAC could generate an overall annual summary of the status of AMR mitigation in Canada. Should the Centre undertake accountability for national reporting, it would need to be specifically resourced to perform this function. Current cost estimates only forecast resourcing for reporting of Centre projects.

▶ The familiarity of the AMR Centre model, and its single locus of contact, has the potential for greater international credibility.

At the same time, this model has risks and disadvantages:

▶ While is it much easier to implement this model with its clear organizational structure and a familiar top-down approach, this model poses a longer-term risk that the work becomes focused on places that are already well resourced and highly functional, replicating existing power imbalances and inequities so that the largest and loudest organizations — who are not always the most diverse and inclusive — will still be allocated the majority of the resources and attention.

> **We heard a general consensus across the stakeholder community: properly addressing AMR in Canada will require a strategic, coordinated, and highly collaborative approach that encompasses all aspects of One Health across all sectors and regions.**

▶ We heard from some stakeholders working in animal health and agriculture that the AMR Centre may have less credibility within their domain, which reportedly has had a positive experience with network approaches and less success with approaches that are perceived as 'top-down' or that use directive powers. For some, the concern with the AMR Centre model led them to suggest a hybrid model where the AMR Network would be implemented in the animal health and agriculture domain if the AMR Centre is selected as the overall model.

▶ The focused nature of setting priorities in this model will almost certainly mean that some of the current AMR efforts would be outside of whatever priority foci are selected by the AMR Centre. While that does not mean that the current work would stop, the level of coordination and collaboration in those areas would likely be lower than they would in the AMR Network model.

▶ There is a small risk that the AMR Centre might duplicate or be in competition with the function of existing organizations. This risk can be mitigated by ensuring the Centre focuses on undertaking projects that other groups cannot, due to complexity or cross-sector reach.

▶ The Centre model is less flexible and less capable of responding nimbly to new and emerging issues than the more distributed AMR Network is.

We have outlined the estimated annual operational costing for each model: $5.6 million for the AMR Network and $9.2 million for the AMR Centre.

While our work has focused on the design of governance model options to coordinate the One Health AMR response in Canada, we know that a successful response is inextricably linked to ensuring that organizations have the resources — which includes funding — to deliver on the robust and sometimes costly activities required to mitigate AMR.

Considering this, we recognize that the AMR community in Canada will require significant additional resources, beyond the basic operational costs indicated above, to deliver on the promise of AMR mitigation.

While determining the exact level and appropriate sources of the incremental investment that will be required was outside of our mandate, throughout our discussions, we used a figure of $100 million per annum (in addition to the organizational operating costs) as an order-of-magnitude estimate to inform our planning.

About this Project

This report is the outcome of a project designed to answer the need for strengthened governance of Canada's antimicrobial resistance (AMR) response. Governance, in this context, refers to coordination and leadership across One Health.

It is generally recognized within Canada[1-6] and internationally[7-12] that the complexity of responding to antimicrobial resistance requires a strategic, coordinated, and highly collaborative approach that encompasses all aspects of One Health[13] across all sectors and regions. Currently, however, coordinating such a complex response is beyond the remit of any one organization.

While the current AMR mitigation activities in Canada have their strengths,[14] an environmental scan in Canada from 2008-2018 concluded that the response remains largely siloed, uncoordinated, and often restricted within sectors or regional boundaries.[15]

Strengthening governance — the processes and mechanisms that coordinate a response across many organizations — is an essential pre-requisite for success of the One Health AMR response in Canada.

Several primary pan-Canadian[16] guidance documents describe why governance is a cornerstone for change in the AMR space.[17] In particular, the Pan-Canadian Framework for Action[18] notes a strategic goal "to strengthen governance structures to generate knowledge and information on AMR and antimicrobial use (AMU) in humans, agriculture, and animals through the monitoring, detection, and tracking of resistant organisms to develop and monitor interventions."

Our Mandate

To respond to this need for governance as a foundation for an improved response, our project was tasked by the Public Health Agency of Canada (PHAC) to develop feasible, credible, and sustainable governance model options to strengthen the AMR response in Canada across One Health. Our charge included a requirement to consult broadly.

Our mandate asked us to go to a certain level of detail – understanding the governance requirements in this arena, reviewing how other jurisdictions have approached this

challenge, and developing at least two model options that we believe are both credible and feasible in the Canadian context. We were not asked to recommend a specific model for implementation.

Concurrent with our project, the federal, provincial, and territorial (F/P/T) governments have been working together to finalize the Pan-Canadian Action Plan. Our scope excluded setting priorities within the spectrum of AMR response activities. Similarly, it excluded identifying associated funding requirements.

The Project Steering Committee

As a first step, we established a Steering Committee (see Appendix A), intentionally comprised of experts from across One Health, across Canada, and with specialized knowledge that extends beyond AMR — governance, equity, diversity, and inclusion (EDI),[19] health policy, and more. This committee was charged with guiding the development of model options and ensuring that the perspectives of all stakeholders were considered early and often. Further,

Steering Committee members served to act in the best interest of the AMR One Health community, putting aside their direct organizational and/or professional interests. All decisions were reached using a consensus model. The Steering Committee also sought input from three Special Advisors and an external Advisory Committee (see Appendix B), who, together, helped inform consultations and respond to findings.

Defining 'One Health'

One Health is a collaborative, multisectoral, and transdisciplinary approach — working at the local, provincial/territorial, national, and global levels — with the goal of achieving optimal human, animal, plant and environmental health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.[20]

Project Approach

Over the course of project, we needed to consider several interrelated elements: the purpose and objectives of the governance structure, its functions and activities, the accountabilities for which it would be responsible, its structure, and the operating budget required to deliver on the above.

For each of these elements, we developed possible options based on lessons learned from our research, consulted broadly, and adapted our initial thoughts in response. Making this a more complex endeavor, it was important that each component be addressed iteratively given the interconnection between them.

Consultation Approach

Given the remarkable diversity of the stakeholders and organizations in Canada — not to mention the impact of AMR in so many different socio-economic areas — we knew that broad based consultation was vital.

At the beginning of the project, we anticipated a different consultation process than what eventually transpired. Like so many other things, our plans were complicated by the COVID-19 pandemic. What were supposed to be cross-country town hall events became virtual sessions with remarkable turnouts, despite busy schedules, Zoom fatigue, and a somewhat dense topic.

The high levels of engagement affirmed the sense of urgency amongst the stakeholders for strengthening AMR governance in Canada. That said, we acknowledge that the nature and timing of the process — especially the fact that it took place during a pandemic — means some voices may not have been heard.

Defining Governance

Governance is a challenging concept, so we found it helpful to keep several complementary definitions in mind as we designed these models:

▶ Governance is about how decisions are made — the structures, processes, and protocols that ensure accountability, transparency, responsiveness, stability, equity, and inclusiveness.

▶ Governance determines who has a voice in making decisions, how decisions are made, and who is accountable.

▶ Indigenous health governance values the principles of self-government, self-determination, nation-to-nation decision-making, reciprocal accountability, and meaningful community engagement.

▶ Governance is "the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and cooperative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest." [21]

In our consultations, many stakeholders did not use the term 'governance,' but instead referred to these concepts by other terms — leadership, effective coordination, and collective action.
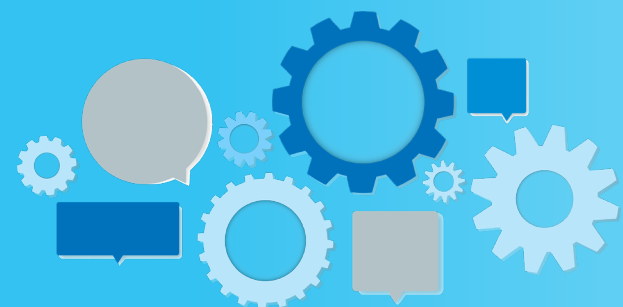
Overview of this Report

This report brings together our key findings and proposes two model options, each with its own distinct advantages and risks. Rather than recommending a specific option, we have been asked to present *multiple* options, and not to make a final selection.

Divided into five chapters, this report synthesizes the evidence and project findings that informed these model options. In developing this report, we recognized that the many readers of this document might have diverse backgrounds, so we hope that its language and structure helps to create a shared understanding of the problem and our proposed solutions.

Chapter 2 describes the current environment of One Health AMR in Canada, and what makes this such a complex issue to address. Chapter 3 considers various governance approaches and models from a theoretical perspective. Chapter 4 proposes two governance model options. Operational costing for each model and the incremental investment required to support AMR activities are identified in Chapter 5. Finally, supplemental reports are presented in a companion document ("Volume II") to provide access to additional details and project background.

By the Numbers

827 Stakeholders engaged

535 Organizations engaged

210 Responses to baseline survey

150 Participants at 'functions' consultations

82 Participants at 'structure' consultations

5 Interim reports published

64 Comparable organizations and strategies examined

23 Virtual town hall events

Describing Antimicrobial Resistance

"AMR occurs when microbes (e.g. bacteria, viruses, fungi and parasites) evolve in ways that reduce or eliminate the effectiveness of antimicrobial medicines (e.g. antibiotics, antivirals, antifungals and antiparasitics) to treat infections by killing or slowing microbial growth. When microbes are exposed to antimicrobials, they adapt and become more resistant. This contributes to increased AMR in humans, animals, crops and in the environment (e.g. water, soil) through exposure to waste water, consumer products and animal manure. There are also many social and environmental factors that contribute to rising rates of AMR including poor hygiene, inadequate infection prevention and control (IPC) practices, lack of awareness and education about AMR and appropriate antimicrobial use (AMU), insufficient access to health services, overcrowded housing conditions and a lack of clean water."[22]

Project Timeline

Over the course of this project, we have engaged in and reported on cross-sectional research, literature reviews, and a series of broad consultations.

Spring 2020

Understanding the Landscape
We assembled a robust database of people who are directly or potentially involved in Canada's response to AMR. From our small starting list — compiled from various sources, including PHAC, our Steering Committee members, and a small group of AMR-involved organizations—our database grew to over 825 stakeholders that represent more than 530 organizations that span all three One Health domains.

Literature Review & Environmental Scan
We reviewed literature and documentation from a wide variety of sources, including Canadian guidance documents, AMR-related reports, current governance approaches for existing networks (both AMR focused and not) in Canada and internationally (See Vol. II, S.5).

Baseline Survey
We invited more than 600 Canadian AMR stakeholders to participate in a survey to help us understand who is doing what in One Health AMR in Canada. With around a 35% response rate, the information garnered from this questionnaire was a key input that helped us chart the path of our project (See Appendix D).

Series 1 Consultations: Functions
We consulted with hundreds of stakeholders from across Canada's One Health spectrum about which functions would be important to include in a potential governance entity (See Appendix B and Vol. II, S.1).

Series 2 Consultations: Form & Structure
We translated our findings from Series 1 into two baseline model options — the distributed collaboration model and the lead-entity model. These were detailed in a discussion document that served as the bedrock for our second round of consultations, which focused on what the governance body should look like (See Vol. II, S.2 and S.3).

Series 3 Consultation: Draft Findings
We developed a discussion document that tied all of our findings together and outlined two refined models. This round of consultations was designed to garner stakeholder input on their overall feasibility and credibility (See Vol. II, S.4).
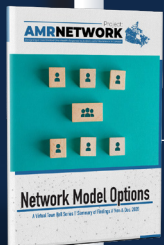
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Final Report Development and Submission
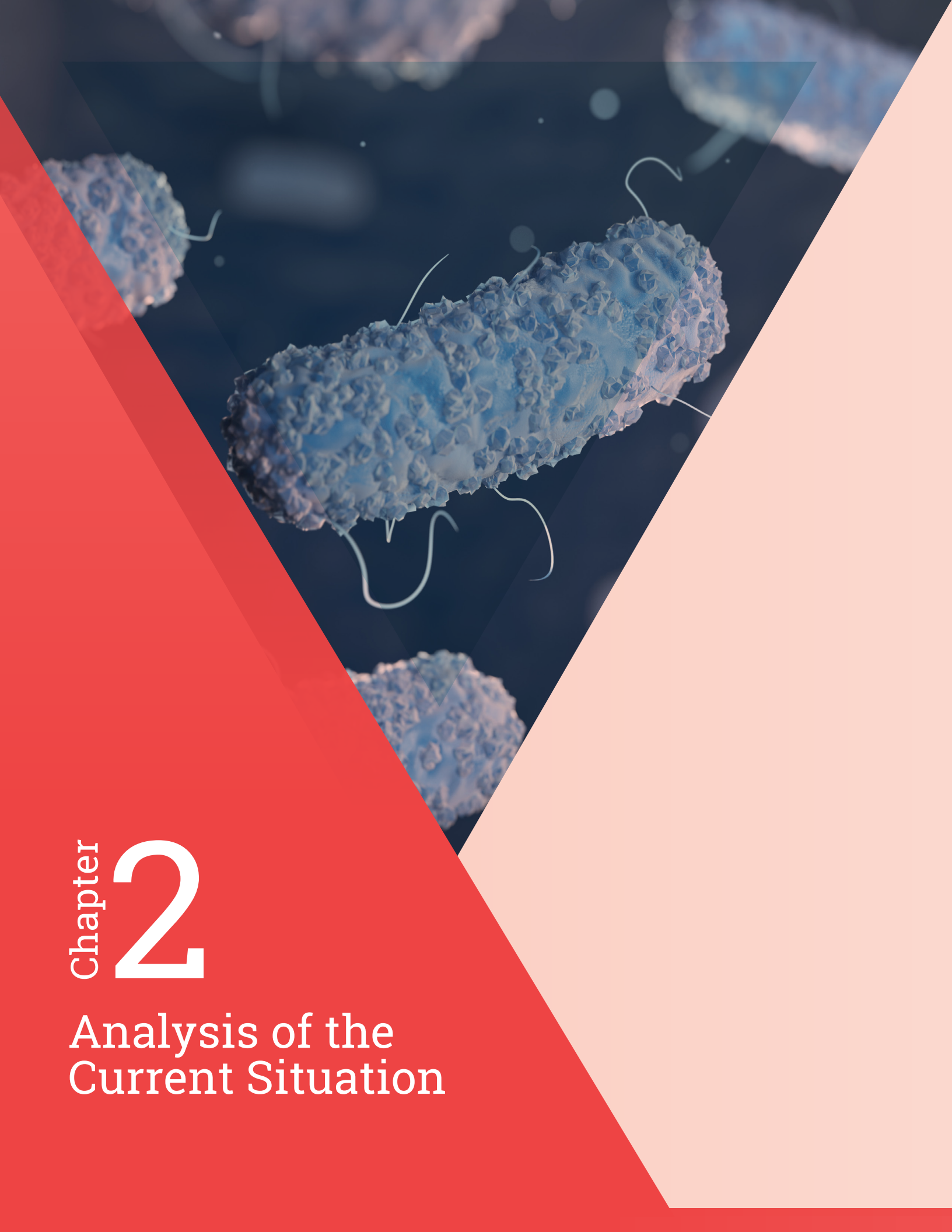
Chapter

2

Analysis of the Current Situation

The One Health Antimicrobial Resistance Problem in Canada

A One Health approach recognizes the interconnectedness of AMR — across humans, animals and agriculture, and the environment — to inform the scope and extent of the sectors that must be engaged to address the immense challenge of AMR.

Why is AMR a problem? What is the impact?

AMR occurs when microbes (e.g. bacteria, viruses, fungi, and parasites) evolve in ways that reduce or eliminate the effectiveness of antimicrobial medicines (e.g. antibiotics, antivirals, antifungals and antiparasitics) to treat infections by killing or slowing microbial growth.[1]
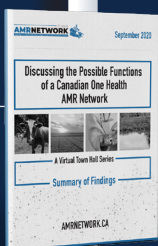
AMR has far-reaching implications for numerous sectors, extending beyond human and animal health to economy, trade, tourism, and more. In response to this critical threat, the World Health Assembly adopted a global action plan[2] for AMR that underscores the need for a One Health response. This plan calls for coordination across international sectors and actors in the areas of human and animal health, environment, and agriculture.

Focusing on human health/patient safety impacts, in 2018 in Canada alone, 5,400 deaths were caused by AMR, and an average of about 26% of bacterial infections are resistant to first-line antimicrobials.[3] A Review on Antimicrobial Resistance suggested that a failure to address AMR could lead to more deaths than cancer by 2050, claiming up to 10 million lives across the globe per year.[4]

There is also increasing recognition of the negative economic impacts of AMR. In Canada, a 2019 report[5] predicted a continuing decrease in Gross Domestic Product ($2 billion/year) and a negative impact to the healthcare system ($1.4 billion/year). The report predicts that, if left unchecked, by 2050, 13,700 people will die each year from resistant bacterial infections.

The impact is equally significant for the animal and agriculture sector, though measured and described differently. The Pan-Canadian Framework[6] notes that

"the appropriate use of antimicrobials in agriculture (e.g., in animals and crop settings) plays a key role in safeguarding the health of food-producing animals, and also promotes the health of the Canadian population by improving access to healthy and safe food at competitive prices. Since the international trade of animal products and food by-products is a critical component of Canada's agriculture industry, continued alignment with international standards and regulatory measures to address AMR is crucial for governments and industry in Canada. Some evidence has emerged that several infection-causing animal microorganisms are developing resistance to commonly used antimicrobials, posing a risk to the health and welfare of animals."

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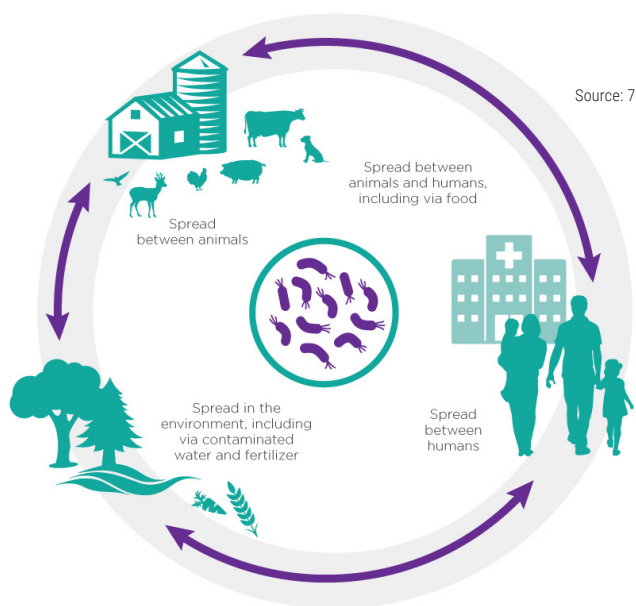
Emerging evidence, plus market and social pressures, are driving livestock producers to use fewer antimicrobials. Canadian producers are actively working on solutions that respond to the unique size, scope, and scale of the Canadian landscape and demonstrate appropriate use of antimicrobials in order to ensure the health and welfare of animals, preserve and ensure a safe food supply, and keep livestock producers competitive.[8]

Why do we need to consider the One Health approach for AMR?

In Canada and internationally, leading organizations assert that a One Health approach is the best possible way to effectively frame collective action.[9,10] Because the drivers of AMR lie in the interrelated ecosystems of humans, animals, plants, food, and the environment, a sustained One Health response is essential to engage and unite all stakeholders around a shared vision and shared goals.

One Health recognizes the interconnectedness of AMU in humans and animals and the concurrent presence of antimicrobials and resistant bacteria within the environment.[11] It also acknowledges that tackling AMR requires a global approach and therefore advocates for coordinated actions across domestic and international borders, sharing solutions for a comprehensive and effective response.[12] This requires that human and animal health, agriculture, food production, and environmental sectors all work together to contain the emergence and spread of AMR.[13]

An Indigenous Approach

Indigenous[14] worldviews and knowledges about holistic health and wellbeing preceded the evolving concept of One Health in veterinary and human medicine.[15] Western conceptualizations primarily define physical health through a deficit-based approach, as the absence of illness and disease.[16]

Meanwhile, many Indigenous Peoples and communities in Canada and around the world take a holistic approach.[17] The Medicine Wheel,[18] for example, presents health as a balance between the physical, emotional, spiritual, and mental aspects of human beings, and also talks to how human health is linked and interconnected to the health of our environment, ecosystems, and animals. Stewardship of the planet is foundational to maintaining human health.

Who is part of the One Health AMR response in Canada?

While One Health is a useful concept to guide and align an AMR response, it needs to be both socialized and operationalized in the Canadian context. To better reflect the diversity of organizations active in AMR across One Health and to inform our consultations, we built a database of Canadian One Health AMR stakeholders over the course of the project. From our starting point, our database was expanded to over 800 stakeholders representing over 500 organizations, collected through organic recruitment strategies. This database was used to survey and engage stakeholders and to inform our consultations, making them as comprehensive and inclusive as possible.

Perhaps the most interesting element of the development of this database was that it highlighted some of the factors that make the One Health AMR arena so complicated to govern:

► While we came to use the term "AMR community" as a shorthand for those involved in the AMR response in Canada, there is in reality no such community — stakeholders continue to work in isolation, and while there is desire for additional collaboration, the sense of community is nascent at best. Indeed, while the participants at our consultation sessions came with an understanding of the complexity of the AMR issue, they frequently expressed surprise about the diversity of actors in Canada and how little they knew about the goings-on in sectors beyond their own.

► We also came up against the challenges often encountered when classifying a diverse group. For example, our database includes a broad representation of people working within each of the One Health domains, but also those bridging multiple domains (e.g., agriculture and environment), and some who saw themselves attached to disciplines beyond any of the domains (e.g. political scientists). A second example was that we asked stakeholders to associate themselves with the traditional AMR pillars of surveillance, infection prevention and control, antimicrobial stewardship, and research and innovation. Interestingly, the vast majority did not associate with the pillars at all, and those who did often selected more than one.

► We also observed that not all of the important voices were well represented in the database, including Indigenous communities and environmental scientists. Being inclusive of those communities and diverse populations within Canada, improving representation across the One Health domains and sectors, and an explicit focus on EDI will be paramount to gaining and maintaining legitimacy and trust.

> **"**
>
> While there is desire for additional collaboration, the sense of community is nascent at best.

The Current Level of Coordination and Collaboration

Design of a governance model for a One Health AMR response is not a blue-sky exercise. It is critical to understand what networks and activities already exist to address AMR in Canada, so that any proposed model can complement and leverage current efforts.

Although AMR has long been a threat, much of the country's work toward mitigation has been largely siloed from a One Health perspective. Because AMR is so deeply rooted in so many different areas, industries, and regions, governance of the issue has remained far beyond the reach of any existing organization or government agency.

Responsibilities related to antimicrobial stewardship, surveillance, infection prevention and control, and research and innovation are shared among the federal, provincial, and territorial governments, as well as with professional organizations, private industry, and non-governmental organizations.

Activity at the Federal Level

Under the current government, the Prime Minister directed the Minister of Health to coordinate a response to AMR.[19] Currently, the Public Health Agency of Canada (PHAC) is responsible for the coordination of national responses to public health threats, such as antimicrobial resistance.[20] The Agency provides national leadership for public health aspects of AMR and AMU through the design of guidelines, the development of tools for antimicrobial-resistant infections, and the surveillance of antimicrobial-resistant organisms in humans and AMU in both humans and animals. For example, PHAC coordinates several programs to integrate key surveillance data from across the country, including the Canadian Antimicrobial Resistance Surveillance System (CARSS),[21] the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS),[22] and the Canadian Nosocomial Infection Surveillance Program (CNISP)[23] with key partners.

Canada has continued to take steps toward improving the country's international standing in the response to AMR. According to the 2018 Joint External Evaluation (JEE)[24] of the International Health Regulations, Canada demonstrated several strengths in addressing AMR, particularly in the areas of surveillance, diagnostic capacity, and infection prevention and control.[25]

Furthermore, CIPARS is regarded as the global gold standard for AMR surveillance, as it combines data from human, animal, and food sources.

> " Our survey and research confirmed that there is already a significant amount of AMR-related activity occurring — advocacy, awareness, coordination, education... and more.

However, published around the same time as the JEE report, the House of Commons Standing Committee on Health[26] agreed "that Canada has made significant efforts to tackle AMR. At the same time, the committee stresses that more needs to be done." They also called for enhancements in the following areas: [27]

► Accelerated development of the PCAP
► Federal Leadership
► Stewardship
► Surveillance
► Funding

Examples of Collaborations

In addition to the mechanisms that ensure cross-sectoral collaboration and accountability within governments in Canada, the human health, animal health, and agriculture and agri-food [28] sectors are already engaged in numerous activities to address AMR and many are achieving good results in their specific areas of responsibility. Indeed, our survey and research confirmed that there is already a significant amount of AMR-related activity[29] occurring — advocacy, awareness, coordination, education, funding, guidelines and best practices, knowledge translation, leadership, legislation, policy development, regulation, reporting, research, standards and tools, surveillance, training, and more.

In our scan of organizations working to enhance a One Health AMR response, we found numerous examples of effective collaborations. A few examples, drawn from our case study scan to illustrate the scope of work (See Vol. II, S.5 for a full list and methodology), are highlighted here:

► **National Farmed Animal Health and Welfare Council (NFAWC).** The council brings together industry and federal/provincial/territorial (F/P/T) partners to provide collaborative guidance on a cohesive, functional, and responsive farmed animal health and welfare system in Canada.[30] The council tackles animal welfare, emerging diseases, animal health surveillance, antimicrobial use and resistance, with consideration for One Health and One Welfare concepts. It works in partnership to elevate farmed animal health and welfare and accelerate results.[31]

► **Canadian Animal Health Surveillance System (CAHSS).** A division of NFAWC and a network of animal health surveillance networks independent from government.[32] CAHSS links individual network groups which are self-organizing and self-governing, but have a shared purpose and principles. CAHSS has a national vision to ensure effective, responsive, and integrated animal health surveillance in Canada. Sector networks include poultry, swine, equine, dairy cattle, aquatic, beef cattle, and wildlife. Cross-sector groups include the antimicrobial use surveillance network.

▶ **Global One Health Network**. This interdisciplinary "research-to-action" network seeks to strengthen Canadian leadership in the global governance of infectious diseases and AMR. The Network convenes researchers and knowledge users from the social sciences as well as human, animal, and environmental health sciences to develop a transdisciplinary One Health approach to Infectious Disease and AMR governance at global, national, and local levels.[33]

▶ **Joint Programming Initiative on Antimicrobial Resistance (JPIAMR).** This global collaborative platform engages 28 member nations, including Canada, with a mandate to curb AMR using a One Health approach.[34] The initiative coordinates national funding to support transnational research and activities within six priority areas of the shared JPIAMR Strategic Research and Innovation Agenda, namely: therapeutics, diagnostics, surveillance, transmission, environment, and interventions.

▶ **Choosing Wisely Canada.** Choosing Wisely is the national voice for reducing unnecessary tests and treatments in health care.[35] Using Antibiotics Wisely is a national campaign to help clinicians and patients engage in conversations about unnecessary antibiotic use. Using Antibiotics Wisely has launched targeted campaigns in different practice settings and developed tools and resources that encourage conversations about inappropriate antibiotic use.

▶ **Do Bugs Need Drugs?** A community education program about handwashing and responsible use of antibiotics, and currently a provincial program in Alberta and British Columbia.[36] Materials are made available for healthcare professionals and the public to explain why antibiotic resistance is an issue and assist in identifying steps to prevent antibiotic resistance from developing. The program started as a small six-month pilot in Grande Prairie, Alberta in 1998-1999. Components of the program are used elsewhere in Canada, the United States, and abroad.

▶ **HealthCareCAN.** The national voice for health organizations and hospitals across Canada.[37] They advocate in support of health research and innovation, enhanced access to high-quality health services for Canadians, and provide health professionals with in-class learning programs. HealthCareCAN plays a leadership role in promoting AMS programming and advocating for increased resources to advance stewardship in Canada. HealthCareCAN has developed a 10-point roadmap for improving AMS in Canada.[38]

Beyond these examples, our initial mapping of AMR stakeholders in Canada confirmed that there were some wide-ranging connections between organizations and individuals across multiple sectors, and these relationships continue to evolve.

Areas for Improvement

More broadly, our consultations and research have found that these collaborations do not span One Health and highlight the opportunities that would be created by enhancing collaboration across sectors and geographies:

▶ There is no pan-Canadian coordinating function for One Health activities — AMR or otherwise. Our baseline survey (Appendix D) highlighted that the human and animal health, agriculture, and agri-food sectors are actively engaged in numerous activities to address AMR. However, our consultations exposed missed opportunities for cross-sectoral collaboration and coordination, duplication of effort, and inefficiencies in the use of time and resources, all contributing to a slower response to AMR in Canada.

► "There are already numerous actions underway that address AMR in Canada by those in the public health, healthcare, and agriculture sectors. However, many of these actions have been isolated and uncoordinated, creating an important opportunity to knit them together through improved cross-sectoral coordination and collaboration at all levels for a coherent pan-Canadian response to AMR. Leadership on AMR at all levels of government and by human and animal health stakeholders taking actions within their spheres of responsibility is required to successfully accomplish this."[39]

► Other reports have provided evidence of areas where increased coordination and collaboration would be valuable. Current surveillance systems have little data on antimicrobial resistance in community and rural settings and use of antibiotics in beef and cattle.[40,41] Laboratory surveillance is suboptimal, as hospital labs are collecting data separate to reference labs in each province.[42] In addition, interprovincial lab data is not available. Provinces also vary in their methods for collecting animal health data and, as a result, it is difficult to aggregate information.[43] Effective communication and educational interventions remain regionally specific like the "Do Bugs Need Drugs?" program.[44] There is no national consensus on antibiotic prescribing benchmarks[45] and uptake of existing federal/provincial guidelines is low.[46]

► In the 2015 Audit, Canada's Auditor General noted that the work involved in developing a pan-Canadian AMR strategy, and in particular the need to "mobilize the provinces, territories, and other stakeholders in identifying priority actions, clarify roles and responsibilities, and establish clear and realistic deadlines for the development of a pan-Canadian strategy."[47]

The Need for an EDI Lens: What we Heard at our Consultations

"We need to be attentive to equity because we know and we have known for a very long time that structurally marginalized populations, racialized populations, LGBTQIA populations, Indigenous Peoples, newcomer Canadians, incarcerated populations — all of these populations are more and more vulnerable and experience poorer health outcomes on every dimension. And AMR is not going to be any different. Even though, yes, AMR impacts everyone, it's not going to impact all populations equally."

"Equity considerations need to be built into the response — and it's not only about being mindful of what interventions are going to promote individual behavioral change. It's also about being mindful of the political, infrastructural, and economic drivers that shape that vulnerability in the first place."

► Our consultations reinforced these findings. For example, 30% of our baseline survey respondents mentioned "coordination" as an expectation or desired function of a pan-Canadian AMR network along with other functions such as collaboration and information sharing, noting a contributing factor is simple mechanics and administration: it is difficult and labour-intensive to find others who are working in the AMR sphere. Another example that demonstrates the current silos that exist both between and within the human, animal, and environmental domains is that only 22% of survey respondents noted that they worked across more than a single One Health domain, and 100% of organizations reporting a national mandate noted that their mandate was within a specific One Health domain.

The Benefits of Increased Collaboration

Through our work, we became even more convinced that strengthened governance of the AMR response in Canada would address many of the shortcomings of our current approach to mitigating AMR by enabling key benefits:

▶ Meaningful action and faster mitigation of AMR
▶ Improved connectedness and trust across One Health AMR in Canada
▶ Increased intersectoral and cross-disciplinary collaboration
▶ Canada could better meet international AMR commitments
▶ Less duplication of effort across regions and sectors
▶ Innovative approaches to identifying and solving problems

Willingness to Collaborate

One of our tasks has been to assess the general willingness of potential Canadian network partners to actively participate in facilitated and structured collaboration initiatives. Repeatedly, we heard deep frustration with the current state of affairs and have concluded that there is overwhelming agreement with the need for enhanced governance and a clear willingness to participate. Virtually nobody that we consulted suggested the notion of AMR governance was a bad idea — some identified nuances about how it should be done, but nobody outright resisted it. When we tested various model options, most participants expressed preferences for one idea or another, but almost all participants noted a clear willingness to compromise if it meant meaningful action and faster mitigation of AMR. In other words, people are less

concerned with how things play out, as long as they do indeed play out. They noted that "perfect is the enemy of good" — that some governance mechanism is better than none, as long as it progresses the national response.

At the same time, this willingness to cooperate is not without some concerns on the part of the stakeholders.

▶ Noting that a sustainable AMR response requires understanding and balancing the commercial/economic and public health interests of multiple stakeholders, in an environment where both the specific nature of the AMR threat and the evidence that can inform the response is constantly evolving, participants generally acknowledge that there is an unavoidable and inherent tension between

the various interests of the AMR stakeholders across the One Health continuum, as well as potential conflicts between the interests of some stakeholders and the interests of some funders. Robust conflict of interest policies, transparent communications, and the use of approaches such as public-private partnerships were identified as important elements of any potential solution.

▶ There is also concern — especially within the animal/agriculture sectors — that the existing work underway in Canada may not be recognized by whatever new governance structures are implemented, potentially resulting in duplication or conflict.

▶ For some, increased coordination is a proxy for increased funding toward the AMR response; there is a risk of disappointment and criticism of any new coordination mechanism, should this not materialize.

The Notion of Leadership

Often, this willingness to collaborate was expressed as a call for strong leadership in the AMR space in Canada; however, it was also apparent that different people meant different things when they discussed 'leadership.' While noting that good leadership needs to come from all levels of any proposed governance structure, participants talked about three possible approaches to leadership by organizations in a diverse arena like a One Health AMR response:

▶ One that is directive and authoritative, makes bold decisions, determines priorities, and drives people to act in the interests of the entire One Health spectrum instead of the interests of their own sector. The degree to which this leadership approach is feasible in the Canadian context, given the federated nature of the country, is unclear.

▶ One that sets out a clear focus and then lets people and organizations determine their own course of action to achieve the defined objective. Some people discussed the concept of nudging — instead of pushing people down a path unwillingly, leadership could take a more suggestive approach.

▶ One that assumes that improving access to information and increasing awareness alone is sufficient and would bring different groups together and give them the necessary tools and know-how to collaborate effectively.

Understanding these various perspectives, and in which circumstances each might best be applied, was especially useful to us, and informed the possible governance models that we examined and ultimately recommended.

Federalism in Canada

The federated nature of government in Canada results in a complex operating environment for organizations working to strengthen our AMR response across One Health. Any proposed governance mechanism needs to respect the reality of working within the mandates, structures, and priorities of multiple jurisdictions with varied and changing priorities.

Governments across Canada have identified AMR as a priority, undertaking multiple initiatives to combat AMR, including surveillance, awareness campaigns directed at human and animal health professionals to reduce antibiotic use, and immunization programs to prevent and control infections and the spread of infectious diseases.

Given the federated nature of Canada, decision-making may reside with multiple levels of government, including provincial, territorial and Indigenous leaders, with each jurisdiction having unique constitutional rights and responsibilities. Any strengthened AMR governance mechanisms that are proposed will have to work within these structures, respecting the diverse priorities and needs of the multiple jurisdictions, as well as the Crown's obligations to Indigenous Peoples.

There are two principal pan-Canadian guiding documents for the AMR response.

The Pan-Canadian Framework for Action

In 2017, recognizing the complexity of AMR, the Government of Canada issued Tackling Antimicrobial Resistance and Antimicrobial Use: Pan-Canadian Framework for Action, which called for coordinated action domestically and globally to slow the increase of AMR and its impact and to preserve the effectiveness of our existing and future antimicrobials. Grounded in the One Health approach, and developed with input from F/P/T governments, academics, non-governmental organizations, industry, and subject matter experts representing human health, animal health, and agriculture sectors at all levels, the Framework's overarching goal "is to strengthen Canada's ability to combat the risks of AMR in a coordinated, multisectoral, and effective manner."

The Framework seeks to bring together governments, private and public partners, and the public across human, animal, and environmental sectors for action against AMR.

The Framework consists of four components: surveillance, infection prevention and control, antimicrobial stewardship, and research and innovation. Four strategic goals were identified:

▶ Strengthen governance structures to generate knowledge and information on AMR and AMU in humans, agriculture, and animals through the monitoring, detection, and tracking of resistant organisms to develop and monitor interventions.

▶ Promote, facilitate, and measure appropriate AMU in humans and animals to conserve the effectiveness of antimicrobials that are critical to human and animal health, and to limit the development and spread of resistant organisms within and among populations.

▶ Reduce the need for antimicrobial treatment by promoting infection prevention and control practices to decrease infection rates in healthcare, community, and animal settings.

Tackling Antimicrobial Resistance and Antimicrobial Use

A Pan-Canadian Framework for Action

▶ Support the advancement of research and innovative approaches for the identification, characterization, and real-time detection of microorganisms including resistant bacteria, the treatment and prevention of infections, as well as basic and behavioural research.
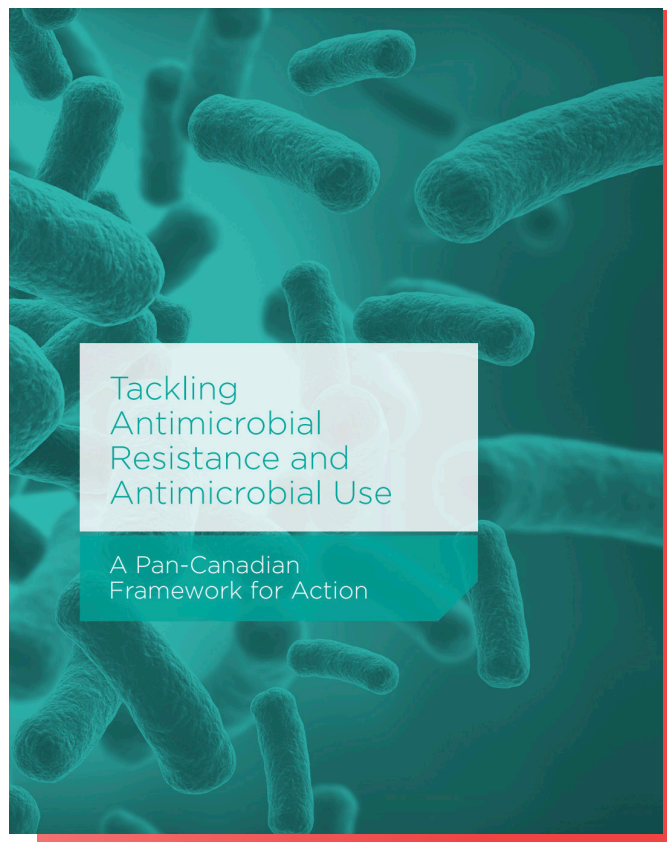
The Pan-Canadian Action Plan (Draft)

A Pan-Canadian Action Plan on Antimicrobial Resistance and Antimicrobial Use (PCAP) is being developed to operationalize the Framework for Action and to set the policy foundation for a coordinated and pan-Canadian response to AMR. The federal government is working jointly with the provinces and territories to finalize the initial version of the PCAP, which is the result of a two-year engagement process with experts in the human, animal, and agriculture and agri-food sectors. Our understanding of the purpose of the action planning process is that it will provide a multi-year blueprint for collaborative action against AMR that facilitates multi-sectoral coordination and action through a One Health approach. Developing a Pan-Canadian action plan is an absolutely essential element of generating a coherent national response to the looming One Health AMR crisis. However, a plan by itself is insufficient, and mechanisms are required to foster and guide the collaborative efforts necessary for the successful implementation of the plan, recognizing that broad representation from non-governmental organizations is also essential in the fight against AMR.

> **The federal government is working jointly with the provinces and territories to finalize the initial version of the action plan, which is the result of a two-year engagement process with experts in the human, animal, and agriculture and agri-food sectors.**

In subsequent sections of this report, we propose two model options. Implementing either option will involve creating some type of new organization. In our view, this organization should only be held accountable for the responsibilities that it agrees to undertake — which, as described, are not likely to include the entirety of the actions within the forthcoming PCAP and may also include activities beyond the scope of the PCAP. Given this, any new governance mechanism will need to be strategically aligned with key policy and guidance documents, including the Framework and PCAP, which serve as touchstones to ensure that the AMR mitigation efforts in Canada are coordinated.

We heard significant levels of frustration within the stakeholder community about delays in the finalization of the PCAP — albeit with an appreciation of the challenges of completing this document in midst of the pandemic. In the absence of this guidance document, important AMR-related work is underway, but the sense of cohesion that would be brought to this work through the publication of the PCAP is missing.

Stakeholders recognize that, as a living document, the PCAP will likely change over time — and evolve in scope to incorporate environmental needs and other emergent priorities. However, we heard heterogeneous opinions regarding who stakeholders thought should be responsible for refreshing the plan over time. The PCAP will be a public policy document and, therefore, it is the responsibility of the Government of Canada, in consultation and collaboration with provincial, territorial, and Indigenous partners, to maintain, evaluate, and report on its success. While it is possible that this responsibility could be delegated to an entity outside of government, that would not alter the fact that the ultimate responsibility belongs with government.

Finally, we heard a clear message that additional capacity is needed to deliver on a broadened AMR response and that simply publishing an action plan without an associated increase in the resources invested to implement that plan will significantly reduce the positive impact of the plan. We explore this further in Chapter 5.

COVID-19: Building on Lessons Learned for the AMR Response

The COVID-19 pandemic caught the world by surprise, taking a social and economic toll of devastating proportions. Individuals, organizations, and policymakers across the world have become acutely aware of the consequences of infectious diseases for which we have no treatment. Canada has mobilized an extensive COVID-19 response.[48,49] It is essential that Canada leverage the heightened awareness and investment that COVID-19 generated to accelerate our AMR response — whether in the areas of sharing of information on treatment and prevention, enabling rapid actions to develop, license, and distribute vaccines, or establishing new coordination mechanisms, the current pandemic offers lessons that can be applied to the AMR space.

It is important to apply the lessons learned from COVID-19, particularly that effective response requires coordination and communication among decision makers, advisors, policy makers, regulators, public health, funders, researchers to ensure that the links between evidence need, production and translation are efficient.

COVID-19 has also imparted important lessons regarding the governance of complex health issues, including how best to foster multi-sector/multi-government action in the areas of medical countermeasure selection, acquisition, and distribution. Additionally, it has demonstrated the importance of having strategically established bodies with clear and distinct mandates that can provide advice to governments and stakeholders when evidence is rapidly evolving.

The pandemic has also reinforced the fact that an effective response requires coordination and communication among decision makers, advisors, policy makers, regulators, funders, researchers to ensure that the links between evidence need, production and translation are efficient. Additional insights will no doubt emerge with the benefit of hindsight once there is time to reflect post-pandemic.

While COVID-19 is exacerbating AMR[50] urgency — through increases in secondary infections with drug-resistant bacteria and reduced attention on key areas like multi-drug resistant bacteria — it also demonstrates the impact of an infectious disease as a societal issue — not just a health issue. Further, the global and political attention on COVID-19 highlight challenges (e.g., crisis fatigue, resources directed away from AMR surveillance, low public awareness), and opportunities (leverage infection control, build on technology advancement like rapid diagnostic tests, vaccine development, sewage surveillance). The increased awareness of wastewater and the role of wastewater surveillance reinforces the One Health approach and provides a pathway to meaningful engagement with the environmental sector, which has been historically lacking.

COVID-19 is an example of systems level change at a global scale. At the end of the day, we are optimistic that Canada will leverage the awareness, the lessons learned and the massive investment that COVID-19 generated to accelerate our AMR response.

The International Context

As a component of our jurisdictional scan, we also looked for lessons that could be learned from the work that other countries are doing in their own AMR responses. While we found extensive literature on the need for and status of National Action Plans, there was less available information on the design and operationalization of the governance mechanisms that countries have established to implement their plans.

The WHO adopted a global multisectoral action plan in 2015[51] in collaboration with the Food and Agriculture Organization (FAO) and the World Organization for Animal Health (OIE).[52] A framework for national action plans was provided, setting out key actions to be taken over a five- to 10-year incremental period. Actions are structured around the following objectives:

► To improve awareness and understanding of antimicrobial resistance through effective communication, education, and training
► To strengthen the knowledge and evidence base through surveillance and research
► To reduce the incidence of infection through effective sanitation, hygiene, and infection prevention measures
► To optimize the use of antimicrobial medicines in human and animal health
► To develop the economic case for sustainable investment that takes account of the needs of all countries
► To increase investment in new medicines, diagnostic tools, vaccines, and other interventions

Action on Action Plans

The global action plan underscores a "One Health" approach that would coordinate international sectors and actors, human and veterinary medicine, agriculture, finance, environment, and informed consumers. The variable resources that states have to combat AMR as well as economic factors that discourage pharmaceutical replacement of products, are addressed in the plan. The plan also calls for an "all-out effort."

The global plan notes that countries are expected to develop their own national action plans in line with the WHO plan, but that also recognize the unique characteristics of each country.

The WHO global progress report in 2018[53] showed that, of 154 countries who responded to a survey, 60% have a multisectoral national action plan and 33% have a plan in development — with Canada in the latter category. Many countries in Europe, the South East Asian Region, and in the Western Pacific Region have developed operational plans and monitoring arrangements, and/or have implemented action

plans with defined funding sources with relevant sectors involved in monitoring and evaluation. Canada is involved in numerous international AMR efforts: [54,55]

▶ The Transatlantic Task Force on Antimicrobial Resistance (TATFAR) has issued recommendations for collaboration that are revised every five years.

▶ Amongst G7 countries, Canada, Germany, the United Kingdom, Italy, Japan, and the United States have committed to action packages on AMR via the Global Health Security Agenda.

▶ The Asian-Pacific Economic Cooperation Forum (APEC) involves Canada, Japan, and the United States supporting AMR efforts. A set of guidelines on effective control and prevention have been issued.

▶ The Global AMR R&D Hub is a partnership of countries, non-governmental donor organisations and intergovernmental organisations to address challenges and improve coordination and collaboration in global AMR R&D using a One Health approach. The Canadian representative is the current vice-chair.

▶ The June 2015 G7 meeting in Germany saw the commitment of G7 leaders to intensify joint international efforts to tackle AMR. They also committed to developing, reviewing, and effectively implementing national action plans, in addition to supporting other countries with developing their own action plans.

▶ Finally, the 2020 G20 Summit in Riyadh noted that countries including Canada will continue tackling antimicrobial resistance (AMR) and zoonotic diseases based on the One-Health approach; supporting and accelerating research and development (R&D) of new antimicrobials; ensuring access to existing antimicrobials, while enhancing their prudent stewardship; and maintaining our efforts in tackling infectious and non-communicable diseases. [56]

These numerous and evolving global commitments reinforce that beyond the domestic action plan, Canada's AMR response will require strong federal leadership at the global level.

> The WHO global progress report in 2018 showed that, of 154 countries who responded to a survey, 60% have a multisectoral national action plan and 33% have a plan in development — with Canada in the latter category.

Design Considerations for a
Strengthened Pan-Canadian
AMR Governance Structure

An Overview of the Chapter

Designing and implementing a strengthened One Health AMR governance system is a complicated undertaking. To complement our extensive stakeholder engagement activities, we conducted a review of literature and examined other governance models in Canada to understand the critical factors to consider in proposing governance models.

Informing all of our work was our recognition that stakeholders in our consultations saw systemic change in the AMR response occurring in different ways, informed by their experiences, beliefs, and values. In distilling the different perspectives about how change happens, we identified two main views on how to frame the problem and respond with potential solutions.

The first is that the problem is too complex to allow a single locus of control and that what is needed is a coordinating body that can promote information-sharing across the community, connect disparate groups, identify new opportunities and solicit interest to work on them, and pursue greater alignment across the community at large.

The second view is that strong leadership is needed to set a focus for the work and to move the agenda forward, and that a new entity should be directly responsible for leading AMR efforts, with sufficient staffing that enables it to succeed.

Either of these perspectives call for the establishment of a new organization that can focus upon a multi-decade AMR response. We considered adding this mandate to an existing organization – either inside or outside of government – but ultimately concluded that creating the necessary level of trust and relationships across a diverse One Health domain requires the creation of a distinct entity, as there is not currently an organization with a sufficiently broad mandate.

Considering these two perspectives led us to consider two fundamentally different conceptual approaches for improved governance of the AMR response in Canada. The first involves the creation of a network that achieves results through distributed collaboration and the other involves the establishment of a pan-Canadian organization to lead change in select priority areas with key partners. We spent considerable time understanding the strengths and weaknesses of these approaches and how they could be adapted to best advance rapid, effective, efficient action to address AMR.

In our considerations, we chose to focus on governance mechanisms outside of pure regulatory tools.[1] During our stakeholder engagement, we heard clearly that, while the regulatory environment is complex with regulatory powers distributed across multiple levels of government, the regulatory framework is generally working well, and there is no desire for additional regulatory bodies. The needs we heard were less about regulatory mechanisms, and more about mechanisms that could foster collaboration between and amongst individuals and organizations working on AMR response.

In this chapter, we articulate two conceptual models and key design considerations. Chapter 4 then applies the One Health AMR design considerations to these more theoretical models to develop specific model options that could be implemented.

Recommended Core Functions and Design Principles

One of the first questions that we needed to address was the role that any strengthened governance structure would play in advancing the AMR response in Canada.

Throughout our consultations, and leveraging the lessons learned from other pan-Canadian organizations, we came to understand that the success criteria for any strengthened governance model is a subtle blend of *what* the model does and *how* it works.

Core Functions

While we began with a comprehensive list of possible functions, the priority needs crystallized around two core functions:

▶ The **first core function** is that of "creating connections and fostering knowledge-sharing within the community." Regardless of the model, mitigating AMR requires people working together, and working together requires trust and effective relationships. This starts with having the ability to connect individuals and organizations from across sectors, disciplines, and regions who would otherwise have difficulty finding each other, let alone collaborating.

To improve reach and impact across the complex and currently siloed One Health AMR landscape, any model must incent collaboration and provide the tools and capabilities to make this easy. Technology, like online forums and contact lists, will enable this, as will staff, who will play an essential role in brokering connections, facilitating conversations and sparking the sharing of ideas.

Addressing AMR in a One Health context is knowledge-intensive with information constantly evolving as new research is released, emerging threats are identified, and timely solutions are discovered. A key role for any model will be to give those across the AMR community the ability to easily share, update, and iterate on collective knowledge and generate the best possible evidence to inform action by creating a "one-stop-shop" where comprehensive, up-to-date information related to AMR/AMU would be available online, along with information about the range of AMR-related initiatives underway across the country.

▶ The **second core function** is that of "accelerating action toward meaningful impact." The raison d'être of our project is to propose governance mechanisms that accelerate decisive actions to mitigate AMR and build community by doing things together — not just create another 'talk shop.'

Two additional areas generated significant discussion. While each may form a component of what the governance model should deliver, they are not core functions.

The first relates to the role of the network in aligning policy advice to government and funders. An argument was made that given the complexity of AMR, policymakers and funders often receive different messages, so alignment would help decision makers while also increasing the credibility of the

overall AMR field. Ultimately, the Steering Committee decided that developing common policy statements that 'everyone' can sign on to will be difficult, considering the diversity of the network members, and that there is a risk that the network will strive for consistency in messaging in areas where there are legitimately distinct views driven by differing interests.

The second relates to the relative priority that public awareness should have in the work of the governance mechanism. We determined that while it is important for whichever organization that is created to play some role in raising public awareness of AMR, this should not — at least in the first five years — be a core function, with emphasis instead placed on areas that we see as higher priorities: building collaboration and rapid action to address AMR. In our costing estimates, we have not allocated a significant portion of the operating budget to general public awareness activities.

"

Any model must incent collaboration and provide the tools and capabilities to make this easy.

Design Principles

We also heard throughout our consultations that, to be credible in Canada, any proposed coordination mechanism must be designed, staffed, led, and operated in a manner that:

▶ Is equitable and inclusive of the linguistic, gender, geographic, economic, and cultural diversity across Canada

▶ Acknowledges the Crown's obligations to Indigenous Peoples and values the principles of Indigenous health governance, which include self-government, self-determination, nation-to-nation decision-making, reciprocal accountability, and meaningful community engagement

▶ Respects the ongoing AMR work happening across One Health sectors, through augmenting the work that is currently underway while minimizing the disruption and duplication that the introduction of a new governance structure could bring

▶ Supports transdisciplinary collaboration[2]

▶ Fosters trust and legitimacy through clear and transparent communications

▶ Fosters the use of current evidence in decision-making

▶ Enables transparent identification and management of real and perceived conflicts of interest

▶ Recognizes different levels of need regarding support, infrastructure, and resources across the AMR community, and is able to respond accordingly

Our consultations revealed a high level of symmetry between the set of guiding principles outlined in an early draft of the PCAP and those that we heard that the organization will need to embrace in order to be successful. We have reproduced these below:

A One Health Approach

Adopting an integrated approach recognizes the interconnectedness of humans, animals, and the environment, and the need for coordinated actions by all implicated actors.

We will continue our efforts to renew the nation-to-nation, Inuit-Crown, and government-to-government relationships with First Nations, Inuit, and Métis Peoples to reduce the development, spread and impact of AMR and to promote the appropriate use of antimicrobial drugs.

Moving Toward Truth and Reconciliation

Sustainability & Collaboration

Implementing the Action Plan requires sustained engagement and collaborative actions by all jurisdictions, sectors, partners, and the public to effect real change and reduce the emergence and spread of AMR.

Implementing the Action Plan requires a flexible and tailored approach that is adaptable and recognizes that the challenges posed by AMR and AMU and capacities to respond to it, vary across governments and sectors.

Flexibility

Information Sharing

A concerted response demands that information and best practices be shared and leveraged across jurisdictions and sectors.

To reflect and meet the needs of Canada's diverse population, programs and policies will respect cultural realities and practices, while promoting the safety of individuals and communities.

Developing Culturally Safe Programs and Policies

Applying a Health Equity Lens to Programs

All people—regardless of their sex, gender, race, income, education, sexual orientation, geographic location, age, or culture—have equitable access to appropriate healthcare services.

Canada's response to AMR is inextricably linked to global efforts and solutions. It is important for Canada to continue to contribute to global efforts and to align with international efforts to better position and leverage domestic actions that maximize contributions and benefits to Canada in the global context.

Global Cooperation

Conceptual Approaches to Inform Our Thinking

Multiple organizational designs can be used to bring together autonomous people and organizations to achieve a shared goal. Informed by academic literature and real-world evidence, we looked carefully at two specific approaches — a network design and a lead-entity design.

The Notion of a Network

Networks bring together groups of autonomous[3] people and organizations to achieve a shared outcome. These groups (network participants or members) typically have limited formal accountability for network-level goals. Unlike other types of organizations, networks have special characteristics that have implications for how they are governed and managed. Specifically, conformity to network rules and procedures is often voluntary. In other words, people join and participate at their own discretion, making pure networks less optimal in environments where strong accountability is required.

With that in mind, the role of governance in network oversight is to ensure that participants engage in collective and mutually supportive action, that any potential conflict is addressed, and that resources are acquired and utilized efficiently and effectively.

In reviewing literature on network governance, we found numerous models for how networks can be designed. However, the models themselves tend to vary according to how they strike a balance along several dimensions:[4]

▶ The need for administrative efficiency versus a need for inclusive decision-making
▶ The need for legitimacy of the network within its membership versus the need for the network to be seen as legitimate by partners and external stakeholders
▶ The need for flexibility versus the need for stability

While networks take on a wide range of shapes and designs, experts say nearly all models have a few common elements including "social interaction, relationships, connectedness, collaboration, collective action, trust, and cooperation."[5] Furthermore, at their foundation, "networks consist of the structure of relationships between actors (individuals and organizations) and the meaning of those relationships. Trust is the lubricant that makes cooperation between these actors possible, and higher levels of trust are believed to lead to more effective collaboration."[6]

Organizations join or form networks for a variety of reasons, including the need to gain legitimacy, serve clients more effectively, attract more resources, and address complex problems, such as AMR in Canada.

But, regardless of the specific reason, in a general sense, all network organizations are seeking to achieve some goal that they could not achieve independently. This notion can be applied to AMR, where coordinated action is required across a complex ecosystem of autonomous One Health actors and organizations based all around Canada. While some people and organizations may actually have competing interests and differing priorities within their individual mandates, they are all connected by a shared goal: mitigating AMR in Canada. A network could enhance this connection and lead to meaningful change.

While numerous approaches have been implemented to foster distributed collaboration across networks, few have been applied to move forward large agendas like eliminating homelessness, tackling climate change, or addressing AMR. One with a track record of success is the constellation model developed by the Centre for Social Innovation.[7]

This model embraces professional and organizational independence while fostering collaboration, by putting the onus of action in the hands of its stakeholders. Collaborators are pulled together by a common desire, opportunity, or interest in what are called action groups, which are struck when members of the network have the desire to take action on a specific idea. When priorities change or objectives are met, action groups are disbanded. Since efforts and action are driven from the bottom-up in this model, there is a need for highly effective coordinating mechanisms:

▶ A network coordinating or stewardship council helps establish strategic direction and ensures that all work being conducted by the action groups adheres to the network's guiding principles. This mechanism guides action groups as needed but does not directly manage their work. The primary objective of the network council is network development and not issue area development. In other words, its focus is to achieve and maintain network health — not to focus on the content of the particular issue that the network has been struck to solve. Generally elected by the network members, this body is also responsible for drafting annual priorities, which are designed to help inform the creation and direction of new action groups.

▶ A secretariat is the glue that holds the network together by providing support to both the council and the various action groups. The appropriately-sized team will ensure transparency and coordination and provide communications and administrative support for the different elements of the network — for example, contact information, distribution lists, annual reports, finances, project management, and action group support. As a centralized resource hub, through which members can access a variety of services, neutrality of the secretariat will be vital to maintaining an equitable balance of power. The people working for the network's secretariat will need to be highly skilled, have clearly defined roles, and embody collaborative leadership. Their purpose is to provide process support to network members, which means constantly balancing leading the process with responding to needs. Responsibilities might include facilitation, conflict mediation, project development, partnerships, and more. They employ and maintain a robust suite of online tools that enable community-building and support peer-to-peer dialogue and knowledge sharing.

▶ Members of the network form the largest body of this model. Members are generally asked to sign a membership agreement, which documents the network's guiding principles, its expectations of members, and other relevant information. There are often different levels of membership — individuals versus organizations, for example — and there would absolutely need to be a minimum viable number and diversity of members in order to adequately represent the ecosystem and demonstrate external legitimacy.[8] Finally, whether there is or is not a membership fee is an important design consideration for this type of network.

Lead-Entity Models

The lead-entity approach appeals to those who look for a single organization with responsibility for providing strong and focused leadership to solve complex issues. Adapting a common model used in many corporations and not-for-profit organizations, and with a Board able to set overall strategy and priorities, a lead-entity organization can present a unified face to funders and can coordinate which organizations and/or individuals will join project teams.

In Canada, there has been a long history of creating organizations to assist governments in resolving public policy problems. For example, a recent review described the federal health portfolio as resembling "a solar system — with the core functions in an inner circle in direct contact with the federal minister of health, and two additional concentric rings at increasing distance."[9]

In the first ring are organizations that report directly to the minister such as Health Canada or the Public Health Agency of Canada. The second ring is made up of public organizations with administrative autonomy. Placed under the authority of a president or executive director, as opposed to a deputy minister or equivalent role, these organizations enjoy a certain degree of administrative autonomy, including in the determination of their program priorities, but do not have the capacity to modify the mandate or mission entrusted to them by legislation. An example of this second ring is the Canadian Food Inspection Agency. The third ring consists of self-governing and self-directing organizations with the possibility of determining their own strategic orientations — within the parameters of their mission statement and their funding agreements. The federal government provides most of the funding, but some Pan-Canadian Health Organizations (PCHOs) also benefit from contributions from the provinces and territories or from other sources of revenue, such as user fees or donations. The executive leadership of each PCHO is usually appointed by its board and enjoys a substantial

degree of independence from government. The composition of the boards raises more questions, mostly because they tend to count among their members many delegates from participating governments."[10]

As we considered the lead-entity model, we looked at lessons learned from the suite of Pan-Canadian Health Organizations (PCHOs) — self-governed, non-profit organizations that, although the federal government provides the majority of their funding, operate as arm's-length bodies. Set up between 1988 and 2007 to respond to disparate health policy issues affecting the country,[11] the PCHOs "take many shapes and sizes, with huge differences in status and influence."[12] All of the PCHOs are led by a Board of Directors; the "composition of these boards varies: in some cases, boards are filled largely with provincial and territorial deputy ministers and delegates; others have members of the public or content experts sitting as directors."[13]

Examples of Pan-Canadian Health Organizations

▶ Canada Health Infoway (Infoway)

▶ Canadian Agency for Drugs and Technologies in Health (CADTH)

▶ Canadian Centre on Substance Use and Addiction (CCSA)

▶ Canadian Institute for Health Information (CIHI)

▶ Canadian Partnership Against Cancer (CPAC)

▶ Healthcare Excellence Canada (resulting from the merger of the Canadian Patient Safety Institute and the Canadian Foundation for Healthcare Improvement)

▶ Mental Health Commission of Canada (MHCC)

Chapter 4

Proposed Governance
Models for a One Health
AMR Response in Canada

An Overview of the Chapter

This chapter explores two governance model options in great detail while comparing their key similarities and differences.

Synthesizing the learnings from our stakeholder consultations, a broad environmental scan, and best practices in governance design, we have developed two model options that will strengthen governance of our AMR response, albeit in different ways.

Either model would support the implementation of the Framework and the PCAP when it is released — ensuring that there is coordinated, measurable work underway, responding to Canadian needs and circumstances, to mitigate AMR across One Health.

This chapter describes our two proposed models, including what they share and what makes each one distinct, recognizing that many important details will be finalized during the implementation of whichever model is ultimately selected by PHAC. For this reason, we intentionally limited the use of illustrating activities through examples and likewise refrained from setting any priorities. Priorities will need to be decided as part of the implementation phase using the decision-making mechanism applicable to the selected governance approach.

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> **We have developed two model options that will strengthen governance of our AMR response, albeit in different ways.**

Our First Proposed Model: The AMR Network

Our first model leverages the traditional constellation model, adapting it to respond to the One Health AMR context.
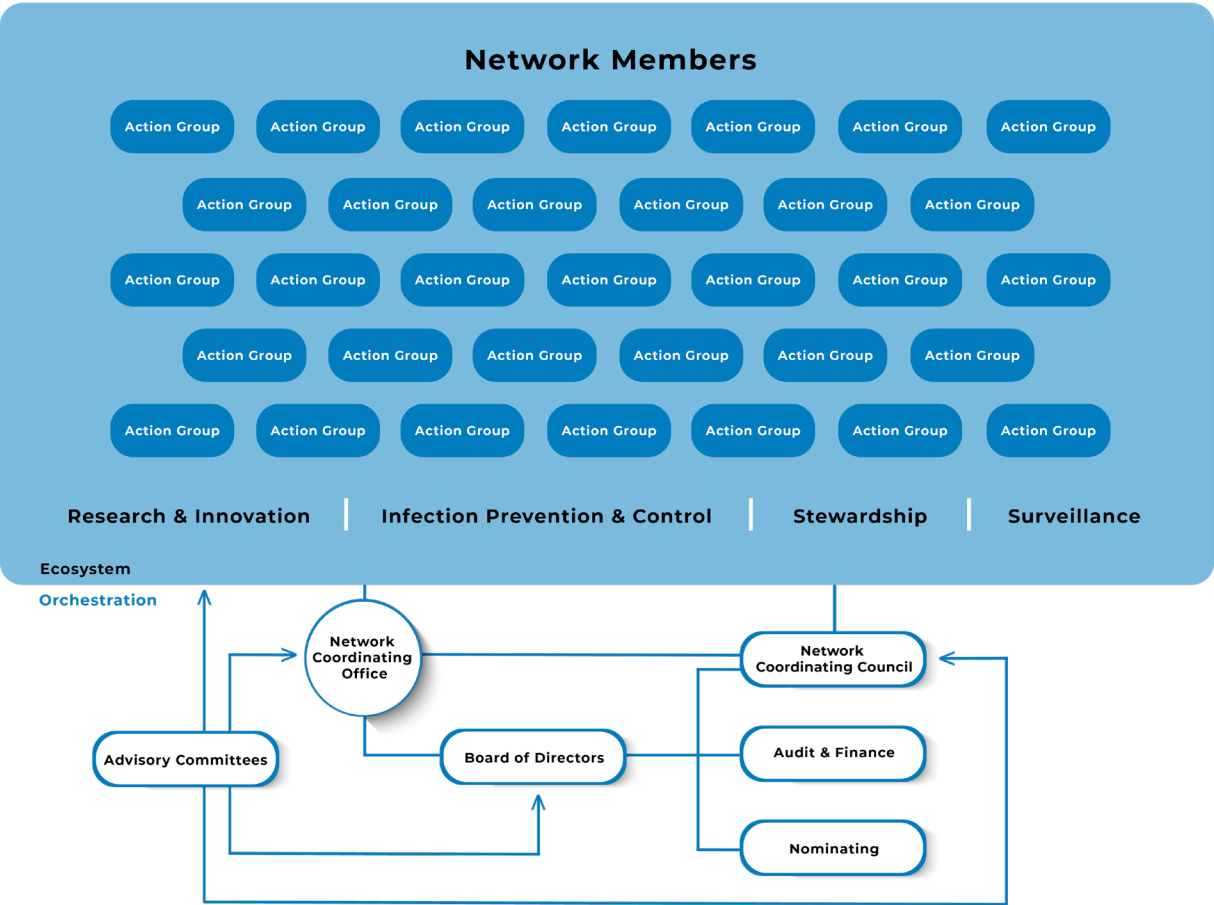
This model appeals to those who view the AMR ecosystem in Canada as highly complex, both in terms of the diversity of stakeholders involved and the range of actions that are required to address the issue at hand. Acknowledging the immense amount of work that is already underway in Canada, as well as the different economic incentives at play across the AMR community, this model would produce a network that enables and empowers its members to work on the things that they value while also contributing to overarching network goals. In doing so, this model will enable new work that transcends disciplines, sectors, and geographies. This

model has greater potential to reduce the 'silo within silo' challenge by fostering an open culture that creates a mechanism for including sectors that are not well represented in existing collaborations. Any member can invite someone else to participate, either as a member or as part of an Action Group.

The AMR Network is predicated on the view that the problem of AMR is owned by everybody and that a single point of control is therefore unrealistic and potentially ineffective.

To function optimally, a network leveraging the distributed collaboration model must have a clearly articulated goal, employ non-hierarchical oversight, encourage coordinated autonomy, achieve trust and legitimacy, and be nimble and flexible in the face of emergent pathogens and ever-shifting priorities. It must also be well resourced with a strong secretariat to ensure that the collective work of the network members is properly advanced.

The advantages of this model include:

▶ Giving the experts control of priorities — it's the members, not an oversight body, who make decisions and drive action
▶ Providing a mechanism for explicit discussion of intellectual property rights and how they are addressed in the context of each specific Action Group
▶ Enabling a high degree of nimbleness and flexibility, allowing members to pursue interesting opportunities as they emerge, while ensuring the Action Groups have the facilitation and project management resources needed to succeed; this is particularly important in AMR, where novel pathogens can create crises that require a broad-based response

▶ Connecting individuals and organizations from across sectors, disciplines, and regions who would otherwise have difficulty collaborating
▶ Having the ability to support a number of different initiatives, which may be of differing priorities in different jurisdictions across the country and among different stakeholders, while reducing duplication because of increased connection, trust, and cooperation between members
▶ Being more likely to provide room for the meaningful inclusion of Indigenous Peoples, equity-seeking groups, and structurally marginalized populations

At the same time, this model has risks and disadvantages:

▶ Networks can be less efficient than more directive models. There is a risk that decentralized accountability for results, combined with the more diffuse decision-making authority, may lead to initially slower outcomes
▶ Networks can also take more time to get everyone working together collaboratively across the multiple different spheres, requiring patience on the part of the funders and stakeholders
▶ There is a need for an effective collaborative leadership function so that the efforts of the membership add up to more than the sum of its parts
▶ Without effective leadership, the network could devolve into a chaotic or non-functional 'talk shop,' minimizing the volume of useful action
▶ While this model is likely to be seen as highly legitimate — and is preferred by many stakeholders, since it enables a greater sense of ownership for members — it may be considered less favorable by those outside of the network and by those looking for a model where decision-making is more structured and a path to action is more clear

Our Second Proposed Model: The AMR Centre

Our second model leverages the familiar top-down model, adapting it to respond to the One Health AMR context.
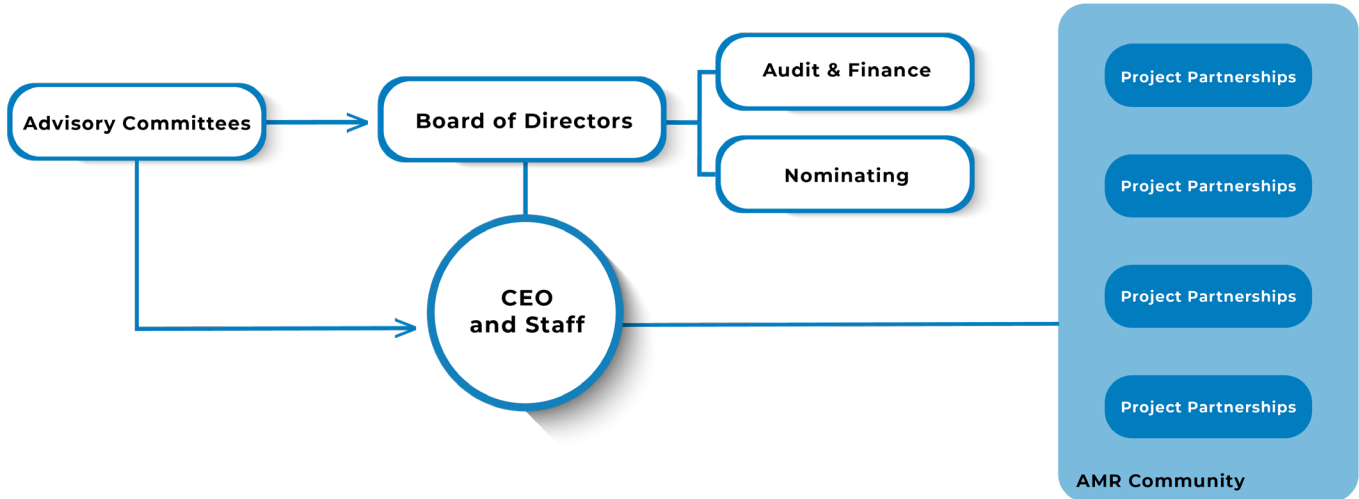
Using a classic top-down approach with a purpose-built organization — a familiar and easily understood model — the AMR Centre provides a number of advantages:

▶ The AMR Centre enables a comprehensive approach to selecting its priorities, choosing to make meaningful impact in a select number of priority areas. It will drive change in those areas through its own staff, equipment, and infrastructure; through strong partnerships; and through contracts with leading experts and institutions

▶ It offers a vehicle through which PHAC could generate an overall annual summary of the status of AMR mitigation in Canada. Should the Centre undertake accountability for national reporting, it would need to be specifically resourced to perform this function. Current cost estimates only forecast resourcing for reporting of Centre projects

▶ The familiarity of AMR Centre model, and its single locus of contact, has the potential for greater international credibility

▶ It is positioned to become the focal point for AMR activity in Canada through regular initiation of large projects — via internal staffing and competitive project funding grants — with pan-Canadian mandates that focus on the selected priority areas

At the same time, this model has risks and disadvantages:

▶ While is it much easier to implement this model with its clear organizational structure and a familiar top-down approach, this model poses a longer-term risk that the work becomes focused on places that are already well resourced and highly functional, replicating existing power imbalances and inequities so that the largest and loudest organizations — who are not always the most diverse and inclusive — will still be allocated the majority of the resources and attention

▶ We heard from some stakeholders working in animal health and agriculture that the AMR Centre may have less credibility within their domain, which reportedly has had a positive experience with network approaches and less success with approaches that are perceived as 'top-down' or that use directive powers. For some, the concern with the AMR Centre model led them to suggest a hybrid model where the AMR Network would be implemented in the animal health and agriculture domain if the AMR Centre is selected as the overall model

▶ The Centre model is less flexible and less capable of responding nimbly to new and emerging issues than the more distributed AMR Network is

▶ The focused nature of setting priorities in this model will almost certainly mean that some of the current AMR efforts would be outside of whatever priority foci are selected by the AMR Centre. While that does not mean that the current work would stop, the level of coordination and collaboration in those areas would likely be lower than they would in the AMR Network model

▶ There is a small risk that the AMR Centre might duplicate or be in competition with the function of existing organizations. This risk can be mitigated by ensuring the Centre focuses on undertaking projects that other groups cannot, due to complexity or cross-sector reach

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The AMR Centre enables a comprehensive approach to selecting its priorities, choosing to make meaningful impact in a select number of priority areas.

The Notion of a Hybrid Model

Considerations and complexities relating to potential hybrid models.

In discussing these two models with the stakeholder community, we were frequently encouraged to present something that is a hybrid our two models, and a variety of such hybridizations were suggested:

▶ Combining the "best" elements from each.

▶ Creating a "nested" model, where a top-level organization would be structured according to one model and subsidiary organizations would follow the other model.

▶ An evolutionary approach, wherein Canada would start with one model and then evolve over time to the other model (we heard suggestions to start with the Centre model and evolve toward the Network model, and vice-versa).

▶ Create two organizations, with one operating under one model and the other the second model to recognize that both models offer complementary leadership and decision-making styles, and that there is utility in implementing both models simultaneously.

Two broad rationales were proposed for such hybridization:

▶ Some — particularly within the animal/agriculture domain — indicated a preference for the AMR Network as it more closely reflects their current modus operandi. They preferred options that would allow that model to apply within their domain, even if the Centre model were to be selected for other domains.

▶ Others noted that both models offer complementary leadership and decision-making styles, and that there is utility in implementing both models simultaneously or sequentially.

In part, the amount of feedback we heard related to hybrid models may also have reflected that our consultation documents likely portrayed the models in a more absolutist fashion that we had intended. Indeed, the two leadership styles are useful in different situations, and it is highly probable that in the implementation of either model, the other style will be used for some aspects of the work. For example, in the Network model, some of the Action Groups may choose to apply a fairly top-down style of leadership
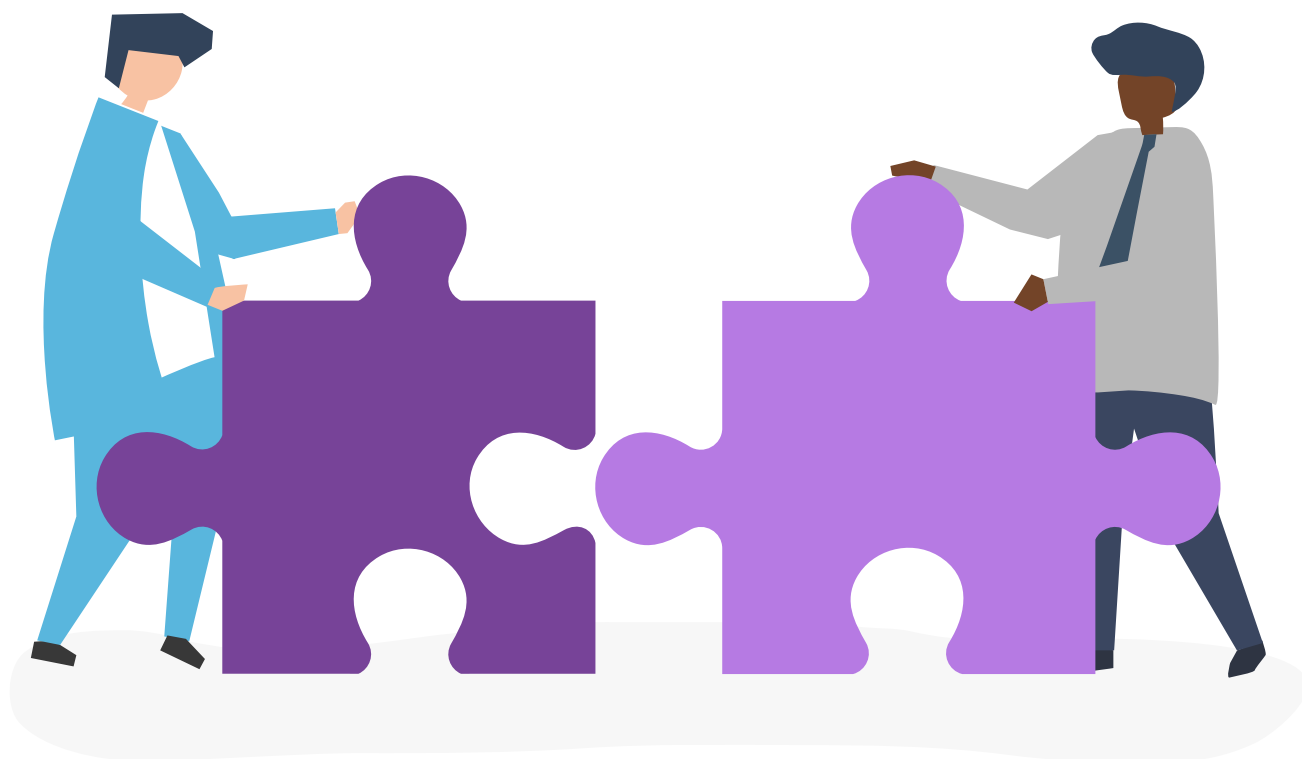
within their Group; or in the Centre model, there may well be an opportunity to use collaborative leadership styles in some of the projects or stakeholder engagement work.

Given the strength and diversity of the feedback, we spent considerable time reflecting on the question of whether to propose a hybrid model, and if so, which one. Ultimately, four considerations led us to determine that we would not.

► We heard very limited consensus on which hybrid would be most desirable, and concerns related to either credibility or feasibility from at least some stakeholders for any of the hybrid ideas as they came up in our consultation discussions.

► We believe that key choice facing those who will fund and establish the new governance structure is what operating style they wish the new entity to apply at

the highest level of the organization – the Board of Directors and the senior staff. Our two models are different – with one emphasizing administrative efficiency and the other emphasizing inclusive decision making. In the end, we think it is useful to state clearly this strategic choice.

► We could not find examples of Canadian nested models that have stood the test of time in an area as complex as One Health AMR, and we had difficulty seeing how the few international examples that we found would effectively translate to the Canadian context.

► While the governance structure will undoubtably evolve over time, we found few examples of pan-Canadian organizations that have fundamentally changed their operating style – and none that were created with the specific intent to do so.

Comparison of Purpose, Core Functions, and Structures of the Two Proposed Models

The following tables explore the various elements that comprise both models, highlighting important similarities and noting key differences.

Purpose Statements

A purpose statement captures the 'why' that unites individuals and organizations from multiple sectors to work toward a shared goal. It is what the organization is bringing people together to respond to; everything else flows from this North Star. The differing statements between the two models represent the differing ways each one will achieve its goals.

In the AMR Network	In the AMR Centre
Assemble an active community and foster and support action across One Health to mitigate AMR in Canada.	Lead efforts by setting clear priorities and coordinating a One Health AMR response across Canada.

> A purpose statement captures the 'why' that unites individuals and organizations from multiple sectors to work toward a shared goal.

Core Function:
Create Connections and Foster Knowledge Sharing Within the Community

As noted earlier in our report, mitigating AMR requires people working together, and working together requires trust and effective relationships. This starts with an ability to connect individuals and organizations from across sectors, disciplines, and regions who would otherwise have difficulty finding each other, let alone collaborating. While primarily focused within Canada, these connections need to extend beyond our borders, both to support our international commitments and to ensure that we are learning from successes and challenges elsewhere. This core function has two elements:

► **Create Connections:** To improve reach and impact across the complex and currently siloed One Health AMR landscape, either model must incent collaboration and provide the tools and capabilities to make this easy. Technology (like online forums, contact lists/member databases, partnering software) will enable this, as will staff, who will play an essential role in brokering connections, facilitating conversations, and sparking the sharing of ideas.

► **Foster Knowledge Sharing:** Addressing AMR in a One Health context is knowledge-intensive with information constantly evolving as new research is released, emerging threats are identified, and timely solutions are discovered. A key role for any model will be, leveraging technology as well as forums such as conferences, to give those within the AMR community the ability to easily share, update, and iterate on collective knowledge, to generate the best possible evidence to inform action, and to adapt, scale, and replicate successes in new settings.

Commonalities Between the Models

Responding to these needs, both models include staff and technology to:

► Provide a centralized, curated knowledge repository with resources to ensure AMR stakeholders and decision-makers have access to current evidence through dynamic tools that make information accessible and actionable

► Maintain a database of Canadian resources and distribution lists to help build linkages between those working in AMR response

► Provide facilitated interactions and offer ways for people and organizations to speak directly to other community members through online and in-person forums

► Hold virtual or in-person conferences

Neither model will include large-scale public advocacy campaigning, although general public awareness resources will be available, and projects may include awareness within their project delivery mandates and subsequent knowledge translation.

In the AMR Network	*In the AMR Centre*
Because the Network is driven by the membership, creating community and connection across the various One Health domains and AMR actors is a key enabler of this model. This model lends itself well to collaborations with existing networks and associations, giving them a vehicle to extend their reach and impact.	To support the focused nature of its work, the AMR Centre will limit the degree to which the resources outlined above will support areas outside of the priorities identified by the AMR Centre. A sense of community is a by-product of this model; not a primary purpose. While the Centre will share knowledge resources and collaboration tools across the AMR community, its primary purpose is to work closely with partners to undertake projects specific to its mandate. It is not designed to bring all groups together; instead, it is designed to provide focus.

Core Function: Accelerating Action Toward Meaningful Impact

The raison d'être of our project is to propose governance mechanisms that increase the capacity of the AMR community to deliver solutions that mitigate AMR.

Commonalities Between the Models

Both models are designed to increase the considerable work that is already underway across the community by coordinating implementation, stimulating innovation, and scaling efforts while valuing and leveraging current work and existing organizations. It is expected that some work will continue to occur outside of or unaffiliated with the selected model. Each model needs an open-door culture to welcome organizations as the AMR response evolves over time. They also both contain mechanisms structured to deliver on elements of the Framework and the forthcoming PCAP's priority actions, and to provide reports and updates to government to inform monitoring, evaluation, and updating of the plan. However, as neither model is creating a new regulatory body, neither the AMR Network nor the AMR Centre will have powers to make or enforce regulations.

In the AMR Network	In the AMR Centre
What makes this model unique is that the agenda is driven by those on the ground. In other words, this approach not only embraces expert knowledge, it empowers it. Work is carried out by "Action Groups," which are comprised of different network members whose aligned self-interests lead to collective impact. While these groups may occasionally emerge at the behest of network leadership in alignment with the annual plan, they will most often form organically amongst network members — as such, AMR priorities are in large part in the hands of membership. However, these groups will be vetted by the Network Coordinating Council (NCC) before they achieve formal designation as an Action Group. Participation in Action Groups is voluntary and driven primarily by self-interest; members who join or form Action Groups will have a strong desire to accomplish a defined goal. Participants will come from the full gamut of stakeholders — government, academia, industry, and beyond.	In identifying what work will occur, this model provides a focus by selecting priority areas identified within a multi-year strategic plan. In this model, saying 'yes' to a priority area means saying 'no' to areas that are not selected. That said, it's important to note that this focus applies only to the work undertaken by the Centre; other organizations will continue to advance their own objectives that may feed into the national action plan maintained by the federal government.
Staff from the Network Coordination Office (NCO) will provide project management and facilitation supports as requested by the Action Groups. This design intentionally creates a light-weight engine to handle the overhead of running a project, leaving Action Group members to focus on content and action. Each Action Group develops a project charter that outlines the roles and responsibilities of each participating member, budget accountability, how intellectual property rights will be respected, and the ownership of project results and how they will be disseminated.	Because the Centre will assume responsibility for undertaking projects, staff will work on a variety of implementation, innovation, and scaling efforts in-house, while also contracting work out to leverage the unique capacities and capabilities of leading experts and institutions. The Centre will forge strategic partnerships with leaders across One Health AMR in Canada who provide expertise and participate in advisory and project working group activities. These partnerships are selective, intentional, and focused opportunities to amplify, accelerate, and catalyze change across One Health AMR.

The Lifecycle of an Action Group

As noted in the previous subsection, Action Groups are at the heart of the Network model. These groups will form when network members recognize a need or an opportunity and have the desire to take action. A charter will be established to clarify what specific actions they will undertake, which will be certified by the NCC. Working within the charter and accountable for any resources provided by the network, the action group proceeds on its work. When the task is complete or when energy declines, the action group disbands. Evaluations will determine scaling opportunities (if any) and inform the development of future action groups.

Action Groups in the Network Model

INITIATION · CONFIRMATION · DELIVERABLES · DISSOLUTION · ANALYSIS
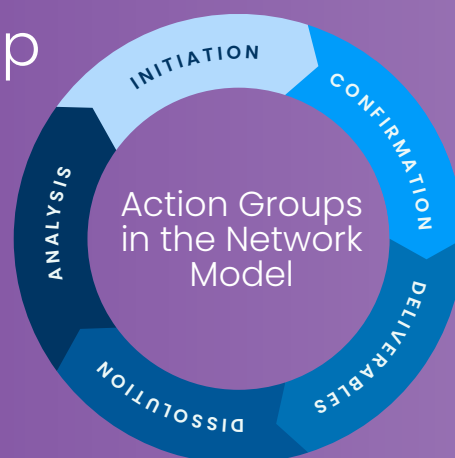
Structural Element: Board of Directors

Both models call for a purpose-built organization to be established to hold funds, manage assets, and hire staff. Like any not-for-profit corporation, this organization will require a Board of Directors to assume fiduciary responsibilities such as strategy development, appointment of the CEO, accountability and performance management, monitoring and financial management, and risk oversight. Some of the design decisions we faced as we developed our proposed models include the size and composition of the Board, how the Board is appointed and by whom, and what subcommittee and advisory structures are required.

Commonalities Between the Models

Both models have a skills-based[1] Board of Directors with 13 volunteer directors (including the chair). To ensure that the Board has legitimacy in the eyes of both funders and the AMR community, the Board as a whole will have scientific knowledge and expertise on AMR across the One Health domains, as well as governance expertise and knowledge of key subject areas including law, financial management, technology, and public policy. It will also be representative of Canada from an equity, diversity, and inclusion perspective, including geography, language, gender and equal representation of Indigenous, racialized and other groups that have not historically been equally included in leadership structures in Canadian organizations. The Board will meet at least six times per year, with meetings open to the public.

In the AMR Network	*In the AMR Centre*
The Board of Directors will be elected by members who have been actively involved in the work of the network in the previous year.	Similar to other pan-Canadian organizations such as CIHI or Canadian Blood Services, the Board will be appointed by Canada's 10 provinces, three territories, and the federal government, acting collectively. The appointees will come from inside and outside of government and, as a whole, the Board will meet skills listed above. In this model, a key role of the Board is to approve a multi-year strategic plan with defined priorities.

Structural Element: Sub-Committees and Advisory Committees ——

Sub-committees of the Board are assigned to take action on a specific task or area, such as finance or nominations. Advisory Committees, meanwhile, will have the power to advise and influence but are not decision-making bodies.

Commonalities Between the Models

In both models, the Board of Directors will have at least two standing committees — an Audit & Finance Committee and a Board Nominating Committee — whose membership will be appointed by the Board. Each of these subcommittees will be chaired by a member of the Board.

Initially, three specialized Advisory Committees will be established in both models to provide advice and recommendations. Appointed by the Board of Directors, these committees will combine expertise in AMR and the specific focus of the Advisory Committee. Consistent with the design principles outlined earlier, all of the sub-committees and Advisory Committees will be representative of Canada from an equity, diversity, and inclusion perspective.

▶ An **Economics Advisory Committee** will consider the various economic implications of the AMR work that is underway
▶ An **Equity, Diversity, and Inclusion (EDI) Advisory Committee** will provide expert advice about functionality and activities using an EDI lens
▶ An **International Advisory Committee**[2] will inform what lessons from other jurisdictions could be applied in Canada, including international trends, developments, and potential collaborations

In the AMR Network	*In the AMR Centre*
There will be a third standing committee, a Network Coordinating Council (NCC), whose role will be to foster a vibrant ecosystem by providing a clear vision and annual priorities to guide the work of the network. With its specific focus, the Council will have the time and the mandate to approve, guide, and inform Action Groups and approve their requests for Network Coordination Office resources (within a Board-approved budget and other limits). The Council will have 12 members appointed by the Board and that are broadly representative of the AMR field and seen as credible experts by their peers. As well, a Broader Alignment Advisory Committee, comprised of representatives of governments from across Canada, will promote alignment with the Framework, PCAP, and other public policies. Recognizing the knowledge and assets they bring, existing networks or associations who join as members of the AMR Network may also take on convening and advisory roles for the network as a whole.	A Canadian Scientific & Industry Advisory Committee will provide advice and recommendations on projects, opportunities, and priorities across One Health.

Accountability

The Board of Directors (whether of the Network or of the Centre) will be accountable to the funders, whether government or outside of government, for the proper use of the funds that it has been given, and for reporting on how funds were used and what results were achieved. Accountability mechanisms that will be used to set expectations and demonstrate value for money will include accountability agreements, publicly available annual reports (including audited financial statements), and periodic evaluations using evidence-based metrics.

As previously described, this organization should only be held accountable for the responsibilities that it agrees to undertake — which are not likely to include the entirety of the actions within the PCAP. Instead, the Framework and PCAP will serve as touchstones to ensure that the AMR mitigation efforts in Canada are aligned. Given this, any new governance mechanism will need to be strategically aligned with the action plan, and other key policy and guidance documents.

Structural Element: Engaging the AMR Community

The two models take fundamentally different approaches to engaging with those active in One Health AMR in Canada.

Commonalities Between the Models

Despite their key differences, both the AMR Network and the AMR Centre have been designed to augment — not to replace — the AMR mitigation work currently underway across the country, through enabling connections, sparking new opportunities, and creating action where it is not already taking place. Similarly, anticipating that existing funding and funding mechanisms will continue and be supplemented with incremental funds, the AMR Network or the AMR Centre will provide an AMR focal point for the existing funding bodies (such as the Tri-Council organizations), recognizing that their mandates are much broader than AMR.

In the AMR Network	In the AMR Centre
Membership in the AMR Network will be open to individuals and organizations (including government, and other networks/associations) who are working to mitigate AMR in Canada, who are Canadian or are based in Canada, and who commit to actively contribute to the network. Membership will be required in order to participate in any network activities or access network resources. There will be no membership fee. A broad-based network recognizes that not everybody's specific interests are going to be exactly aligned all the time. What all members will have in common is a desire to slow or to address the threat of AMR. The network will convene members who share this vision, allowing them to work together in areas of shared interest, while respecting that in other areas they may have differing or competing interests. Members will be required to sign a 'Membership Agreement' that outlines the reciprocity between members and the network, and that includes the expectations that members agree to:	The AMR Centre does not operate on a membership model — instead, it will deliver results through a combination of its own staff, equipment, and infrastructure; strategic partnerships; and contracts with leading experts and institutions.

► Participate in network activities on a regular basis, contributing to the knowledge base, within the limits of intellectual property

► Work respectfully and collaboratively with network members

► Participate in good faith toward decision-making and conflict resolution, recognizing that members need not agree on all issues

► Not take a position regarding issues on behalf of the Network, without the consent of the Board

► Clarify in advance, on an Action Group-by-Action Group basis, how each Action Group will operate

► Retain ownership/intellectual property rights for the work of the Action Groups, as determined in the Action Group Project Charter

► Contribute Action Group outputs and key research/working documents to the knowledge base, within the limits of intellectual property, as defined in the Action Group Project Charter

Given that it will be more focused within priority areas than the AMR Network will be, a smaller percentage of the overall AMR stakeholder community is likely to be working with the AMR Centre at any given point in time. Despite this, the AMR Centre will make knowledge resources for the areas in which it is concentrating available to the broader community.

It is unlikely that all of the stakeholders in Canada's AMR community will join the AMR Network immediately; the Network will aim to engage with these stakeholders in a manner that reduces barriers to them joining at some point in the future. For the animal and agri-food sector, this model reflects structures that are already in place[3] and there is strong support for using the networks that currently exist as convening elements within the AMR Network.

Although its Board of Directors will be comprised of government appointees, as a not-for-profit corporation, the AMR Centre will be legally independent of government.

Structural Element: Staff and Culture

Both proposed models include the establishment of a new organization and the appointment of staff led by a Chief Executive Officer (CEO) accountable to the Board. Designing a new organization comes with the advantage of taking a modern approach to some of the fundamental building blocks, while acknowledging the organization must adapt to an existing ecosystem. As with any organization, it is the people that embody and shape the culture[4] and values. Because of the voluntary nature of stakeholder participation in either model, an organizational culture that reflects the values outlined in the aforementioned design principles is central to attracting and keeping the AMR community engaged (in addition to the shared purpose, the participant's self-interests, and the availability of project funding).

Commonalities Between the Models

We heard clearly that the CEO, as the primary leader in both models, must have strong credibility and the ability to develop trust across the various One Health domains. To some degree, this means balancing content expertise (almost certainly derived from one area of One Health) with the ability to engage effectively based on science and evidence regardless of the domain. Under the direction of the CEO, the staff will:

▶ Provide administrative support for the different elements of the organization
▶ Centralize resources for members/partners to leverage
▶ Mediate potential conflicts within and across the various sectors represented across One Health
▶ Foster interdisciplinarity and balanced views across groups where possible
▶ Reflect Canada's diversity, including representation of Indigenous peoples and equity-seeking groups
▶ Offer support and resources to members and partners in both English and French
▶ Ensure that any and all network activities respect the principles of equity, diversity, and inclusion

Staff for either model must be able to work seamlessly across One Health to gain the trust of different types of stakeholders. This will require them to balance content expertise and specialized skills and knowledge in project management and implementation.

In the AMR Network	In the AMR Centre
The members of Action Groups are enabled and empowered to complete AMR projects. Meanwhile, a small staff within a Network Coordinating Office (NCO) will perform secretariat functions for the membership — providing project management support for the Action Groups, facilitating meetings, curating and distributing content across the community, monitoring and reporting on activities, resolving conflicts, and enabling the free flow of information. Led by a strong, facilitative, collaborative, and inclusive CEO that can balance scientific credibility and administrative expertise, the staff role, in this context, is best described as the 'glue,' creating and facilitating opportunities for transdisciplinary collaboration. A total of 33 FTEs will be based out of a single office, along with remote work options.	This model responds to the view that strong leadership is needed to set a focus for the work and to move the agenda forward, and that what is needed is a new organization responsible for directly leading AMR efforts, with the staffing level that enables it to succeed. The Centre will be a driving force in moving the needle on AMR in Canada, and, as such, a large staff is required. Led by a highly credible CEO, 40 FTEs will lead the delivery of AMR activities. In addition to this core operational staffing team, the Centre would hire or contract 75 FTE project managers and project staff as appropriate using project funds. Staff will be based out of two offices located in different regions of the country. Some staff will have remote work options to ensure the Centre has representation in every region of the country. The staff will work on a variety of implementation, innovation, and scaling efforts in-house, while also contracting work out to leverage unique capacities and capabilities. For the purpose of developing the models and the budget, we have estimated the staff size and a likely organizational structure. The final configuration will be refined during implementation and reviewed as experience is gained over time.

5

Estimated Operational Budgets and Incremental Project Investment

An Overview of the Chapter

While this project is focused on the design of governance model options to coordinate the One Health AMR response in Canada, it is inextricably linked to ensuring that organizations have the resources — which includes funding — to deliver on the robust and sometimes costly activities to mitigate AMR.

Throughout our stakeholder consultations, we have heard extensive feedback about the necessity for additional capacity to deliver on AMR mitigation activities.

This sentiment is amplified by international organizations, who are guiding the development and measurement of global action plans, noting that plans require both governance and resources to drive meaningful change.[1]

For the purpose of this report and to support decision-making, we have separated the concept of funding into:

▶ The estimated operational costing for each model based on the respective design assumptions

▶ The incremental investment in the One Health AMR response

Estimated Cost of Operating the Models

The annual operating budgets for the AMR Network and the AMR Centre in the following table reflect the estimated costs for running the organizations as we have described them in Chapter 4, including the services and infrastructure required to deliver on both core functions. The budgets exclude the required additional investment to fund the project work itself.

The two models vary in the degree to which the organizations expend project funding directly — that is, hiring staff to undertake projects (AMR Centre) versus coordinating projects led by community members (AMR Network). This has an impact on the size and cost of the infrastructure in each model. For example, the need for space, the size of back-office admin functions, etc.

"

The two models vary in the degree to which the organizations expend project funding directly.

The budgets assume the AMR Network requires a staffing and infrastructure capability to support up to 50 Network Action Groups to deliver projects of different sizes, while the AMR Centre will have the capability to support up to 100 additional project delivery staff. The budgets do not include the incremental investment in AMR response that would be used to:

▶ Fund the Network Action Groups projects

▶ Hire internal project staff or fund work contracted out by the AMR Centre to leverage the unique capacities and capabilities of leading experts and institutions

While it was outside of the scope of our project to recommend funding sources, the most common assumption within the stakeholder community is that the core operating funding for the Network or the Centre will come from the federal government, and the project funding will come from a range of public and private sector sources, including the existing funding mechanisms.

Detailed assumptions on the operation budgets are included in Appendix C.

Annual Operating Budget Summary

	Network	Centre
Salaries		
Office of the CEO	$620,000	$870,000
Knowledge Mobilization	870,000	1,280,000
AMR Program & Services	670,000	1,160,000
Corporate Services	410,000	970,000
Information Technology	450,000	520,000
Subtotal: Salaries	**$3,020,000**	**$4,800,000**
Additional Staffing Costs		
Benefits	614,000	987,000
Training & Development	64,000	78,000
Travel	81,000	88,000
Subtotal: Salaries & Staffing	**$3,779,000**	**$5,953,000**
Operational Costs		
Technology	537,000	822,000
Building Occupancy	294,000	1,426,000
Professional Services, Insurance & Supplies	412,000	599,000
Travel & Committees	546,000	440,000
Subtotal: Operational Costs	**$1,789,000**	**$3,287,000**
Total Annual Operating Budget	**$5,568,000**	**$9,240,000**

Staffing in The Two Models

In the AMR Network   **In the AMR Centre**

Office of the CEO

In the AMR Network	In the AMR Centre
Chief Executive Officer (1)	Chief Executive Officer (1)
NCC, Advisory, and Board Liaison (1)	Advisory & Board Liaison (1)
Indigenous Lead (1)	Indigenous Lead (1)
EDI Lead (1)	EDI Lead (1)
Executive Assistant (1)	Executive Assistant (1)
Total = 5	Corporate Counsel (0.5)[2]
	Total = 5.5

Knowledge Mobilization Team[3]

In the AMR Network	In the AMR Centre
Team Lead (1)	Team Lead (1)
Creating Connections* (4)	Creating Connections* (3)
Fostering Knowledge Sharing (5)	Fostering Knowledge Sharing (5)
Communications (1)	Communications (3)
Administrative Assistant (1)	Administrative Assistant (1)
Total = 12	**Total = 13**

*These roles include sector liaisons who connect and align existing and emerging AMR work across One Health, as well as grant writers who support members with an inventory of funding opportunities and provide support for grant applications.

*These roles include stakeholder engagement staff to consult on the development and implementation of Centre project work.

AMR Program and Services Team

In the AMR Network	In the AMR Centre
Team Lead (1)	Project Directors & Support (2.5)*
Project Managers & Liaisons (5)	Strategy Development & Oversight (3)
Administrative Assistant (1)	Administrative Assistants (1)
Total = 7	**Total = 7.5**

This team facilitates the incubation, creation, and operation of Action Groups. A team of Project Managers and Liaisons support the Action Groups to successfully set-up, track, and deliver on their projects and provide facilitation support where required.

*Additional project-based staff will be added to this team from incremental AMR project funding to deliver on priority programs and projects. Estimated mix for modelling purposes: 15 Project Managers and 60 Project Staff for a **total of 75**. This team supports the development of the Centre's strategy and provides leadership for priority programs and projects.

Staffing (Continued)

In the AMR Network	In the AMR Centre

Corporate Services Team

In the AMR Network	In the AMR Centre
Team Lead (1)	Team Lead (1)
Finance Staff (3)	Finance Staff (4)
Human Resources & Payroll (1)	Human Resources & Payroll (3)
Admin & Reception (1)	Procurement Support (1)
Total = 6	Admin & Reception (1)
	Total = 10

Human Resource services have been scaled to support the larger project-based staff that will be hired by the Centre.

Information Technology Team

In the AMR Network	In the AMR Centre
Chief Technology Officer (CTO) (1)	Chief Technology Officer (CTO) (1)
Cyber Security & Change Lead (1)	Cyber Security & Change Lead (1)
Network Administrator (1)	Network Administrators (2)
Total = 3	**Total = 4**

The size of this group may increase with project-related staff where the Centre is undertaking IT-related AMR programs or projects.

Total Full-Time Equivalent Staff

▶ The AMR **Network** will have **33 FTEs.**

▶ The AMR **Centre** will have 40 operational staff and 75 project staff, for a total of **115 FTEs.**

A Call for Incremental Investment in the One Health AMR Response

Our project has been focused on designing strengthened governance model options to coordinate the AMR response in Canada, but we know that whatever option is implemented, the AMR community in Canada will require significant additional resources to deliver on the promise of AMR mitigation.

While determining the exact level and appropriate sources of the incremental investment that will be required was outside of our mandate, throughout our discussions, we used a figure of $500 million over five years (or $100 million annually) as an order-of-magnitude estimate to inform our planning.

On an annual basis, this injection represents about 0.3% of the likely annual economic impact that AMR will have by 2050. The economic argument for investment in mitigating AMR in Canada was articulated in 2019, when the Council of Canadian Academies published *When Antibiotics Fail*. The report makes a compelling case that, by 2050, if resistance to first-line antimicrobials remains constant at today's rate of 26%, AMR would reduce Canada's GDP by $13 billion per year. If resistance increases to 40% — a scenario deemed likely by the experts who penned the report — that GDP reduction would plummet further by $21 billion per year. The report forecasts that, again by 2050, Canada's cumulative GDP will decline by nearly $400 billion solely from AMR-related issues.

Although our proposed model options would play critical roles in coordinating AMR activities that would result from incremental investments, much of the new funding need not flow through the new organization. There are numerous existing funding mechanisms across government and industry — our intent is to not disrupt or replace these mechanisms but to ensure that the AMR community is positioned to collaborate effectively and make best use of the new funds as these organizations make additional funds available. Indeed, in our planning we have assumed that, for the AMR Network, *most*, and for the AMR Centre, *some* of the additional incremental investment in the AMR response would flow directly to the AMR community.

> **If resistance to first-line antimicrobials remains constant at today's rate of 26%, AMR would reduce Canada's GDP by $13 billion per year.**

Applying our incremental funding assumption to our two proposed models, the network operating costs as a percentage of the total new funding is approximately 6% in the AMR Network and approximately 9% in the AMR Centre.

In the AMR Network model, all of the incremental investment available for AMR projects would flow to the AMR community. Some of these funds may flow through the AMR Network, and much of it could flow through existing organizations.

In the AMR Centre model, while the ultimate division of the project funds between the Centre and the AMR community will vary based on the chosen projects, we have assumed for planning purposes that approximately $20 million (20%) would be used by the Centre for direct project delivery with the remaining $70.76 million (~70%) flowing out to partners in the AMR community either through the AMR Centre for partnership projects or through existing external funding structures.

Garnering Context from COVID-19

The COVID-19 pandemic has provided context for the direct costs of infectious diseases for which we have no effective treatment. To date, more than 25,500 Canadians have lost their lives to the disease — and this number continues to rise with each passing day. The human toll to our healthcare providers and essential workers, and the impact on the mental health of our population is immeasurable. Governments across the country have invested hundreds of billions of dollars to address the health and economic impacts associated with the pandemic.

Next Steps

We are honoured to submit this report to the Public Health Agency of Canada in fulfillment of our mandate to develop at least two feasible, credible, and sustainable governance model options to strengthen the AMR response in Canada across One Health.

On behalf of Canada's AMR community, we are eager and optimistic as we await the next steps.

Notes & References

Chapter One

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17. The pan-Canadian Framework, published in 2017, built on the 2015 Action Plan that focused solely on the federal response. They are precursors to the forthcoming Pan-Canadian Action Plan that guides a broader response.

18. (Government of Canada, 2017)

19. EDI refers to "equity, diversity, and inclusion." Equity recognizes that some groups are disadvantaged compared to others and are underrepresented. It involves increasing diversity and improving conditions for these groups. Diversity is valuing differences and embracing the uniqueness of individuals and perspectives. Inclusion is respecting and treating all perspectives, groups fairly. Overall, EDI involves efforts to ensure all groups are able to contribute fully to the organization.

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Chapter 2

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18. (Hillier et al, 2021)

19. Prime Minister of Canada Justin Trudeau. 13 December 2019. Minister of Health Mandate letter.

20. (Office of the Auditor General of Canada, 2015)

21. This Canadian Antimicrobial Resistance Surveillance System (CARSS) is Canada's national system for reporting on antimicrobial resistance (AMR) and antimicrobial use (AMU). CARSS synthesizes and integrates epidemiological and laboratory information from Public Health Agency of Canada (PHAC) surveillance programs across the human and agricultural sectors to provide high quality national data on AMR and AMU (Source: https://www.canada.ca/en/public-health/services/publications/drugs-health-products/canadian-antimicrobial-resistance-surveillance-system-2018-report-executive-summary.html)

22. The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) monitors trends in antimicrobial use and antimicrobial resistance in selected bacterial organisms from human, animal and food sources across Canada. The program is based on several representative and methodologically unified surveillance components which can be linked to examine the relationship between antimicrobials used in food-animals and humans and the associated health impacts (Source: https://www.canada.ca/en/public-health/services/surveillance/canadian-integrated-program-antimicrobial-resistance-surveillance-cipars.html).

23. The Canadian Nosocomial Infection Surveillance Program (CNISP) is a collaborative effort between the Public Health Agency of Canada's Centre for Communicable Diseases and Infection Control (CCDIC) and the National Microbiology Laboratory (NML), and sentinel hospitals across Canada who participate as members of the Canadian Hospital Epidemiology Committee (CHEC), a standing committee of the Association of Medical Microbiology and Infectious Disease (AMMI) Canada (Source: https://www.canada.ca/en/public-health/services/surveillance.html#a6).

24. The Joint External Evaluation (JEE) is a voluntary, collaborative, multisectoral process to assess country capacity to prevent, detect and rapidly respond to public health risks occurring naturally or due to deliberate or accidental events. The purpose of the external evaluation is to assess country-specific status, progress in achieving the targets under Annex 1 of the International Health Regulation and recommend priority actions to be taken across the 19 technical areas being evaluated (Source: World Health Organization).

25. (Joint External Evaluation of IHR Core Capacities of Canada, 2018).

26. The Standing Committee on Health studies issues that relate to Health Canada, including bills and regulations. It also has oversight of four health-related agencies, including the Canadian Food Inspection Agency and the Public Health Agency of Canada.

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Chapter 3

1. 'Regulatory tools' refers to explicit government intervention to achieve a specific societal outcome through legislation, licenses, circulars, permits, regulations, registrations, administrative guidelines, directives, and codes of practice.

2. Transdisciplinary work can occur through creating a space to work at the intersection of people, animals, and their environments. This approach combines diverse expertise with great potential to yield innovative adaptations that better address complex scientific and social challenges by fostering novel, holistic approaches to a common issue (adapted from University of Calgary Research source: https://research.ucalgary.ca/one-health https://research.ucalgary.ca/one-health)

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10. (Forest et al, 2018)

11. The suite of organizations that were reviewed, in chronological order of founding: Canadian Centre on Substance Use and Addiction (CCSA), Canadian Agency for Drugs and Technologies in Health (CADTH), Canadian Institute for Health Information (CIHI), Canadian Foundation for Healthcare Improvement (CFHI), Canada Health Infoway (Infoway), Canadian Patient Safety Institute (CPSI) [Note: CPSI now part of Healthcare Excellence Canada], Canadian Partnership Against Cancer (CPAC), Mental Health Commission of Canada (MHCC).

12. (Forest et al, 2018)

13. (Forest et al, 2018)

Chapter 4

1. 'Skills-based' refers to ensuring that the Board has specific skills and experience relevant to the organization's opportunities and risks.

2. Our consultations heard a diverse set of views regarding how the new organization (whether the AMR Network or the AMR Centre) should interact with international organizations within the AMR arena. Some stakeholders advocated strongly for a "made in Canada" approach, others argued for close international linkages, and yet others argued that formal linkages with international organizations are the responsibility of government and not within the remit of the new organization.

3. For example, the National Farmed Animal Care Council is the animal health lead for the national Plant and Animal Health Strategy, includes the stakeholders and linkages needed to support a One Health approach to AMR, and has the ability to collate and share advancements in antimicrobial use practices in veterinary medicine.

4. One definition of culture is the '… expression of those behaviours, expectations, and interactions that either allow for or impede the execution of an organization's strategy and the manifestation of its purpose.' Institute of Corporate Directors. (2019). *The culture imperative*. https://www.icd.ca/ICD/media/ documents/ICD_The_Culture_Imperative_EN.pdf

Chapter 5

1. Researched articles by country:

A. United States

- Original Action Plan 2015-2020: https://www.cdc.gov/drugresistance/pdf/ national_action_plan_for_combating_antibotic-resistant_bacteria.pdf

- 2020-25 Action Plan: https://aspe.hhs.gov/system/files/pdf/264126/CARB-National-Action-Plan-2020-2025.pdf

- Meeting National goals: https://www.cdc.gov/drugresistance/solutions-initiative/index.html

- CDC Leads AR Fight: https://www.cdc.gov/drugresistance/pdf/threats-report/CDC-Leads-AR-Fight-508.pdf

- OUTPUTS (with the money) CDC - 2016 – 2019: https://www.cdc.gov/drugresistance/pdf/threats-report/CDC-Actions-Combat-AR-508.pdf

- CDC Federal Budget Details: 1) https://www.cdc.gov/budget/fy2021/congressional-justification.html 2) https://www.cdc.gov/budget/documents/fy2019/fy-2019-detail-table.pdf

- Activity Review (outputs / results): https://www.cdc.gov/drugresistance/us-activities.html

- Year 4 Report - all agencies (year 5 still being written): https://aspe.hhs.gov/system/files/pdf/263426/Progress-Report-Year-4-CARB-National-Action-Plan-Final.pdf

- FDA Strategy Announcement: https://www.fda.gov/news-events/speeches-fda-officials/fdas-strategic-approach-combating-antimicrobial-resistance-09142018

B. Netherlands

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- 2015 Budget References https://www.jpiamr.eu/wp-content/uploads/2015/12/Presentation-MI-Esveld-Netherland.pdf

- 2015 - 2010 plan: https://www.who.int/publications/m/item/netherlands-dutch-national-action-plan-on-amr

- 2019 Investments: https://www.government.nl/latest/news/2019/06/19/countries-worldwide-join-forces-to-step-up-fight-against-antimicrobial-resistance

- National Institute for Public Health and the Environment (RIVM)/Rijksinstituut voor Volksgezondheid en Milieu/(Ministry of Health, Welfare and Sport): https://www.rivm.nl/en

- RIVM's role in AMR: https://www.rivm.nl/en/antibiotic-resistance/what-is-national-institute-of-public-health-and-environment-rivm-doing-about-antibiotic-resistance

C. United Kingdom

- Tackling antimicrobial resistance 2019-24 (5 Yr National Action Plan): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/784894/UK_AMR_5_year_national_action_plan.pdf

- 2018 Announcement: https://www.gov.uk/government/news/30-million-of-funding-to-tackle-antimicrobial-resistance

- ARM Funders Forum (ARMFF) – 2014: https://mrc.ukri.org/research/initiatives/antimicrobial-resistance/antimicrobial-resistance-funders-forum/

- ARM tracking investments: https://www.nature.com/articles/d41586-019-01409-x

- 2016 - review (leading to original strategy): https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf

- Global response = $40B USD over 10 years (pp. 67)

- Global cost pooling and strategy for some elements (R&D etc.)

D. Australia

- 2020 Budget Announcement: https://www.health.gov.au/ministers/the-hon-greg-hunt-mp/media/22-million-investment-to-tackle-the-global-health-threat-of-antimicrobial-resistance#:~:text=Minister%20for%20Health%2C%20Greg%20Hunt,Resistance%20Strategy%20%E2%80%93%202020%20%26%20Beyond.

- Australian Government - AMR Site: https://www.amr.gov.au/

- AMR Strategy - 2020 & Beyond: https://www.amr.gov.au/resources/australias-national-antimicrobial-resistance-strategy-2020-and-beyond

- 2015 - 2019 Strategy Progress Report: https://www.amr.gov.au/resources/australias-first-national-antimicrobial-resistance-strategy-2015-2019-progress-report

- Also an Implementation plan with accountabilities at: https://www.amr.gov.au/resources/national-amr-implementation-plan

- National Centre for Antimicrobial Stewardship (NCAS): https://www.ncas-australia.org/about-us

- National Health and Medical Research Council of Australia 18-19 appropriation: https://www.nhmrc.gov.au/about-us/who-we-are

E. New Zealand
- 2017 Plan: https://www.health.govt.nz/system/files/documents/publications/new-zealand-antimicrobial-resistance-action-plan.pdf

- Actions assigned to: https://www.health.govt.nz/our-work/diseases-and-conditions/antimicrobial-resistance

- ESR = NZ crown Research Institute - 18/19 appropriation: https://www.treasury.govt.nz/sites/default/files/2019-05/est19-v6-health.pdf

F. Germany
- 2019-March Investment: https://european-biotechnology.com/up-to-date/latest-news/news/amr-germany-set-to-invest-eur39m-into-carb-x.html#:~:text=Under%20the%20four%2Dyear%20agreement,resistance%20to%20antimicrobials%20(AMR).

- 2017-Oct Investment: https://www.devex.com/news/inside-germany-s-push-for-a-global-anti-microbial-resistance-hub-91002

- Website for the hub / secretariat: https://www.gesundheitsforschung-bmbf.de/en/GlobalAMRHub.php

- Action Plan - DART 2020: https://www.bmel.de/SharedDocs/Downloads/EN/Publications/DART2020.pdf?__blob=publicationFile

2. By design, the Network model is intended to be "light weight" in terms of governance and administration. In this model, beyond the initial membership agreements, other legal documents will be negotiated in the context of, and by the members of, an Action Group (IP ownership, leadership, financial roles, etc.). As such, we have not included a legal counsel position within the core operating staff for this model.

3. The Knowledge Mobilization Team helps with "linking the thinking." In other words, it curates and distributes content, and monitors and reports on Network/Centre activities. The Communications staff support organizational communication requirements — annual reports, websites, social media, etc

Appendix A: Steering Committee

Andrew Morris (Co-Chair) is an infectious disease physician, a Professor of Medicine at the University of Toronto, and the Medical Director of the Sinai Health System-University Health Network Antimicrobial Stewardship Program. He is currently Chair of the Antimicrobial Stewardship Committee for the Society for Hospital Epidemiology of America (SHEA) and chairs the Antimicrobial Stewardship Working Group for Accreditation Canada. He was appointed to the Canadian Government's Expert Advisory Group on Antimicrobial Resistance (EAGAR) in 2015.

Gerry Wright (Co-Chair) is the Director of the Michael G. DeGroote Institute for Infectious Disease Research and the David Braley Centre for Antibiotic Discovery. He is a Distinguished University Professor in the Departments of Biochemistry & Biomedical Sciences and Pathology & Molecular Medicine at McMaster University. In response to the COVID-19 pandemic, Dr. Wright has recently pivoted his focus to launching Canada's Global Nexus for Pandemics and Biological Threats, of which he is the Inaugural Lead. Wright holds the Michael G. DeGroote Chair in Infection and Anti-Infective Research and a Canada Research Chair in Antimicrobial Biochemistry.

Herman Barkema is a Professor in Epidemiology of Infectious Diseases at the University of Calgary and holds a joint-appointment in the Deptartment of Community Health Sciences at the Cumming School of Medicine. He is also a Guest Professor at Ghent University in Belgium and a Foreign Expert at the China Agricultural University in Beijing. Dr. Barkema's research program focuses on prevention and control of diseases in cattle herds, including antimicrobial resistance. He leads the UCalgary Biostatistics Centre, the Environment research theme in the Canadian Bovine Mastitis Research Network, the Alberta Johne's Disease Initiative, the Antimicrobial Resistance – One Health Consortium, and more.

Sean Hillier is a queer Mi'kmaw scholar from the Qalipu First Nation. He is an assistant professor at the School of Health Policy & Management and a Special Advisor to the Dean on Indigenous Resurgence in the Faculty of Health at York University. He is the Chair of the Indigenous Council at York and is Co-Chair of the Working Group on Anti-Black and Anti-Indigenous racism in the Faculty of Health. Additionally, Sean is a Board Member of the AIDS Committee of Toronto (ACT). Sean is a former CIHR doctoral scholar in the area of Indigenous Peoples living with HIV. His collaborative research program spans the topics of aging, living with HIV and other infectious diseases, and antimicrobial resistance, all with a concerted focus on policy affecting healthcare access for Indigenous Peoples in Canada.

Steering Committee

Suzanne Hindmarch is an Associate Professor of Political Science at the University of New Brunswick. Her research expertise is in global health and global security, with particular focus on vulnerable populations and health equity in the politics of infectious disease response. Her SSHRC and CIHR-funded research and publications explore the global health security response to HIV/AIDS, and the evolving global governance response to AMR.

Caroline Quach-Thanh is a Professor in the Departments of Microbiology, Infectious Diseases & Immunology, and Pediatrics at the University of Montreal. She is an adjunct Professor in the Department of Epidemiology, Biostatistics, & Occupational Health at McGill University and a scientific collaborator at the School of Public Health at Université Libre de Bruxelles (ULB) in Brussels. She is the physician in charge of infection prevention and control at CHU Sainte-Justine, where she also works as a pediatric infectious disease specialist. Dr. Quach-Thanh is a clinician-scientist and was recently awarded the Canada Research Chair in Infection Prevention and Control. Dr. Quach-Thanh is the current Chair of the National Advisory Committee on Immunization and the former president of (AMMI) Canada.
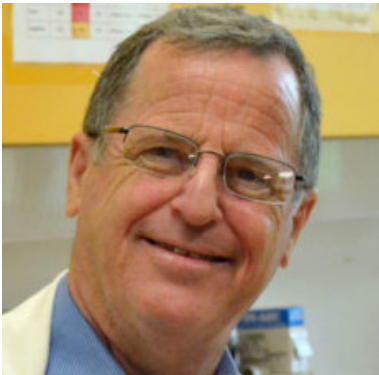
Ed Topp is a Principal Research Scientist with Agriculture and Agri-Food Canada. His current research includes assessment and management of environmental and human health risks associated with agricultural organic fertilizers and the impacts of pharmaceuticals, microbial pathogens, and antibiotic-resistant bacteria in food animal and crop production systems. He is a member of the Joint Programming Initiative on AMR (JPIAMR) Science Advisory Board and a member of the FAO/WHO roster of experts on foodborne antimicrobial resistance. He also holds academic appointments at the University of Western Ontario and the University of Guelph.
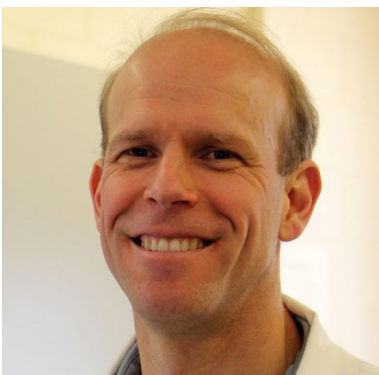
Scott Weese is a Professor at the University of Guelph's Ontario Veterinary College. He is a veterinary internist, a Diplomate of the American College of Veterinary Internal Medicine, a zoonotic disease/public health microbiologist at the Centre for Public Health and Zoonoses and Chief of Infection Control at the Ontario Veterinary College Teaching Hospital. He is a fellow of the Canadian Academy of Health Sciences and member of the Tripartite Global Leaders Group on AMR. His research interests include emerging diseases, diseases and the human-animal interface, antimicrobial resistance, and antimicrobial stewardship.

Appendix B: Acknowledgements

Advisory Committee

- Marie Archambault, University of Montreal
- Madeleine Ashcroft, Canadian Nurses Association
- Megan Bergman, National Farmed Animal Health and Welfare Council
- Luc Boileau, Institut national d'excellence en santé et services sociaux
- Paul-Émile Cloutier, HealthCareCAN
- Eve Dubé, Institut national de santé publique
- Sarah Forgie, Association of Medical Microbiology & Infectious Diseases
- Charles Frenette, McGill University Health Centre
- Susan Fryters, Alberta Health Services
- Lianne Jeffs, Sinai Health
- Lynn Johnston, Dalhousie University
- David Patrick, University of British Columbia
- Dani Peters, Magnet Strategy Group
- Chris Power, Canadian Patient Safety Institute (formerly)
- Robert Strang, Government of Nova Scotia
- Susan Sutherland, University of Toronto

Special Advisors

- John Conly, University of Calgary
- Rainer Engelhardt, Former PHAC Assistant Deputy Minister AMR Surveillance and Innovation
- Jane Philpott, Queen's University

Participating Stakeholders

Stakeholders contributed to this project by completing our baseline survey, participating in a consultation session, providing written feedback.

- Ganesan Abbu, Southern Health
- Lama, Abi Khaled, Innovative Medicines Canada
- Paul Allison, Association of Canadian Faculties of Dentistry
- Betty Althouse, Saskatchewan Ministry of Agriculture
- Maureen Anderson, Ontario Ministry of Agriculture, Food and Rural Affairs
- Krista Apse, Public Health Agency of Canada
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Project Team

- Maureen Perrin, Project Director
- Ian Brunskill, Consultant
- Blake Dillon, Communications
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- Chris Tremeer, Accounting

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Participating Stakeholders (Continued)

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- Denice Bay, University of Manitoba
- Francois Bedard, Agriculture & Agri-Food Canada
- Robert Bell, Bio Agri Mix LP
- Janice Berg, Merck Animal Health
- Reynold Bergen, Beef Cattle Research Council
- Joel Bergeron, Ordre des médecins vétérinaires du Québec
- Albert Berghuis, McGill University
- Alka Bhalla, Correctional Service of Canada
- Amit Bhavsar, University of Alberta
- Terry Blackmore, Saskatchewan Ministry of Health
- Francoise Blain, Merck
- Claude Boivin, Canadian Dental Association
- Paul Bonnar, Nova Scotia Health
- Shelly Bonte-Gelock, Ontario Clean Water Agency
- Calvin Booker, Feedlot Health
- Jennifer Boswell, Canadian Agency for Drugs and Technologies in Health
- Martine Boulianne, University of Montreal
- Dawn Bowdish, McMaster University
- Phil Boyd, Turkey Farmers of Canada
- Fiona Brinkman, Simon Fraser University
- Eric Brown, McMaster University
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- William Ciccotelli, Grand River Hospital
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- Deborah Cohen, Canadian Institute for Health Information
- Brian Coombes, McMaster University
- Mary Coughlin, Canadian Institutes of Health Research (CIHR)
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- Tara da Costa, Canadian Food Inspection Agency
- Peter Daley, Memorial University
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- Doreen Day, Choosing Wisely Canada
- Charmaine Dean, University of Waterloo
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- Jon Dennis, AMR One Health Consortium
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- François Drolet, Roche Diagnostics
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- Jennifer Haley, Livestock Alliance
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- Scott Halperin, Dalhousie University
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- Bob Hancock, University of British Columbia
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- Lorian Hardcastle, University of Calgary
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- Jeffrey Wichtel, University of Guelph
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- Tom Wong, Indigenous Services Canada
- Alex Wong, Carleton University
- Greg Worley, Ontario Ministry of Agriculture, Food and Rural Affairs
- Robin Wright, Health Canada
- Jianhong Wu, York University
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- Rickey Yada, University of British Columbia
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- Sheryl Zelenitsky, University of Manitoba
- Xin Zhao, McGill University
- Beverley Zwicker, Nova Scotia College of Pharmacists

Appendix C: Proposed Staffing & Financial Estimates

Network Model Staff:

	Full Time Equivalent Staff	Salaries
Office of the CEO		
Chief Executive Officer	1.00	$250,000
Network Coordinating Council / Advisory Committee / Board Liaison	1.00	$100,000
Indigenous Lead	1.00	$100,000
EDI Lead	1.00	$100,000
Executive Assistant	1.00	$70,000
	5.00	**$620,000**
Knowledge Mobilization		
Team Leader - Knowledge Mobilization	1.00	$120,000
Creating Connections		
Field Liaisons (member connection building)	2.00	$140,000
Member Enablers (grant opportunity finders / support)	2.00	$120,000
Fostering Knowledge Sharing		
Senior Librarian	1.00	$100,000
Analysts - research, journals, literature	3.00	$210,000
Writers - summaries of work & case studies	1.00	$50,000
Communications		
Senior Communications Specialist	1.00	$80,000
Administrative Assistant	1.00	$50,000
	12.00	**$870,000**
AMR Program & Services		
Team Leader - AMR Program & Services	1.00	$120,000
Project Management		
Action Groups Supporters (facilitation, project management, etc.)	5.00	$500,000
Strategy Development & Oversight		
Administrative Assistant	1.00	$50,000
	7.00	**$670,000**
Corporate Services		
Finance		
Director, Finance & Corporate Services	1.00	$120,000
Senior Accountant	1.00	$80,000
Accounting Clerks	2.00	$100,000
Human Resources & Payroll		
HR Specialist & Payroll	1.00	$80,000
Reception & Admin Support	1.00	$30,000
	6.00	**$410,000**
Information Technology		
Chief Technology Officer	1.00	$200,000
Cyber Security & Change Lead	1.00	$180,000
Network Administrators	1.00	$70,000
	3.00	**$450,000**
TOTAL FULL-TIME EQUIVALENT STAFF	**33.00**	**$3,020,000**

Strengthening Governance of the Antimicrobial
Resistance Response Across One Health in Canada

Proposed Staffing & Operating Budgets   Appendix C

Network Model Budget:

Staffing	Assumptions	
Salaries	1	$3,020,000
Benefits	2	614,000
Training & Development	3	64,000
Travel	4, 5	81,000
		$3,779,000
Technology		
IT Systems & Software	6	$131,000
Hardware	7	57,000
IT Consulting	8, 9	112,000
Telecommunications	10	52,000
Website & Communications	11	185,000
		$537,000
Travel & Committees		
Committee Travel & Collaboration Space Rental	12-15	**$546,000**
Building Occupancy		
Building Occupancy	16, 17	**$294,000**
Professional Services, Insurance & Supplies		
Insurance	18	$75,000
Professional Fees	19	305,000
Office & Misc	20	32,000
		$412,000
Total Estimated Annual Operating Budget		**$5,568,000**

Network Model Budget Assumptions:

1. Salaries as per Staffing Structure
2. Benefits based on 21% of salaries
3. Training based on $2,000 per year per FTE staff
4. Estimated travel volume:
   - 0.50 trips per FTE per year, plus
   - 25 trips for CEO per year
5. Estimated travel cost: $2,000 per trip
6. Software budget based on - cloud based, SAS per FTE for:
   - CRM
   - Office tools & email
   - Collaboration
   - Project management + cloud-based finance and payroll software
7. Hardware: $1,000/FTE/year, plus $25,000 for printers, copiers, network
8. $1,000/month cyber security testing
9. $100,000 in general IT consulting and support services
10. • Integrated VOIP phone and video meeting platform service per FTE
    • Audio plan top-ups for teleconference and audio service enhancements
    • Hardware and software for 5 collaboration conference rooms
11. • Public website hosting & maintenance $25,000 annually
    • Member website and knowledge base $5,000/month license, updates, support
    • Journal library, knowledge base content $100,000 annually
12. Board of Directors travel: 10 members x 6 meetings x $2,000
13. Advisory Committees: 4 committees x 10 members x 4 meetings x $2,000
14. Coordinating Council: 10 members x 4 meetings x $2,000
15. Meeting space rentals:26 meetings x $1,000 per meeting
16. 225 square feet / on site FTE, plus additional collaboration space = 6,000 square feet total
17. Basic rent @ $25/sq ft + Additional rent @$20/sq ft + Maintenance @ $2,000 / month
18. Liability, D&O, Property, Crime coverages
19. Equity, Diversity & Inclusion, Legal, Audit, Corporate / Strategy Consulting
20. Based on $1,000 per FTE

Proposed Staffing & Operating Budgets Appendix C

Centre Model Staffing:

	Full Time Equivalent Staff	Salaries
Office of the CEO		
Chief Executive Officer	1.00	$400,000
Advisory Committee / Board Liaison	1.00	$100,000
Indigenous Lead	1.00	$100,000
EDI Lead	1.00	$100,000
Executive Assistant	1.00	$70,000
Corporate Counsel	0.50	$100,000
	5.50	**$870,000**
Knowledge Mobilization		
VP - Knowledge Mobilization	1.00	$200,000
Creating Connections		
Director, Stakeholder Engagement & Relations	1.00	$150,000
Analysts	2.00	$140,000
Fostering Knowledge Sharing		
Director, Brokering Knowledge & Demonstrating Progress	1.00	$150,000
Senior Librarian	1.00	$100,000
Analysts - research, journals, literature	2.00	$140,000
Writers - summaries of work & case studies	1.00	$50,000
Communications		
Director, Public Awareness & Socialization	1.00	$150,000
Corporate Communications / Issues Management	1.00	$80,000
Communications Specialists	1.00	$70,000
Administrative Assistant	1.00	$50,000
	13.00	**$1,280,000**
AMR Program & Services		
VP - AMR Programs & Services	1.00	$400,000
Project Management		
Director, Project Management Office	1.50	$300,000
Administrative Assistant	1.00	$50,000
Strategy Development & Oversight		
Director, Strategy	1.00	$200,000
Analysts	2.00	$140,000
Executive Assistant	1.00	$70,000
	7.50	**$1,160,000**
Corporate Services		
VP - Finance & Corporate Services	1.00	$200,000
Finance		
Director, Finance / Controller	1.00	$150,000
Senior Accountant	1.00	$80,000
Accounting Clerk	1.00	$50,000
Financial Analyst	1.00	$70,000
Human Resources & Payroll		
Director, HR	1.00	$150,000
HR Specialist	1.00	$80,000
Payroll Administrator	1.00	$60,000
Procurement Support	1.00	$80,000
Reception & Admin Support & Facilities	1.00	$50,000
	10.00	**$970,000**
Information Technology		
Chief Technology Officer	1.00	$200,000
Cyber Security & Change Lead	1.00	$180,000
Network Administrators	2.00	$140,000
	4.00	**$520,000**
TOTAL FULL-TIME EQUIVALENT STAFF	**40.00**	**$4,800,000**

Strengthening Governance of the Antimicrobial
Resistance Response Across One Health in Canada

Proposed Staffing & Operating Budgets

Centre Model Budget:

Staffing	Assumptions	
Salaries	1	$4,800,000
Benefits	2	987,000
Training & Development	3	78,000
Travel	4, 5	88,000
		$5,953,000
Technology		
IT Systems & Software	6	$209,000
Hardware	7	164,000
IT Consulting	8, 9	112,000
Telecommunications	10	152,000
Website & Communications	11	185,000
		$822,000
Travel & Committees		
Committee Travel	12, 13	**$440,000**
Building Occupancy		
Building Occupancy	14, 15	**$1,426,000**
Professional Services, Insurance & Supplies		
Insurance	16	$100,000
Professional Fees	17	460,000
Office & Misc	18	39,000
		$599,000
Total Estimated Annual Operating Budget		**$9,240,000**

Centre Model Budget Assumptions:

1. Salaries as per Staffing Structure - core staff, excluding project staff funded from Incremental AMR Investment dollars
2. Benefits based on 21% of salaries
3. Training based on $2,000 per year per core FTE staff
4. Estimated travel volume:
   • 0.50 trips per core FTE per year, plus
   • 25 trips for CEO per year
5. Estimated travel cost: $2,000 per trip
6. Software budget based on cloud-based, SAS/per FTE (including 75 project FTE) for:
   • CRM
   • Office tools & email
   • Collaboration
   • Project management, plus cloud-based finance and payroll software
7. Hardware: $1,000 per FTE (including project staff) annually, plus $25,000 for printers, copiers, network
8. $1,000/month cyber security testing
9. $100,000 in general IT consulting and support services
10. • Integrated VOIP phone and video meeting platform service per FTE (including project staff)
    • Audio plan top-ups for teleconference & audio service enhancements
    • Hardware and software for 10 collaboration conference rooms
11. • Public website hosting & maintenance $25,000 annually
    • Member website & knowledge-base $5,000/month license, updates, support
    • Journal library, knowledge base content $100,000 annually
12. Board of Directors travel: 10 members x 6 meetings x $2,000
13. Advisory Committees: 4 committees x 10 members x 4 meetings x $2,000
14. 225 sq-ft/on site FTE, plus additional collaboration space = 25,600 sq-ft total, split into 2 locations of 12,800 square feet each"
15. Basic rent @ $25/sq-ft + Additional rent @$20/sq-ft + Maintenance @ $5,000/mo
16. Liability, D&O, Property, Crime coverages
17. Equity, Diversity & Inclusion, Legal, Audit, Corporate/Strategy Consulting
18. Based on $1,000 per core FTE

Appendix D: Baseline Survey Findings

We invited more than 600 Canadian AMR/One Health stakeholders to participate in a survey. The survey sought to:

▶ Build a baseline understanding of the One Health AMR community through enumerating the organizations, their activities by geographical mandate and pillar

▶ Describe the respondents by individual expertise and organizations

▶ Draw conclusions about the strengths and potential gaps/limitations of our project based on participation

▶ Expand our contact list by adding those who were recommended by our survey respondents

With around a 35% response rate, the information garnered from this questionnaire informed the path charted throughout this project.
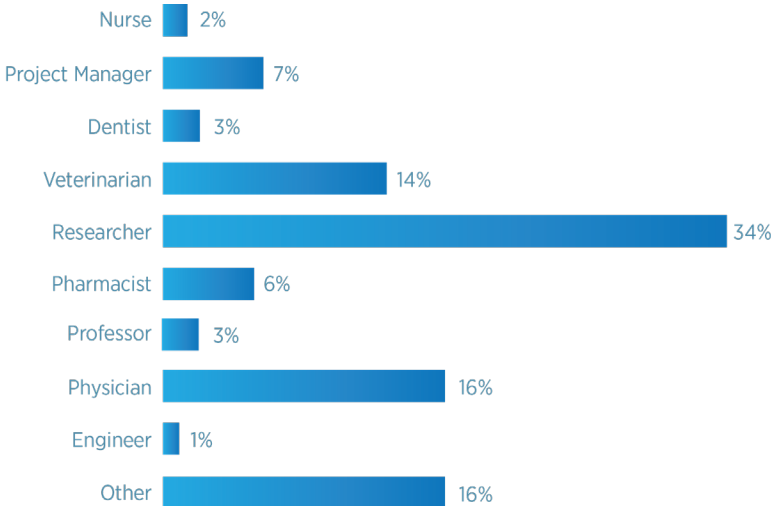
Our community

▶ 737 people
▶ 526 organizations

Survey Stats

▶ 608 stakeholders invited to participate
▶ 201 detailed responses
▶ Respondents represented 134 different organizations

Finding #1: The One Health spectrum in Canada is comprised by a diversity of professions

Survey participants were asked to provide their primary professional designation. Researchers far and away comprised the biggest portion of of respondents (34%), followed by physicians (16%) and veterinarians (14%). A sizeable group of respondents (16%) selected other, indicating they occupy a variety of professions, such as policymakers, food safety officers, and sociologists, to name a few.

Profession	Percentage
Nurse	2%
Project Manager	7%
Dentist	3%
Veterinarian	14%
Researcher	34%
Pharmacist	6%
Professor	3%
Physician	16%
Engineer	1%
Other	16%

Strengthening Governance of the Antimicrobial Resistance Response Across One Health in Canada

Baseline Survey Findings

Finding #2: An overwhelming majority of stakeholders work in human and animal health domains

While the majority of our respondents worked in human health, we have wide representation across each dimension. It's important to note that some respondents selected more than one dimens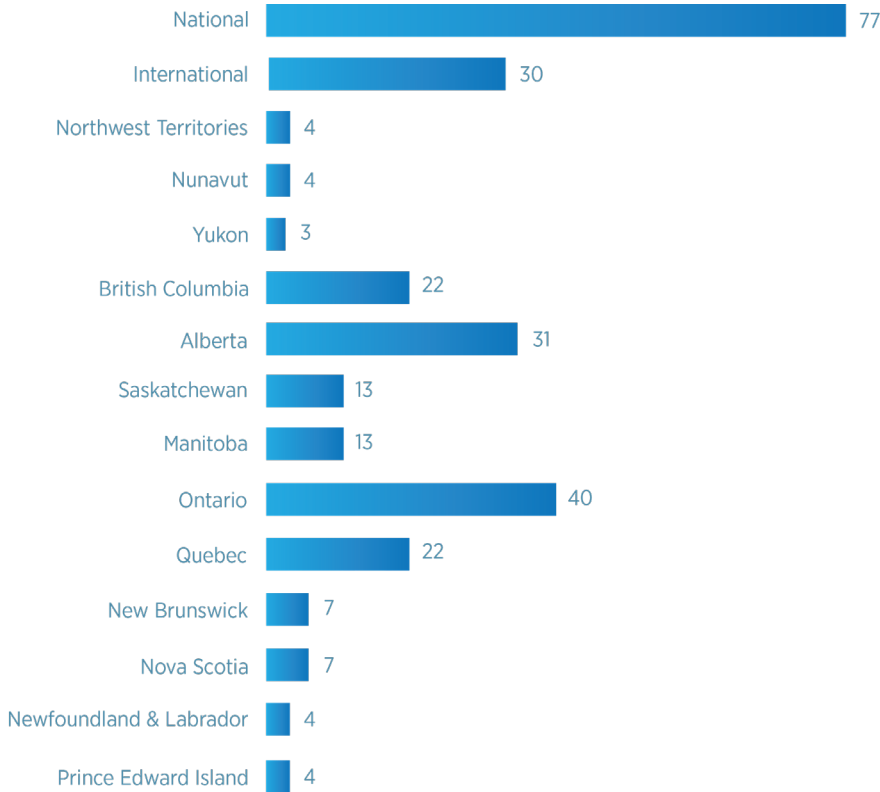ion — for example, animal and environmental health. In this case, "One Health" indicates that the respondent's organization works across the human, animal, and environmental health dimensions, and "Other" indicates that the respondent's organization works outside of One Health altogether — economists and mathematicians, for example, selected "Other."

Dimension	Percentage
Animal & Agri-Food	28%
Human Health	48%
Environment	9%
One Health	14%
Other	1%
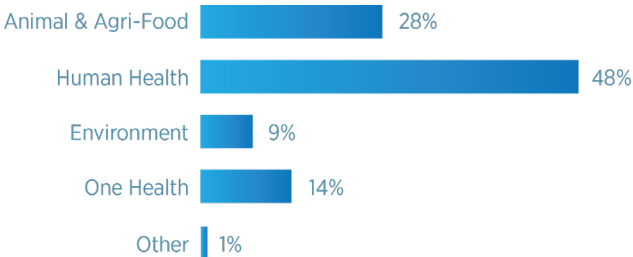
Finding #3: Existing AMR work is spread widely across Canada — and, in some cases, beyond

We asked our survey participants to list their organization's regional mandates. A resounding majority of respondents noted that their work has national implications. While some regions had large representation — Ontario and Alberta, for example — we did achieve response representation across all of Canada's provinces and territories.

Region	Count
National	77
International	30
Northwest Territories	4
Nunavut	4
Yukon	3
British Columbia	22
Alberta	31
Saskatchewan	13
Manitoba	13
Ontario	40
Quebec	22
New Brunswick	7
Nova Scotia	7
Newfoundland & Labrador	4
Prince Edward Island	4

Finding #4: Participants quibbled with the 'Four Pillars' outlined in the *Framework for Action*

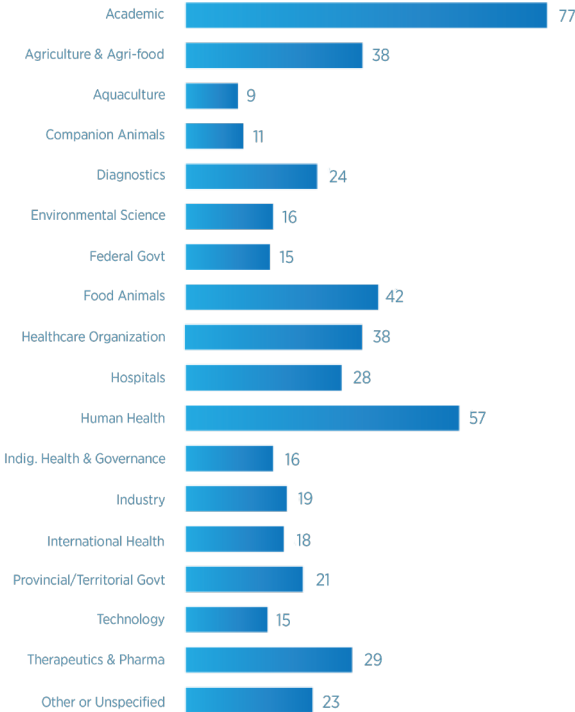We asked participants to list which of the four pillars from the Public Health Agency of Canada's Tackling Antimicrobial Resistance and Antimicrobial Use: A Pan-Canadian Framework for Action their work could be best categorized under. Interestingly, the vast majority did not associate with the pillars at all, and those who did often selected more than one. Some examples of work that fell outside of the pillars are economics, business, and law.
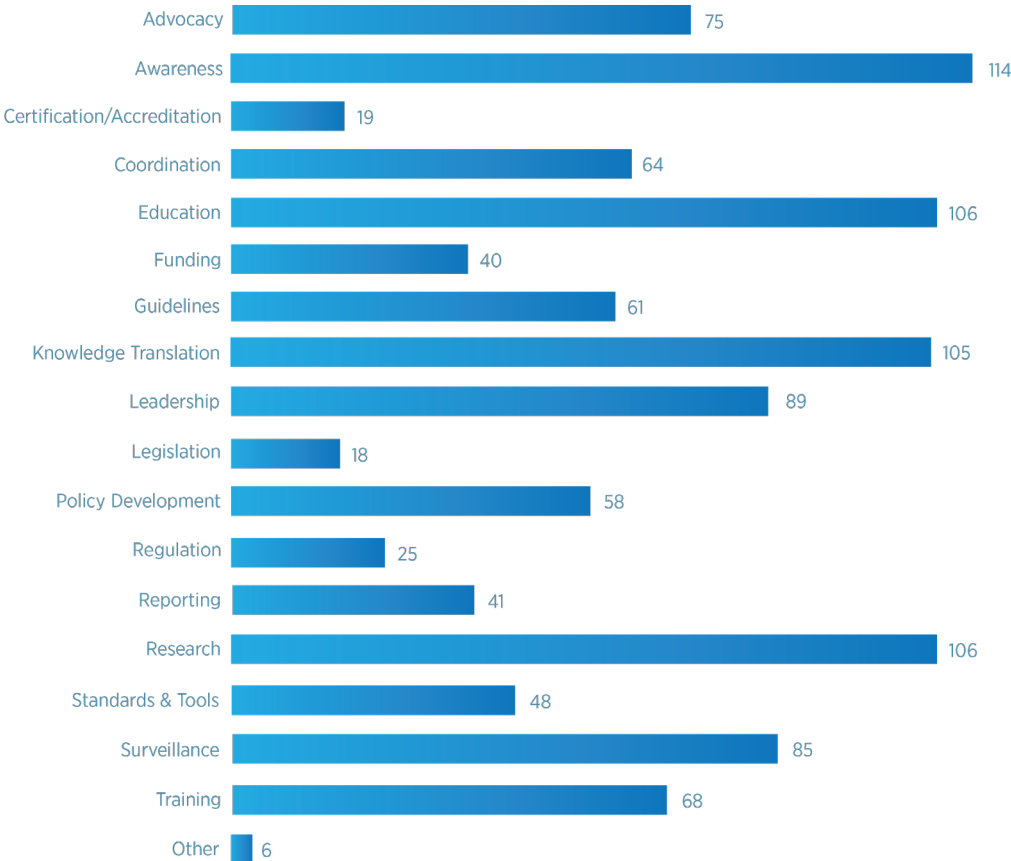
Category	Value
Research & Innovation	75
Stewardship	58
Infection Prevention & Control	33
Surveillance	45
All Pillars	15
Other or Unknown	91
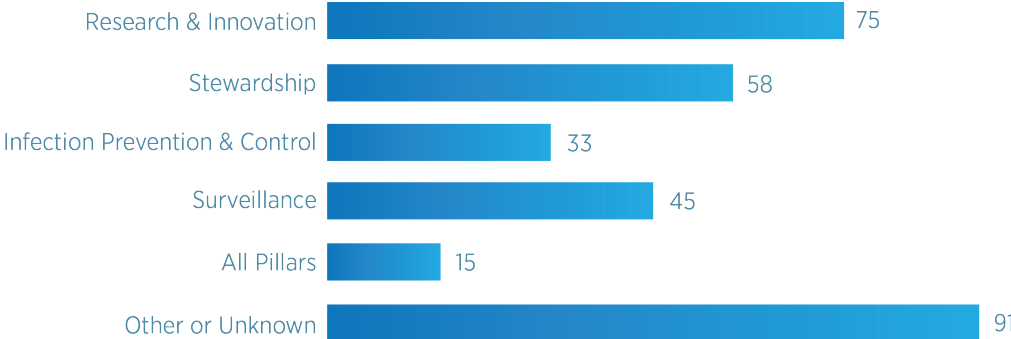
Finding #5: One Health is merely a baseline; there are a number of sectors involved in the AMR response

The majority of our respondents work in academia, but we received wide representation from a diversity of other sectors as well. Some common sectors include human health, animal health, therapeutics and pharmaceutical development, diagnostics, and government.

Sector	Value
Academic	77
Agriculture & Agri-food	38
Aquaculture	9
Companion Animals	11
Diagnostics	24
Environmental Science	16
Federal Govt	15
Food Animals	42
Healthcare Organization	38
Hospitals	28
Human Health	57
Indig. Health & Governance	16
Industry	19
International Health	18
Provincial/Territorial Govt	21
Technology	15
Therapeutics & Pharma	29
Other or Unspecified	23

Finding #6: There is a significant amount of AMR-related work underway in Canada

Our survey tasked participants with listing the AMR-related activities that their organizations currently have underway. Awareness, education, knowledge translation, and research seem to be the key AMR activities taking place in Canada today. There is also considerable activity in the areas of surveillance, advocacy, and leadership. AMR activities relating to regulation, legislation, funding, and accreditation are currently underrepresented, according to our data.

Activity	Count
Advocacy	75
Awareness	114
Certification/Accreditation	19
Coordination	64
Education	106
Funding	40
Guidelines	61
Knowledge Translation	105
Leadership	89
Legislation	18
Policy Development	58
Regulation	25
Reporting	41
Research	106
Standards & Tools	48
Surveillance	85
Training	68
Other	6

Volume II Contents

▶ **Section 1:** Summary of Findings from Consultation Series 1: Discussing Possible Functions of a Canadian One Health AMR Network

▶ **Section 2:** Discussion Document for Consultation Series 2: Network Structure

▶ **Section 3:** Summary of Findings from Consultation Series 2: Network Structure

▶ **Section 4:** Discussion Document for Consultation Series 3: Draft Findings and Proposed Models

▶ **Section 5:** Summary of Comparator Organizations