

# **BUILDING CANADA'S ANTIMICROBIAL STEWARDSHIP ACTION PLAN:**

Issues and insights  
from interviews with  
key informants

Prepared by:  
Margo Rowan, PhD, C.E.  
Charles Thompson, MSc.(c)

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*HealthCareCAN is the national voice of hospitals and regional health authorities across Canada. We foster informed and continuous, results oriented discovery and innovation across the continuum of healthcare. We act with others to enhance the health of the people of Canada; to build the capability for high quality care; and to help ensure value for money in publicly financed, healthcare programs.*

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## 1.0 Background

Drug-resistant pathogens are a major national and international public health threat. The problem will multiply as microbes become more resistant to a wider variety of therapeutic options. Consequently, the seriousness of this matter has propelled it to the forefront of clinical and policy agendas. The Public Health Agency of Canada has published a *Federal Framework for Action* (2014) and *Action Plan* (2015) on antimicrobial resistance and use, identifying Stewardship as one of three essential pillars to combating resistance in Canada. Antimicrobial stewardship is defined by the National Institute for Health and Care Excellence (NICE, 2015) as “an organizational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness” (p. 7).

HealthCareCAN (a national organization, representing Canada's healthcare organizations and hospitals) received support from the Public Health Agency of Canada to conduct developmental work on this issue. It convened an expert Steering Committee for advice and direction. As a result, it planned an Action Roundtable on antimicrobial stewardship to be held in June 2016. The overall objective of the Roundtable is to reach consensus on an approach and key activities that would support moving towards a pan-Canadian multi-sectoral Antimicrobial Stewardship Action Plan, ultimately spanning hospital, healthcare and community settings. To help prepare for the Roundtable, it was deemed important to hear from Canadian and international experts in antimicrobial stewardship about their experiences and knowledge in this area and to get their advice on planning for the Roundtable.

This research report describes the approach and findings from interviews with these stewardship experts. While recognizing that other areas, such as surveillance and research are important, and very connected with stewardship, they were not the focus of this work. Also, this research focused on human health, but nonetheless recognizes that animal health is also important, and will need to link with current developments at some point in the future.

## 2.0 Methods

### 2.1 Study Design

A qualitative approach (Patton, 2015) using semi-structured, telephone interviews was used to collect and analyze information about antimicrobial stewardship.

## 2.2 Sampling Method

Key Informants (KIs) were identified using purposeful, maximum variation sampling (Patton, 2015). The Steering Committee generated an initial list of 19 KIs based on their awareness of experts in the area of antimicrobial stewardship. Participants varied by source country (Canada and internationally); setting (acute care, community care, public health, and Long Term Care (LTC)); occupation (program director, medical epidemiologist, university professor, etc.), and health care specialty (dentistry, pharmacy, medicine). Snowball sampling was also used whereby one KI interviewed identified another colleague to contact. Since the project focused on human health and Canadian hospitals, healthcare and community care settings, experts in the area of animal health stewardship were excluded.

## 2.3 Data Collection

All KIs were initially contacted via e-mail by a representative of HealthCareCAN and invited to participate in an interview. She then established a suitable time for the interview and provided KIs a copy of the information sheet and interview guide (see **Appendix A**). One-to-one interviews were conducted from December 23, 2015 to March 14th, 2016 by an independent research consultant. A research associate of HealthCareCAN was also involved in listening, asking supplementary questions, and taking notes during interviews. He also conducted one of the interviews. On average, interviews lasted approximately 60 minutes. KIs were asked a total of 15 questions within the following areas: 1) Antimicrobial Stewardship Leading Practices, 2) Toward a pan-Canadian Antimicrobial Action Plan, 3) Knowledge Exchange and Translation, 4) Links to Other Areas, 5) Final Questions. The interview guide was first piloted with two experts in antimicrobial stewardship and then significantly shortened.

When necessary, KIs were probed further to obtain a rich and detailed account of their knowledge and opinions. Most probing questions were determined in advance; however, the interviewer(s) included other probes to explore new areas that emerged at the time of the interview. To enhance the trustworthiness of the data, interviews were audiotaped with verbal permission, KIs received a copy of the notes to review for accuracy and completeness, disconfirming evidence was consciously searched, and thick descriptions were provided of KIs' ideas via quotations and examples to confirm patterns. Standardized codes were developed and used to analyze the information.

## 2.4 Data Analysis

Interview notes were reviewed, cleaned and sorted by the research associate. A coding framework was developed based on the interview questions and a line-by-line review of the text. The coding process was iterative, whereby the information was reexamined several times before assigning a final coding label. Open (identifying the meaning emerging from information) and axial (seeing if information should be coded under >1 area) coding methods were applied. The consultant performed all of the coding which was then reviewed by the research associate. Inconsistencies were solved through consensus between the consultant and research associate.

## 3.0 Results<sup>1</sup>

### 3.1 Participant Characteristics

Table 1 describes the characteristics of the study's KI sample classified by where they practice or specialize. Thirteen KIs were interviewed for this study in 12 interviews. The Clinical/Policy distinction refers to the sector in which the KI is employed; some KIs have clinical experience, but participated in this study as policy experts. Hospital-based clinical informants included five infectious disease specialists (one international) and one nurse who manages a hospital-based stewardship program. Community-based clinical informants included three primary care physicians, one public health physician and professor, and one community care dentist. Two KIs with internationally based expertise in stewardship policy were also interviewed: one works on acute care stewardship, and one specializes in community-based stewardship. The sample did not contain any domestic policy experts, and included only one informant with expertise in the LTC setting.

Table 1 - Key Informant Characteristics				
Community Type	Setting			Total
	Acute Care	Community Care	LTC	
<b>Clinical Community</b>	5 Domestic, 1 International	4 Domestic	1 Domestic	11
<b>Policy Community</b>	1 International	1 International	---	2
<b>Total</b>	7	5	1	13

<sup>1</sup> Only major trends are reported here. The full set of findings is available upon request.

## 3.2 Antimicrobial Stewardship Leading Practices: Facilitators and Barriers

A wide span of human antimicrobial stewardship leading practices were identified by KIs from international to local and regional developments (see **Appendix B**). KIs were asked to describe what facilitates these programs along with barriers. The following discussion presents these findings.

### 3.2.1 Facilitators

Table 2 provides the main facilitators identified by  $\geq 50\%$  of KI interviews (i.e., during at least six interviews) followed by more specific findings by theme and subtheme.

Table 2 – Facilitators of Antimicrobial Stewardship (identified by $\geq 50\%$ of KI interviews)	
Theme/ Subtheme (# of KI interviews in which theme/ subtheme content was mentioned)	Exemplary Quotations
<b>Involvement of multiple stakeholders to drive stewardship (10)</b>	<ul style="list-style-type: none"> <li>• “All specialties need to be involved because all specialties prescribe antibiotics.” (ID7)</li> <li>• “Our partnership network is as critical as anything we do...it’s through those efforts I think that we probably make the most impact.” (ID9)</li> </ul>
<b>Adequate capital resources (8)</b>	<ul style="list-style-type: none"> <li>• “Investments need to be made at a <i>national</i> level as this will be a much bigger problem in 15 years. First, money and resources need to be devoted to stewardship programs...” (ID1)</li> <li>• “You need some kind of data management system that allows you to efficiently and in a timely way review and access information and get information out to the people who need to know, which are the clinicians, physicians, and nurses who are caring for these individuals.” (ID10)</li> </ul>
<b>Using evidence (7 under each)</b> <ul style="list-style-type: none"> <li>• <b>For measuring performance/benchmarking</b></li> </ul>	<ul style="list-style-type: none"> <li>• “What the literature on this tells you over and over and over again is you need to be able to build a feedback loop in. And I will keep hitting that over the head because it’s feasible in Canada to do that. It’s feasible to link physician billing to show indications with prescriptions and give physicians a profile of their prescribing habits for common indications compared to those of</li> </ul>



<ul style="list-style-type: none"> <li>• <b>Audit and feedback.</b></li> </ul>	<p>their colleagues or compared to a standard and that can be done in a safe anonymized fashion so you're not calling anyone out." (ID2)</p> <ul style="list-style-type: none"> <li>• "You need to have accountability. This accountability needs to rely on a system that provides a feedback mechanism where you know what has been prescribed, how much, how many, and you have a sense of [whether] what you want to achieve is actually being achieved." (ID12)</li> </ul>
<p><b>Leadership (7)</b></p>	<ul style="list-style-type: none"> <li>• "The Public Health Agency of Canada must take the lead and they have not. They have very specifically not addressed this issue for many years...they absolutely need to stand up and say that this is a priority...and we're going to do it." (ID10)</li> <li>• "We also think you need to have a pharmacist who is kind of a co-leader of that program. In some places that person is the same so the pharmacist is the overall leader of that program, but what we've heard from a lot of hospitals is that can be a challenge in some settings because in some cases they say, you know, prescribing is a <i>medical</i> staff function and there are some places where the culture does not encourage and tolerate a pharmacist 'telling a physician what to do'. You've got to know your own culture. I've heard of hospitals where the pharmacist is wonderful, is very supported and they feel like they don't need a physician necessarily as a co-leader of the program and others where the pharmacist says 'My goodness, I would quit if I didn't have that physician who was co-leading this with me.'" (ID6)</li> </ul>
<p><b>Planning and/or organization of the program (7)</b></p>	<ul style="list-style-type: none"> <li>• "Any stewardship program will have no future if it is not well organized." (ID1)</li> <li>• "I think that the idea of having an antimicrobial stewardship team, which is composed of at least one [identified] physician, one medical microbiologist and one pharmacist...is absolutely crucial." (ID11)</li> </ul>
<p><b>Training/education of providers (7)</b></p>	<ul style="list-style-type: none"> <li>• "How do we help providers improve antibiotic use? We know that a bigger part of it probably has to be education of the providers...what are interventions that might be successful and might help providers improve antibiotic use? How do you deliver that education in a meaningful way?" (ID6)</li> </ul>
<p><b>Policy levers (6)</b></p>	<ul style="list-style-type: none"> <li>• "...We really do need policy levers in order to get all the way there..." (ID9)</li> </ul>
<p><b>Stewardship cultural mindset (6)</b></p>	<ul style="list-style-type: none"> <li>• "Programs that have been in place for a very long time are ingrained as a part of medical culture." (ID1)</li> </ul>

### ***Involvement of multiple stakeholders to drive stewardship***

The most common emerging facilitator was the **involvement of multiple stakeholders to drive stewardship**. There was the sense that everyone in healthcare should be included in discussions about stewardship and a space created for them to initiate conversations, foster buy-in, build unity, and develop a coordinated message to practitioners and the public. It was noted that some stakeholders might be easier to bring to the table than others, noting, for example, that dentistry has had a problem with stewardship in the past owing to the different standards from the medical profession on antibiotic prophylaxis.

Stakeholders were mentioned as, for example:

- **Prescribing professionals: physicians, pharmacists, specialists (e.g., respirologists, intensivists, internal medicine, surgical subspecialties), dentists, midwives, naturopath prescribers.**
- **Professional societies and associations representing prescribing professions and setting or recommending policies in this area (e.g., Accreditation Canada).**
- **Educational faculties associated with prescribing professions, e.g., Faculties of Medicine and Pharmacy.**
- **Government departments (Federal and Provincial).**
- **Public health.**
- **Consumers or patients.**

A few examples were described of successful multiple stakeholder-involved approaches from Canada and around the world. In Canada, examples included programs from Ontario (Mount-Sinai-UHN Antimicrobial Stewardship Program) and QC (Association des Médecins Microbiologistes-Infectiologues du Québec). Internationally, the US Center for Disease Control (CDC) is active in partnering with other system entities, such as the Veterans Administration, to develop more standardized approaches to stewardship in ambulatory care<sup>2</sup> and to promote integration of systems between ambulatory, acute, and LTC settings. On this note, much can be learned from the Dutch Working Party for Antimicrobial Policy, known as SWAB. SWAB collaborates with important players in the field including, but not limited to, government, professional societies of internal medicine, medical microbiologists, hospital pharmacists and general practitioners. SWAB's activities including guidelines, surveillance and other interventions are subsidized to the tune of 400,000 Euros per year. Every year, SWAB develops an Action Plan and applies for funding from the Institute of Public Health. SWAB's board is

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<sup>2</sup>By ambulatory care, we mean outpatient or primary care in the community. Throughout this is simply referred to as community care. Acute care also means inpatient care.



composed of representatives from many backgrounds (from pediatrics to veterinary medicine). Board members are, in fact, mandated by the professional societies of the Netherlands. Meetings are held five to six times a year, though there are sub-working groups that work on surveillance and other activities each holding separate meetings. SWAB's success is owed to "...getting everybody on board and also by having people who are knowledgeable." (ID11)

### ***Adequate Capital Resources***

Capital resources, such as funding, Information Technology (IT) and other tools/equipment were frequently mentioned as vital facilitators. A strong positive relationship was identified between the success of an anti-microbial stewardship program and adequate funding. One example of this pairing includes the Antimicrobial Stewardship Programs under the Adopting Research to Improve Care (ARTIC) initiative organized by the Council of Academic Hospitals of Ontario (CAHO). It was also noted that stewardship in Alberta is better funded than in other provinces resulting in the perception that "Alberta does a little better than some places in terms of hospital utilization." (ID2) Internationally, it was reported that the Belgian Antibiotic Policy Coordination Committee BAPCOC has financially and technically supported the development of antibiotic management teams (AMTs) in hospitals. Further described was the situation in Croatia, which undertakes stewardship efforts through the Inter-sectoral Coordination Mechanism for the Control of Antimicrobial Resistance (ISKRA). Antimicrobial Resistance was branded as an *economic issue* to make the funding application feasible.

IT (hardware and software) was viewed as a valuable resource to support stewardship. Several KIs stressed the importance of having some kind of data management system in acute, community and LTC settings that allows providers to efficiently and in a timely way access and use information for clinical decision making: "[One] thing that you need is some sort of software to be able to manage the data; something that's connected to pharmacy and linked to the hospital database." (ID7) This might include, for example, the use of automated order entry forms to determine key information when an antibiotic is prescribed, such as the indication for which it was described and whether the illness was nosocomial or community acquired. Few KIs mentioned any innovative, let alone basic examples of IT systems in Canada, with the following exceptions: 1) The University of Sherbrooke program leans heavily on software that is interfaced with prescribing activity as well as lab data to track the appropriateness of prescriptions and 2) Calgary uses a computerized order entry system and is developing a series of electronic antimicrobial order sets, whereby once a diagnosis is registered, the software generates a management plan that the prescribing physician may then opt into or modify based on her clinical experience.

An exemplary IT tool described by one KI was that of the award winning iPhone application called 'Spectrum Calgary'. This iPhone application integrates local pathways and guidelines and uses the local antibiogram (a summary of local antimicrobial susceptibilities and resistances) to help guide prescriber behaviors. "The joy of it is that it has all the local pathways and guidelines and you can download it and look at it yourself and it has our local antibiogram...the guidelines are interpreted according to the susceptibilities of the organisms of patients presenting in Calgary and surrounding areas." (ID 8) This flexibility in the use of guidelines is somewhat similar to what is available in the Netherlands. Here, guidelines are written nationally for management of infections for a variety of different indications and situations. Hospitals can access these guidelines online and download a guidelines template. From this, they can pick and choose which options they believe are most pertinent to their patient population.

The use of an EMR to facilitate stewardship was noted. One KI suggested that much of the stewardship agenda in the community could be facilitated by an EMR. Reflecting on the situation in the US, one KI reported that HMOs tend to invest more strategically in IT, including in electronic health records that provide instantaneous feedback to the prescriber about the appropriateness of a given prescription. Both suggested that this is something we need to look at closely in Canada for "when you're talking about prescribing something it is relatively easy to be able to put in little reminders or little comments or something that forces somebody to rethink or think about what they're doing." (ID5)

Specific to LTC, access to on-site laboratories, radiology, and other diagnostic equipment are key to facilitating an anti-microbial stewardship program. Yet LTC is currently lacking in these essential tools particularly if a site is not attached to a hospital. One KI described her experience: "In LTC, sometimes a barrier is laboratory access...most LTC facilities do not have on-site laboratories. Most of them would not be able to collect their own blood cultures for instance – somebody has to go out and pick them up and bring them back... It's a lot easier to give antibiotics than to get a chest x-ray done in a [LTC] facility...The clinical approach to diagnosis is usually much more uncertain in elderly populations in LTC facilities – for a number of reasons – but I'm not sure that's something we can do anything about so it's a matter of working around that." (ID10)

### ***Using Evidence***

Most KIs described evidence as being used to **measure performance/ effectiveness/ appropriateness/ benchmarking**. It was noted that ideally data collection practices need to be reliable, valid and modernized, preferably connected to IT systems, whereby, for example, prescribing activity as well as lab data can track the appropriateness of prescriptions. Such is

the case for the University of Sherbrooke program that is IT/IS based. The issue was raised about the “right” performance measure metrics and targets for antibiotic usage. Success was observed internationally: Sweden does a good job of measuring usage trends in their country and elsewhere in Europe; Scotland is notable for the use of data to demonstrate the efficacy of stewardship programs; and the NHS has developed regional performance measures for antibiotic use. Notably, the US has developed a new, yet “promising” risk-adjusted national benchmark measure for antibiotic use and it has been endorsed by their national body. It is seen as being a potential metric by which to identify top performers. Furthermore, the US is also working on establishing national goals for reduction, whereby by 2020 there will be a 50% drop in inappropriate prescribing. Although ambitious, setting a target goal has fostered the need for quantification as to how much antibiotic use is inappropriate. KIs were mostly silent regarding Canada's involvement in setting or measuring national or provincial performance targets. One respondent suggested that “the Federal government should set guidelines or targets” (ID3), implicating provincial governments in the process.

Most KIs viewed **audit and feedback** as essential for stewardship programs with many suggesting that, based on the evidence, alerting physicians to his/her prescribing performance (relative to a peer or some standard) was among the best ways to influence prescriber behaviour on an on-going basis. Furthermore, the advantage of audit and feedback over purely educational approaches was summed up clearly by one KI: “What's clearly working...are those who are employing the most evidence-based approaches and by and large those approaches are not purely educational. They involve feedback to the prescriber towards encouraging best practice; letting them know when they're out of line with their prescribing; actually restricting availability of some drugs to certain types of practitioners...If you prescribe the wrong thing, somebody's going to pick up on that or an automated algorithm tied to a prescription system is going to pick up on that and it provides feedback to an individual...If there's deliberate feedback, things work better.” (ID2) A few examples were provided of this practice in acute care settings in Canada, such as programs from Charles Lemoyne Hospital, McGill, and Mt. Sinai-UHN.

KIs described examples of audit and feedback systems from the US, particularly in outpatient settings. The California Medical Association runs a program called ‘California Aware’ which involves monitoring individual provider performance based on Healthcare Effectiveness Data Information Set called HEDIS measures. In collaboration with payers, the program sends information to providers as a form of feedback along with educational materials. In general, HEDIS measures are nationally reportable metrics used across the US to track outpatient prescribing behaviors. There are three metrics relevant to surveillance of prescribing that were developed in consultation with CDC: 1) prescribing for upper respiratory infections in children,

2) adult prescribing for bronchitis, and 3) ordering group-based streptococcal tests in presumed cases of Group A Strep. Consideration is currently being given to more broadly incorporating a feedback mechanism to the HEDIS program, such as the one in California: "Right now we're in conversations with a lot of the payers in the US about how we can better leverage these existing metrics... In the past there's been tracking of these metrics, however; without any feedback to providers or without any – I would say – incentives or disincentives it doesn't necessarily change practice...if it's not changing practice then, kind of, what is the point?" (ID9)

### ***Leadership***

**Leadership** was identified as an important facilitator for stewardship at various levels within the health system: micro (institutional, practice); meso (regional, provincial); and macro (Federal). There was no specific mention about leadership on antimicrobial stewardship in community practices. At the **micro level**, leaders in acute care settings were viewed as willing and committed "champions", who, as senior executives, were effective at managing barriers and in liberating necessary funds and human resources for stewardship. One KI noted that it is at this level where the important distinction between a hospital hygiene program and stewardship program needs to be made. Medical directors in LTC, and hospital administrators, physicians and pharmacists were also seen as "on the ground" leaders who provided direction and focus for implementation. Speaking about this level of leadership, one KI indicated that "...leadership is probably the most important thing. Good leaders make good programs" (ID3). At the **meso level**, regional Presidents/CEOs were essential in determining program success. In addition, provincial governments were implicated: "My sense is that you need to have the provincial minister of health and social services involved...that's something that should be picked up by this type of organization." (ID12) It was also expressed that professional bodies could influence their members by sending a coordinated message about stewardship. For example, the Association des Médecins Microbiologistes-Infectiologues du Québec has put in place a formal stewardship program in Quebec hospitals. Finally, **macro level** leadership, for example in setting guidelines or targets, was noted as necessary, but lacking in Canada. Reflecting on other countries' national leadership, one KI noted that "the UK's Chief Medical Officer of Health has played an invaluable leadership role" and that "[programs based in Scandinavia and the Netherlands] are the most effective worldwide because of leadership and engagement at the top level" (ID1)

### ***Planning and/or organization of the program***

Another important facilitator was the **planning and/or organization of the program**, which included a number of separate concepts. A couple of KIs indicated that an antimicrobial program should take a **holistic and comprehensive approach**: looking at the issues from

multiple angles. KIs referenced programs in Scotland and Denmark that exemplified this ecological perspective on programming. A few KIs suggested that there were significant advantages to having a **centralized program** that captures groups of hospitals within a given province, eliminating duplication efforts, and avoiding the problems of healthcare silos. In discussion of one program based in Ontario, one KI noted that its province-wide nature also lifts the program's perceived importance, raising its priority at the executive level and making barriers more manageable. Thus, evaluating stewardship is possible in a way that it might not be if the program were not a priority for senior executives. (ID1) A few KIs noted the negative effect of a decentralized system including incompatible drug formularies across hospitals that are expensive and cumbersome to develop; inconsistent surveillance systems; and balkanized decision-making resulting in difficulties to develop and implement a EMR, with its concomitant effects on stewardship. Furthermore, having **well developed program goals, a strong focus on implementation and a targeted focus/mandate** were very important facilitators noted by several KIs.

Identifying the **Most Responsible Person (MRP)** to lead or take responsibility for the program was vital according to several KIs. As summarized by one KI: "Essential to the process is that a single person, whether that be a physician or a pharmacist, needs to be responsible for stewardship. This is not a role that can be 'tacked on' to someone's existing responsibility. Nor should it be delegated to a committee. Moreover, the process should involve a pharmacist, who might behave as either a leader or co-leader of stewardship effort. The acceptability of the pharmacist-as-leader schema will depend on local culture." (ID6) There were concerns raised about who should be the MRP and some controversy emerged about whether the lead should be a physician vs. a pharmacist, noting that the "health care force is tribal" and that physician engagement can be a problem when stewardship efforts are led by pharmacists exclusively. (ID1) Furthermore, one KI noted the challenge of identifying a MRP in outpatient settings: "We know that there are interventions that work in ambulatory care. There have been many studies of interventions over the years and there are definitely interventions that work. The challenge is identifying who will take ownership and leadership over implementing them?" (ID9)

The final planning and/or organization component was the **creation of a multidisciplinary team with clear roles**. The number and type of team members envisioned by KIs varied. For example, the Mount-Sinai-UHN Antimicrobial Stewardship Program covers seven separate hospital locations and has an extensive team involving physicians, nurses, pharmacists, data analysts, program research coordinators, administrative support, a program manager and a project manager as well as an oversight committee. On the other end of the spectrum, one KI considered a smaller team composed of at least one ID physician, one medical microbiologist and one pharmacist. (ID11) The differences in expectations around team size and composition

may be related context as described by one KI: “[Hospitals] range from five bed – or even smaller – rural community hospitals who might hospitalize patients with community-acquired pneumonia or something that’s not that serious. At the other end of the spectrum we’ve got these tertiary or quaternary care thousand-bed referral hospitals doing bone marrow transplants. We need good antibiotic use in both those hospitals, but clearly the program that gets you to good antibiotic use is going to look very very different [in each]”. (ID6)

### ***Training/education of providers***

**Training/education of providers** was reported as a key facilitator by most KIs. Many listed existing guidelines and/or training programs related to antimicrobial resistance across Canada and internationally, such as Calgary’s stewardship preceptor program for pharmacists and ‘Décision Plus’ training program embedded in family medicine residency training in Quebec. KIs were asked about the facilitators to enhance the use and spread of best practice tools and/or training programs. A few KIs suggested the need for stakeholder engagement and buy-in to catalyze interest, particularly as programs demonstrate their value. One KI describes their experience: “...we had two big national training sessions where we invited from all the hospitals the ID physician, the microbiologist and the pharmacist for a training program that was hands-on and they had to prepare themselves and the intervention and stewardship activity that they will do and start a discussion...” (ID11) A few KIs noted the need to adapt guidelines to the local context: “The last thing we need are [more] guidelines. What we need a little bit more is local guidelines that are based on local epidemiology. Guidelines at the national level, they always want to cover everything... I don’t think we lack in terms of information; what we lack is individualized evaluation.” (ID7) In contrast, one KI noted that there are very few guidelines for dentistry. (ID4)

Gaps were identified by several KIs in the availability of courses/training on infectious disease or other topics related to antimicrobial stewardship particularly for pharmacists and nurses, and those that exist are “too meager” (ID8) One KI noted that “there is, at present, no standing course geared towards pharmacists on infectious disease.” Pharmacists interested in such training must take courses administered out of the United States because there is no Canadian equivalent. (ID1) Another KI specifically noted that training nurses is especially important in LTC settings, though another felt that education alone was insufficient to make a difference in the long run without accompanying regulatory changes (for example, regulations governing when urine cultures should be ordered). The logical consequence of inadequate training is the perception held by several KIs that Canada lacks stewardship expertise in hospital settings, LTC and outpatient care. In answer to this gap, some KIs specifically cited the interplay between regulation and education: “the more people start hearing about this being a requirement, the

more we'll begin to see professional societies developing and launching training programs for antibiotic stewardship." (ID6)

### ***Policy levers***

**Policy levers** were raised by many KIs as essential tools to facilitate antimicrobial stewardship programming. Three forms of policy levers were mentioned. The most common form mentioned was **accreditation/regulatory/standards**. Several KIs were encouraged about having **accreditation standards** for Canadian hospitals and thought they should be spread to LTC facilities: "It was really a good move forward that accreditation came in; we need the same thing for long-term care facilities." (ID2) **Regulatory systems** were described more in the context of the US system. One KI talked about using regionally focused guidelines to move into a "more regulatory approach" (ID10) to Canada's LTC system. This KI was emphatic about the need for a regulatory system in Canada: "...My perspective is if you're going to have an effective antimicrobial stewardship program in LTC or anywhere else it has to be, in fact, regulatory." (ID10) **Drug formulary** was another policy lever suggested by a couple of KIs, and both pointed to the action taken in Alberta: "The best approach to dealing with [hospital drug formularies and stewardship] that I've seen so far has been Alberta's move towards a shared hospital formulary with shared recommended stewardship practices." (ID2) Finally, **legislation** was mentioned in the context of the California health system which "is the only state in the US that has a formal state requirement that hospitals have antimicrobial stewardship programming." (ID6) Although viewed as positive, enforcement was a concern: "Legislation in and of itself is a great step, but 'how do you enforce it?' is another question." (ID9)

### ***Stewardship cultural mindset***

The **cultural mindset** that helps facilitates stewardship was mentioned by several KIs. As one KI described, it is something that develops over time: "Programs [that] have been in place for a very long time [have it] ...ingrained as part of medical culture." (ID1) Results from interviews suggest that this is something that European countries have more in common than Canada, partly because they have had programs in place for a longer time and have addressed and communicated the lessons learned. In consequence, European countries have been better able to influence professional and consumer thinking on antimicrobial use. One KI suggested that Scandinavian countries seem to publish a great deal about stewardship and their metrics suggest that, as a region, these countries are low consumers of antimicrobials. This may be a result of the interplay between education and culture in these nations. (ID6) By comparison, when asked "And how long have we [in Canada] been [engaged in stewardship]?" one KI replied "I'm still waiting for us to start." (ID1)



### 3.2.2 Barriers

Table 3 provides the barriers identified by  $\geq 50\%$  of KIs followed by more specific findings by theme.

Table 3 – Barriers of Antimicrobial Stewardship (identified by $\geq 50\%$ of KI interviews)	
Theme (# of KI interviews in which theme content is mentioned)	Exemplary Quotations
<b>Not having or using evidence (10)</b>	<ul style="list-style-type: none"> <li>“Even in the best of circumstances where everyone is implementing stewardship in their ambulatory care settings, we’re still not going to probably get where we need to be...we need to really identify the interventions that are going to really reduce inappropriate use all the way. (ID9)</li> <li>“You don’t have a unified structure for looking at the use of antibiotics in humans from the beginning to the end; from outpatient to inpatient care, nursing homes, long-term care facilities etc...” (ID3)</li> </ul>
<b>Not recognizing/appreciating the importance of stewardship (9)</b>	<ul style="list-style-type: none"> <li>“I think we’ve been left behind, and I think it’s a real embarrassment the way Canada has simply not moved forward. And I understand why that is – it’s the usual issue with the Canadian healthcare system, it’s a provincial responsibility in terms of delivery and somehow it hasn’t been a priority...it’s a real disappointment.” (ID10)</li> <li>“This is a relatively new field, and its success is compromised somewhat by a longstanding belief in the tools of infection prevention and control. There used to be few resistant biota and many antibiotics to leverage against them. Now the situation is reversed, but the mindset has not. Therefore the response to resistance has been to isolate affected patients rather than to engage in stewardship efforts that would prevent or delay resistance.” (ID1)</li> </ul>
<b>Inadequate human resources (8)</b>	<ul style="list-style-type: none"> <li>“[In LTC] the resource issue is a tremendous struggle. These are settings where there may not be physicians around. There may</li> </ul>

	<p>not even be advanced practice nurses around. So a lot of the care is provided by nursing assistants and nurses' aides." (ID6)</p> <ul style="list-style-type: none"> <li>• "A huge number of dedicated people are required to make stewardship programs work and the budgets we have in place are simply not adequate to sustain the effort required." (ID2)</li> </ul>
<b>Inadequate financial resources (6)</b>	<ul style="list-style-type: none"> <li>• "It's all about getting the money...Most programs are either inadequately funded or are not funded at all. No provincial government has funded stewardship efforts directly in hospitals or in the community, and there is no billing code that the physicians can tie to stewardship efforts for the purposes of compensation." (ID1)</li> </ul>

### ***Not having or using evidence***

The most commonly mentioned barrier was that of **not having or using evidence** for stewardship programming. Several KIs talked about the primary need for adequate **surveillance** data as a vital link for stewardship: "You have to do surveillance; you have to do surveillance for antimicrobial resistance and for antimicrobial use and there has to be a good way to do that effectively and efficiently." (ID10). From this research, there is evidence to suggest that surveillance in Canada is somewhat progressing in acute care, such as in major centres in Alberta and Quebec. The US is also advancing in acute care surveillance efforts lead by CDC and on the outpatient front supported by HEDIS metrics. One KI suggested that Canada needs to work towards a standard set of metrics for surveillance: "One hospital may use DDDs (Daily Defined Doses), one hospital may use PDDs (Prescribed Daily Doses), another may use DoTs (Days of Therapy). We have to make sure that we use the same units; that surveillance targets are the same." (ID7) Moreover, several KIs indicated that Canadian specific surveillance data are suboptimal or non-existent in outpatient and LTC settings, and in dentistry.

Issues were raised about **performance measurement and evaluation** of stewardship programs. Several KIs mentioned the lack of robust evidence to identify the most effective interventions related to antimicrobial stewardships: "We need more clinical studies that evaluate [situations] where antimicrobials were used or not used in different ways to assist clinicians...there is some evidence, but there needs to be more. Different types of questions need to be asked." (ID10) There were also concerns raised by individual KIs about:

- **Measurement, benchmarking and the identification of quality indicators:** "The other barrier that we encounter a lot on the inpatient side is on the measurement piece.

People want to know 'how do I know if I'm doing a good job of improving antibiotic use.'" (ID6)

- **Having an IT system to support the collection of indicators:** "Does the program have IT resources sufficient to measure quality indicators?" (ID11)
- **Long term impacts and sustainability of evidenced based interventions:** "...There are publications that describe programs – some of them provide evidence of efficacy – but they're short term, multiple interventions. It's not at all clear how sustainable they are...they need lots of resources." (ID10)

### ***Not recognizing/appreciating the importance of stewardship***

Noncommittal beliefs and attitudes towards stewardship were raised as a barrier to moving programs forward: "There's got to be credibility and that credibility needs to be built from many levels." (ID4) Part of this credibility, according to one KI, relates to the misperceptions of leaders. According to this KI, programs organized by Public Health Ontario and BC have been modestly successful, but are stymied somewhat by the perspectives of their leadership. Of particular note is that the programs focused on antimicrobial stewardship are led by specialists in infection prevention and control. This KI felt that there should be recognition that stewardship and prevention/control are different objectives and programs should be organized, funded, and delivered differently as a result. (ID1)

Resistance to stewardship efforts was voiced on several fronts. Several KIs discussed the challenge of meeting **patient expectations and demands**. In outpatient care, it was seen by one KI as difficult to communicate the "collective good" to patients: "...When you're in the heat of the encounter and you have a specific patient facing you, it's very hard sometimes to get abstract enough to understand that you need to reflect on the collective good... A patient doesn't think that he's contributing to the collective good. He has a health issue and he wants you to have a solution..." (ID12) One KI in the US noted the dilemma associated with meeting patient satisfaction vs stewardship: "...The challenge is we're very driven here by patient satisfaction. What can happen is a patient goes to an ambulatory care provider and the provider doesn't give them an antibiotic – they're not satisfied – they can go online and give them a negative review." (ID9) Another concern mentioned by KIs was the **pharmaceutical industry**. One KI indicated that their interest is more in overuse of medications over their appropriate use. Another suggested that they had little interest in developing new antibiotics as they are prescribed for a short course compared to those drugs used to treat chronic conditions, thus concluding that "Talk of stewardship is antithetical to the interests of the

pharmaceutical industry.” (ID3) Finally, several KIs noted **resistance to stewardship efforts** in providers in general: “It’s the general resistance to change in practice that we see in all professions across the board...I think the longer you’re in practice the more you get married to ideas and your experience supports that. You know, ‘I had that one horrible case’ and ‘if I hadn’t prescribed antibiotics for a month that patient would’ve died’ and that’s what sticks in people’s minds...Antibiotics have been around for so long and have done so much good that people are fearful of changing practice...fearful of doing the wrong thing I think. (ID4)

### ***Inadequate human resources***

Inadequate human resources were viewed as a primary barrier to implementing stewardship programs by most KIs, particularly noted in acute and LTC settings and involving physicians, pharmacists, and to a certain degree nurses. One KI indicated that a 2012 survey of 90 hospitals studied in Quebec showed that while 30 claimed to have active stewardship programs, far fewer met fairly basic criteria for acute care stewardship, notably the presence of a full-time dedicated pharmacist or surveillance efforts: “They don’t do very much because they don’t have the resources.” (ID7) One KI pointed to the economic argument for investing in properly resourced stewardship programs: “If you take a look at how these programs can reduce the rate of prescribing in a favorable direction in terms of human health they’re actually saving more money in drug costs alone than they’re costing.” (ID2)

KIs talked about their struggles to implement a program given inadequate resources: “What you have is ...full-time physicians trying to implement policies to control the amount of antibiotics being used. They have a limited amount of resources, and it’s difficult to implement something on a much wider scale.” (ID3). It was noted that of the 4-5 specialist physicians working in antimicrobial stewardship at a certain Quebec hospital, none was specifically compensated for this work. Furthermore, lack of continuity of staff (pharmacists and residents) was a concern resulting in the need to “reset” the hospital stewardship program to cope with turnover: “We lost a pharmacist ...[who] was not replaced for about a year and a half and we went right back to where we were before...That’s typical; that’s happened to me many times...And then it takes about probably a good 3-6 months for them to become functional..” (ID7)

### ***Inadequate financial resources***

Another important barrier indicated by several respondents was that of **inadequate financial resources** for stewardship programs, particularly in Canada. Comparatively speaking, one KI indicated that the US has spent about *776 million USD* on stewardship programs; the UK has

spent *over 500 million GBP* on such programs and Canada as a whole has devoted only about *4 million CDN* on stewardship (ID1). An exemplary quote to further highlight this barrier is provided: "Hospital physicians do not feel as if they have the resources at their disposal to do antibiotic stewardship the way they'd like to do it; they don't feel it's a high enough priority for their facility in terms of executives and leadership willing to give them the support that they need...that always comes up as the number one concern". (ID6)

### 3.3 Toward a Pan-Canadian Antimicrobial Action Plan

This section shifts the focus towards planning for the upcoming Action Roundtable.

#### 3.3.1 Priority Topics to Address at the Roundtable

Table 4 describes the perceived importance of inclusion of various aspects and activities in a national action plan on antimicrobial stewardship as judged by KIs. Informants were asked to judge the importance for inclusion based on a five-point Likert scale, where 1= low importance and 5=high importance.

Results suggest that all topics were rated as important, with management and organization of a stewardship program rated the highest and patients at the lowest end. The following describes KIs expressed thinking about their ratings.

***Management and organization of the stewardship program*** (e.g., including leadership, expertise, team membership and roles, an effective change management process, adequate funding).

This was the highest rated topic to include in the Action Plan as: "Any stewardship program will have no future if it is not well organized." (ID1) Leadership, adequate resources and the involvement of multiple stakeholders were also mentioned by several KIs as vital components to support the management and organization of programs. It was cautioned that not all stewardship programs should be exactly the same, depending on the size and setting for the program. One KI specifically noted the difference between acute care and outpatient settings: "... In the acute care setting, this is probably extremely important and I would give it a high mark. In an outpatient setting, the question is 'Does every practice actually have a stewardship program?' or do they just implement one intervention and not necessarily even have a full-fledged program." (ID9) Another KI indicated that a program should reflect the local decision making of the hospital: "I think there can be some room for local autonomy in terms of what that leadership looks like...I think there are different ways to crack this nut in terms of which human resources are applied and how. That will also be dependent on the IT/IM support that

you've got. There has been a move towards [defined human resource ratios in hospital stewardship] and maybe that's the way it is unless you've got more IT/IM support. You can imagine that if you've got five pharmacists running around a university hospital network checking up on people's prescription that if you had an automated feedback loop you might be able to do it with fewer. You don't want to be so prescriptive that you end up saying 'okay this is the human resources you require from now to eternity.'" (ID2)

**Table 4– Key Informant Responses: Importance of Inclusion in Action Plan by Topic<sup>3</sup>**

Interview ID	Management and Organization of Stewardship Program	Evidence Informed Best Practices	Evaluation and Metrics	Knowledge Exchange and Translation	Patients
<b>1 (a)</b>	5	3	3.5	4	4.5
<b>1 (b)</b>	5	4	3.5	4	4.5
<b>2</b>	4	5	5	4	4
<b>3</b>	4	5	5	4	3
<b>4</b>	5	5	3	5	5*
<b>5</b>	5	5	4	4	4
<b>6</b>	5	5	5	3	4
<b>7</b>	5	3.5	5	5	3
<b>8</b>	5	3	4	3.5	3.5
<b>9</b>	Missing	5	5	4	4
<b>10</b>	5	5	5	Missing	3
<b>11</b>	5	5	5	5	3
<b>12</b>	5	5	5	5	5*
<b>Mean</b>	4.83	4.50	4.46	4.21	3.88

One KI from CDC reflected on their experience in the US and echoed the importance of having “a flexible framework that can be applied in any setting [whereby] the focus [is]... on what healthcare facilities or providers do, and not on precisely how they do it.” (ID6) This KI outlined seven core elements published by CDC that operate on this principle:

1. Leadership Commitment: Dedicating necessary human, financial and information technology resources.

<sup>3</sup> Asterisks in the table represent cases where KIs responded with a 6 on that five-point scale, indicating that they felt this factor was the most important to include. These assessments have been adjusted downwards to five in order to fit the scale.

2. **Accountability:** Appointing a single leader responsible for program outcomes. Experience with successful programs show that a physician leader is effective.
3. **Drug Expertise:** Appointing a single pharmacist leader responsible for working to improve antibiotic use.
4. **Action:** Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (i.e. "antibiotic time out" after 48 hours).
5. **Tracking:** Monitoring antibiotic prescribing and resistance patterns.
6. **Reporting:** Regular reporting information on antibiotic use and resistance to doctors, nurses and relevant staff.
7. **Education:** Educating clinicians about resistance and optimal prescribing.

***Evidence informed best practices*** (e.g., addressing prescribing practices and prudent antibiotic use).

To most KIs, evidence was seen as the basis to guide any stewardship program: "[Evidence] is the foundation...You want to make sure that when [antibiotics] are needed they're used optimally and when they're not needed there's a natural pathway to non-prescription. All that goes back to a really good review of the evidence that's pertinent to the patient population you're working with." (ID2); "Evidence informs everything. To give credibility to any sort of strategy evidence is very important...if you're going to give any sort of guidance you have to be backed by evidence." (ID4) However, a couple of KIs indicated the sense that the evidence base is sufficient and that the focus rather should be on translation: "We cannot do without [evidence informed best practices], but I think a lot of it is out there. I think we don't necessarily need to put the emphasis on getting the evidence. I think there's lots of evidence in the literature. I think even most people know about it. But the problem is how do you translate it?" (ID7) Contrary to this thinking, one KI noted that the evidence base is insufficient and more research is needed: "Nobody really knows what an optimal stewardship program is. The basic research in terms of trying to find what is necessary and what is effective and how effective can it be? It's quite possible that even the most effective programs we can generate will have quite a limited impact." (ID10)



***Evaluation and metrics*** (e.g., monitoring data through local labs, measuring success of interventions and areas to improve, providing feedback and follow-up).

Evaluation and metrics were rated third in importance for the national action plan on antimicrobial stewardship, with one KI indicating: “A national action plan must have some concrete, measurable outcomes.” (ID6) As previously mentioned in the section on facilitators, these concepts were associated with monitoring implementation, benchmarking and audit and feedback: “The importance of measuring is absolutely vital. That’s where you need [standardized metrics] so that if you apply methodologies against it you’ve got something to be able to evaluate your success or failure as you move forward.” (ID8) However, one KI warned against waiting for the perfect metric system before launching into stewardship: “It’s important, but sometimes I feel that people put it so much as an important thing that they say ‘okay well we’re trying to have the metric first before we do something to improve practice’ and that’s where I think we need to be careful. It’s an emergency sometimes to act and you cannot wait for the perfect system in place.” (ID12) Several KIs pointed to gaps in current data systems, such as insufficient data.

***Knowledge exchange and translation*** (e.g., training, education and awareness for healthcare professionals and the public; regular updates and communication to ensure providers have rates and trends of antimicrobial prescribing and are aware of new antimicrobials).

Although rated as important, most KIs indicated that knowledge exchange and awareness were insufficient to guarantee practice change or have any significant impact on prescribing trends. There was the sense that other factors were more important, such as providing audit and feedback and properly managing the program: “We’ve been providing education and training for years. The problem is it goes in one ear and out the other...unless you’re there continuously managing the process and pounding the pavement people revert back to their old habits.” (ID8); “Providing feedback in terms of rates and trends would be a number 5. That by itself can change behavior and has done so repeatedly, especially with surgeons. But education and awareness for clinicians and the public should be rated somewhat lower. Not that it shouldn’t be done, but it’s not going to have a big impact.” (ID10)

***Patients*** (e.g., education and accountability)

As an area to include in the national action plan on antimicrobial stewardship, “patients” were rated less important than other areas. Several KIs indicated that patient education was “part of the solution” (ID5) towards a culture change in antibiotic use as: “[Patient attitudes are] a major

determinant of whether physicians prescribe...on a broader societal level the education of patients goes beyond their own personal use of antibiotics.” (ID2) A couple of KIs noted that patient engagement in hospital settings presents more challenges, and is likely less important than in the community: “In the outpatient arena, patient engagement absolutely is critical...If you’re talking about the hospital setting, I think patient engagement in antibiotic use improvement is a little bit down the road – we don’t even know how best to do that, we’re struggling with that...” (ID6) One KI indicated that patients cannot be held accountable and that messaging can backfire: “I don’t see how you can make patients accountable...Yes, they demand antibiotics sometimes but I don’t think you can blame them for that... Patients who receive the message that they shouldn’t overuse antibiotics can become reticent to use antibiotics in any circumstances. Educating them otherwise might take five times as long.” (ID10) Nonetheless, there were various suggestions mentioned by one or two KIs about how to get the message across to patients:

- **Appeal to different generations, cultures and languages:** “There is a change in the mentality of many people. If you look at the older generation that was used to getting antibiotics for everything, if don’t give them an antibiotic they’re pissed off; you know, they’re not happy...The younger generation is probably more aware of the balance between giving and not giving antibiotics...[one challenge involves] some immigrant populations coming from areas where they can buy antibiotics on the corner of the street. Suddenly you tell them not only can you not buy antibiotics but I’m not going to give you an antibiotic as a physician.” (ID3); “Public awareness campaigns in both official languages are important. These campaigns should be adaptable to different cultural contexts as well.” (ID12)
- **Provide consistent messaging across inter-professional disciplines:** “A lot of patients come in and say ‘well you know my orthopedic surgeon said I need antibiotics and I educate them as to why I don’t believe that’s necessary and ask them to go back and see their orthopedic surgeon...We’re working with [orthopedic surgeons on inter-professional guidelines] but it’s going to take a long time...That will be one of the ways to overcome barriers is to have a common inter-professional stance on things.” (ID4)
- **Start early:** “Patients should be educated early, at school...Most of these campaigns towards adult or educating parents of small children not to use antibiotics; we think it’s too late and it’s the wrong moment...It’s like educating them how to brush their teeth.” (ID11)

### 3.3.2 Health Care Settings to Prioritize

KIs were asked which settings (e.g., acute care hospitals, community care, and LTC) to prioritize in advancing antimicrobial stewardship. Looking towards the US experience, one KI explained how it has used a phased approach, first focusing on primary care, then acute care and more recently, LTC. It was noted that acute care-focused programming in the US is the furthest along today, despite starting in primary care. More importantly, the initial focus of stewardship might have been different given their experience over time: “To be honest, I think [CDC’s choice to start stewardship efforts in the outpatient setting] stemmed from the group at CDC that had that initial interest in doing this. The whole effort was part of what’s known as our respiratory diseases group...I think if we were approaching it *de novo* now it would probably look very different, but that’s how it evolved.” (ID6) The rationale behind the implication that it would have been better to start with acute care is likely because the US has seen success in this setting: “You’ve got infrastructure; you’ve got a good scientific basis and good examples of what people can do, and we also have a good measurement system – the national healthcare safety network which CDC runs. The antibiotic use measurement part of that is very nascent but the platform exists already in all of the acute care hospitals in the US along with a measurement system that hospitals are very comfortable with and used to reporting into. All of the pieces are there and some of these regulatory and payment pieces are there as well, allowing us to really take some advanced steps in the acute care setting...On the outpatient side we’ve historically had good data...but much much less has been done on how to improve use...there are some challenges that we face there.”(ID6)

Likewise, several KIs indicated that acute care should take priority:

- **Interventions are more well-known:** “...we know the most about interventions in the acute care setting and are most likely to succeed there...” (ID1)
- **Uptake will likely be higher:** “Where the rubber hits the road is in acute care hospitals. This is where patients get infections that they die from. And I think the uptake in acute care hospitals – probably teaching hospitals – will be better. (ID4)
- **Programming will likely influence norms in the profession:** Hospital-level programming is likely to influence norms in the profession that may ‘trickle down’ into the community as there are family physicians who do some work in hospital settings who conceivably would spread stewardship into the community. (ID1)
- **There is better infrastructure upon which to build a program:** “In acute care hospitals, there is an infrastructure that you can build upon to develop a program...” (ID9)

- **A captive audience:** “It is a challenge to implement in the community because there’s so many places to do it. There’s only so many hospitals and it’s a captive audience to some extent, whereas in the community you don’t have that captivity.” (ID5)

Several other KIs indicated that that they were undecided about the top priority as they saw benefits in focusing on each setting. Of these, most thought acute and community care were equally important: “I put primary and acute care on an equal basis. Primary care is more the volume, acute care is more where we see the resistance the most.” (ID7) One KI indicated that all settings were important for various reasons: “There’s a whole host of things you can do in acute care and none of those are relevant to primary care. In primary care there’s this massive use of antibiotics for outpatients. And then long-term care has this captive population that’s there forever in most cases. It’s a different issue and a different problem.” (ID10) Finally, a couple of KIs suggested that in general, priority setting should consider what is feasible and where the evidence suggests efforts are urgently required.

### 3.3.3 One Size Fits all vs Responsive Adaptation

Should an antimicrobial stewardship action plan reflect different contexts/circumstances of the provinces/territories or is “one size fits all” a better approach? Responsive adaptation was preferred by all respondents, many of whom expressed their opinions emphatically: “One size never fits all.” (ID4); “I absolutely think that allowing for flexibility is important.” (ID9); “There’s nothing that’s going to make something fail faster than trying to implement something from Ontario in Manitoba.” (ID10). Most KIs indicated that jurisdictional flexibility and local autonomy is justified by numerous factors including, but not limited to differences in:

- Settings and contexts for care (rural vs urban; acute, community, LTC)
- Local pathology
- Resistance trends
- Culture
- Data archiving
- Prescribing environments for health professionals (e.g., dentists, nurse practitioners)
- Drug pricing and criteria in offering health services
- Funding and expertise available.

There was a sense by a few respondents that a national strategy or guideline would be helpful, with actions and decisions made by individual provinces and health authorities: “There should

be a national strategy that is provincially adapted...there [should] be overarching themes that fit all and those themes should be adapted – not just provincially but within a province, locally.”

(ID4) One KI described her understanding about working out the finer points in the Netherlands: “In the Netherlands, antibiotic practice guidelines for hospitals are written nationally by SWAB for management of infections for a variety of different indications and situations. These guidelines are translated by SWAB into a practical online antibiotic guide called SWAB-ID, which is updated regularly with each updated guideline. Hospitals can take a yearly subscription and access this guide online and download the template. From this, they can pick and choose which options they believe are most pertinent to their patient population.”

(ID11) Similarly, CDC has a framework (6 essential tasks) for stewardship and allows states and institutions to work within it, taking their own context into account. This approach reflects one KIs thinking about the need for a top-down *and* bottom-up approach to implementation of stewardship programs in Canada: “You need to employ both top-down and bottom-up management strategies for successful programs at this level. You need to have some type of top-down approach to some extent. You need to contact every organization covering the regional area you want to work with. You need to have them onboard. Once you’re there – because they’ve agreed for you to be there – you need to work from the bottom-up with the people that are really doing the day-to-day job. And that’s when you see the most mobilization happening.” (ID12)

### 3.3.4 Potential Obstacles of Building a National Consensus

Before laying out the obstacles, several KIs talked about some of things to consider in planning the Roundtable. A couple mentioned the importance of staying positive and were encouraged about the importance and timing of the gathering: “People are ready for a national consensus.” (ID4). Other aspects mentioned by one or two KIs were:

- **Have the right people present**, particularly those who will influence the next steps: “You need to have a group of people taking this as their responsibility and putting it on the agenda...it could be the Public Health Agency of Canada...but it would need to have the means to do so and ... build a real strong leadership with all the key players.” (ID12)
- **Set the right scope** around the most important issues and what can reasonably be achieved given resources and support.
- **Have a good moderator.**

Several obstacles were identified to building a national consensus. Most KIs indicated that resources were the biggest challenge to implement stewardship programs: “That always is an

issue with these things: where is the money coming from to support this? (ID4) A few KIs indicated that Federal funding could be tied to meeting explicit conditions, surveillance metrics or targets: "The federal government [should] set up the standards; the provinces [should] meet certain criteria, and [be given] a budget that is proportional to their populations and [allowed to] manage their budgets...You give the feeling to the provinces that they're in charge of the money, but they have to report to the federal government in terms of the outcomes." (ID3).

Several comments were made about jurisdictional obstacles. A couple of KIs indicated that Federal-Provincial divide was a significant concern: "The first obstacle will be a political one. [Federal and provincial governments] might agree but obviously the provinces will be very reluctant to let the federal government get into the healthcare sector." (ID3) Similarly, two KIs suggested that it was difficult for jurisdictions to work together on this topic: "Provincial exceptionalism is the biggest barrier. It's the constitution. The bottom line is health is a provincial responsibility so we have 13 fiefdoms when it comes to healthcare. Most of the time, people are going to want to exercise the authority that this allows them." (ID2)

Finally, there were several concerns about the implementation of consensus recommendations reflecting a need to accommodate the unique challenges associated with different settings. For example, one KI spoke of the difficulties in making stewardship a key priority in acute care settings given the "ocean of quality improvement work" that must be attended to in hospitals (e.g., improving falls, pressure ulcers, better use of anticoagulants, opioids, and surgical options). (ID 6) Although recognizing the importance of having explicit standards for stewardship programs, one KI suggested that standards and deliverables will differ by facility (acute care vs LTC for example).

### 3.4 Linking Stewardship to Surveillance and Research

KIs offered their perspectives on the links between stewardship to surveillance and research. With the exception of one KI, who indicated that **surveillance** was outside the scope of the current discussion, most others indicated that it was integral to promoting stewardship: "Surveillance is the diagnostic tool for stewardship. If you don't have surveillance you can't diagnose the problems." (ID7) A couple of KIs pointed to an improved IT system as essential for good stewardship: "You need to have the infrastructure through IT and/or human resources to measure antimicrobial metrics within your hospital and within your community environment." (ID8) One KI spoke about her experience in Manitoba: "One of the reasons why we are just abysmal with antimicrobial stewardship in our acute care hospitals here in Manitoba...is because the pharmacy information system that they use is an inventory system...It doesn't allow you in any way to deal with issues of appropriate usage...you're talking about millions of dollars to replace these systems." (ID10)

Many ideas emerged in linking stewardship and **research**. Several KIs talked about the need to research the effectiveness of stewardship programs to given settings and contexts, to “try to get a better picture of the situation and to bring some type of solutions.” (ID12) and to be able to set standards for stewardship, if so desired: “Lots [of research about stewardship] is being done. I think we need to establish those standards. What is the evidence that we need one pharmacist per 250 beds? What are the effective components of a stewardship program?...We have to try to correlate outcome and process. It was done for infection control 30 years ago – we need to do it for stewardship.” (ID7) The same KI suggested that more research is needed to improve diagnostic tools: “If I think it’s a viral infection, I’d like to do a test that tells me it is a viral infection and I’d like to have the results of that test the same day so I can decide whether or not I need an antibiotic...If I have access to all those tests in real time, I’m much more able to make the right decision.” (ID7) Funding for research was highlighted by one KI: “Having CIHR or funding agencies or even provincial governments set aside money to fund stewardship research would help move the ground forward and create some excitement to be able to provide evaluations of best practices.” (ID8) Finally, a negative side to research was described by a couple of KIs, who cautioned that focusing on research could diminish stewardship opportunities: “The focus on research has, in a sense, crowded out opportunities to discuss and promote stewardship. The focus of research is often on new therapies or treatment opportunities, but stewardship is about treating *appropriately* with the tools already available.” (ID1)

### 3.5 Partnering with Other Countries

Most KIs indicated that Canada should partner with other countries and/or international organizations, particularly the US (CDC), EU, UK and Australia. Two KIs had a contrary view and indicated that collaboration would be very difficult because, “there are some countries in the world which have a very big pharmaceutical industry and they have to protect [it].” (ID3) and because “...it’s really a local level [issue]” (ID7). Most often the benefit of partnering was so that Canada could learn from the experience of other countries who have been involved in stewardship for a much longer time: “Canada should learn from the example of more experienced countries. I would put heads together and start from there.” (ID11) It was also noted that Canada should learn from within: “Canada should also take inspiration from some of its more successful provinces on stewardship. “Why reinvent the wheel?” (ID11) Other focus areas for partnering mentioned by one or two KIs were:

- **Benchmarking/standardization:** “The role of such partnerships should be primarily to benchmark and develop standards for data collection and dissemination.” (ID1)



- **Education:** “Cross-border education would also be a valuable goal of these partnerships, recognizing that these efforts would be specialty-dependent.” (ID1)
- **Sharing information (e.g., guidelines and evidence):** “We need to learn about best practices and share materials. (ID2)
- **Research:** “[Canada could research] in first world settings, what are the optimal ratios of components of a program to be able to dedicate resources. [Canada] could team with other countries to say ‘what would be the ranges that would be available to facilitate the pharmacist and/or human resource manpower to help run your tertiary program in both urban and smaller rural settings.” (ID8)
- **Invest/fund** stewardship applications and research: “[Canada could invest in] the development of stewardship apps that could be used globally with both Android and iPhone because a lot of people use a smartphone. This could be an area where Canada has a leading edge.” (ID8)
- **Create peer pressure:** “I think we can also create peer pressure in a healthy way, in that when I talk to Sweden and they say ‘Well here’s where we are and this is what we’ve been able to do to accomplish this.’ we can take some notes and say ‘well we can’t do all of this because we’re not Sweden, but there’s certainly some lessons we can learn from Sweden’, and I think the same thing could go for Canada...The more countries and the bigger splash we can make every year we can make with our communications efforts the better off we will be in terms of being able to get traction in our respective countries.” (ID9)

## 4.0 Discussion

This study set out to listen to national and international experts in anti-microbial stewardship about their practices and views in this area along with advice on planning for the National Roundtable and Action Plan. There are three “take home” findings followed by recommendations on preparing for the gathering and resulting Plan.

## **Leadership and investment is needed in antimicrobial stewardship at all levels in the Canadian health care system**

The first main finding underscores the need for leadership and investments into antimicrobial stewardship at all levels in the system, under the premise that stewardship is both a *health* and an *economic* issue. Beginning at the Federal level, there was overwhelming evidence that more investments are required to fund stewardship programs, human resources, training programs, IT, applied research, and others. A national strategy (or guideline) for Canada was called for at this level. There was receptivity to having Federal funding linked to performance targets founded on evidence based indicators—that need to be clarified. Leadership is needed at the provincial and regional levels to work with Federal and community stakeholders to responsively adapt top down policies with jurisdictionally reflective bottom up programming. Leadership was valued and appreciated by way of policy levers to help facilitate programming. Furthermore, Associations linked to prescribing professionals can lead by delivering a coordinated message about stewardship to their members. Finally, at the community level, there seemed to be a need for both top level administrative leaders and “on the ground” providers as champions in acute care settings (and potentially in LTC). While the former focusses on making stewardship a funding priority given the bombardment of multiple priorities within a given setting or network of care settings, the latter is concerned with planning and organizing how a program will be implemented and evaluated, and by whom. It is unclear who will take the leadership on antimicrobial stewardship in community practices; however, a starting point might be with their professional associations and societies.

## **When planning an antimicrobial stewardship program it is important to attend to similarities and differences among health care settings**

The second major finding was the need to consider similarities and differences among acute care, community care and LTC in their stewardship needs. The acute care system seems to be ahead of other health care settings when it comes to stewardship and for that very reason, it seems appropriate to start by focusing on acute care, with valuable lessons that could be learned and applied to community care and LTC. Indeed there are similar needs (with different applications) across all three settings to be addressed by leadership and funding (as previously noted); an improved focus on training and education of providers; and better ways of collecting and using evidence for audit and feedback, performance measurement and surveillance of prescribing behaviour. Each setting also has unique needs that require special attention. Acute care settings are trying to identify the best way to organize and manage stewardship programs, accounting for local conditions such as resistance patterns or resource disparities while following an evidence informed path. There are some exemplars across Canada for guidance in

this area. Community care is faced with how to provide audit and feedback mechanism into practice partly because of difficulties with EMR systems and inadequate prescribing surveillance systems. The education of consumers is of greater concern in this setting than others because of the influence of patient demand on prescribing behaviour. Finally, LTC seems to be missing not only human resources, but also some of the crucial tools for functional stewardship, such on-site labs and diagnostic capabilities. As in community settings, surveillance data in LTC are suboptimal or non-existent.

### **Ultimately work towards creating an antimicrobial stewardship culture in Canada**

The final major finding is about building a culture of stewardship in Canada. We have heard that Canada needs to build more credibility about the importance of stewardship. How can we do this? Perhaps it starts by listening and partnering with other countries around the world that have been involved in stewardship for a much longer time than Canada. These allies consider stewardship to be an inherent part of their culture—a progressive mindset of leaders, providers and consumers. They have done much more for stewardship than we have: they more adequately fund stewardship; they have been able to successfully implement country-wide stewardship programs and are more aware of better performing metrics and benchmarks for appropriate antibiotic use; they have educated their providers and citizens about it; they have flexible guidelines; and they have successfully united important stakeholders in the area in working towards a common goal of appropriate prescribing. Perhaps we should also look internally to distinguish, honor and build on those successful exemplars that we have in Canada. But more than that we need to recognize the urgency of acting now, even if we don't have a perfectly adaptable stewardship model, ideal surveillance capacity, or indisputable metrics. A common denominator from almost all our interviews was impatience with the status quo coupled with the sense that the time for proper stewardship is long overdue. Ultimately, it will all start by listening to and involving the very people who will be offering or affected by stewardship programs—the path towards the Roundtable is the right one!

### **Preparing for the National Roundtable and Action Plan**

Gathering, consulting and involving multiple stakeholders to drive stewardship was seen as a major facilitator of stewardship in this country, giving much credibility to the upcoming Roundtable. It is recommended that a wide range of stakeholders be considered from the prescribing professions, major professional societies and associations, educational faculties, Federal and Provincial governments, public health and consumers or patients. It is also suggested that international experts be invited given their important insights. Topics have been ordered in importance from:

- ***Management and organization of the stewardship program***
- ***Evidence informed best practices***
- ***Evaluation and metrics***
- ***Knowledge exchange and translation***
- ***Patients***

Consider addressing or preparing for potential obstacles to building a national consensus for an Action Plan, particularly concerning topics of resources, jurisdictional/political obstacles between Federal-Provincial governments, and finally, implementation concerns to accommodate the unique challenges associated with different settings as explained throughout this report.

## **5.0 Limitations**

Though precautions were taken to ensure the independence and validity of results reported here, this study nevertheless has some methodological drawbacks that limit the interpretation of its results. As the project team had only one experienced qualitative researcher, coding was not systematically cross-validated between multiple coders. KIs were, however, offered the opportunity to view and validate interview notes (most of which were also recorded) to ensure their responses were not misrepresented. Furthermore, both interviewers were involved in reviewing findings and identifying quotes for accuracy and relevancy. Clinical experience was over-represented in our study sample relative to policy experience, and the policy experts included had experience in the stewardship landscape outside Canada. Moreover, LTC experience was under-represented in our sample, with only one KI having experience in that setting. Finally, the discussion of leading programs should not be taken as a census of all leading programs operating in Canada or abroad.

## **6.0 Conclusion**

This study of national and international antimicrobial stewardship experts revealed important themes germane to the discussion of how to move forward on stewardship in Canada. We believe that these insights provide important background to the upcoming 2016 Antimicrobial Stewardship Action Roundtable in terms organizing the event, areas to discuss, and topics to consider for its Action Plan.

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## 8.0 Appendices

### 8.1 Appendix A – Interview Guide

#### Interview Guide

#### Developmental Work for an Action Roundtable on Antimicrobial Stewardship in Canadian Hospital, Healthcare and Community Settings

#### Antimicrobial Stewardship Leading Practices (ASLP)

As you know, antimicrobial resistance is a serious health concern to Canada and other countries around the world.

ASLP1. Please complete **Table 1** by identifying the leading programs you are aware of in human antimicrobial stewardship from around the globe and at various levels in the Canadian healthcare system. Also provide a brief explanation of what works well for these programs.

<b>Table 1 – Leading Programs in Human Antimicrobial Stewardship</b>		
<b>Level in the System</b>	<b>Name and <u>brief</u> description of the program</b>	<b>What works well</b>
<b>International</b> (e.g., countries outside of Canada—US, UK, Europe, Australia).		
<b>National</b> (i.e., across Canada).		

<b>Table 1 – Leading Programs in Human Antimicrobial Stewardship</b>		
<b>Level in the System</b>	<b>Name and <u>brief</u> description of the program</b>	<b>What works well</b>
<b>Provincial</b> (i.e., in specific provinces in Canada).		
<b>Local</b> (e.g., at regional, municipal levels including local acute care hospitals and primary health care organizations).		

ASLP2. What barriers have you faced or are you aware of in implementing leading programs in antimicrobial stewardship and how have these barriers been addressed? (Probe: lack of awareness of the differences between infection prevention control and stewardship programs).

ASLP3. Let's talk about human resources and human infrastructure. What do you think needs to be put in place to facilitate stewardship programs? (Probe: is there a sufficient supply of appropriately trained nurses, pharmacists, etc.).

ASLP4. In what way do you think Canada could partner with other countries on solutions and innovations in the arena of antimicrobial stewardship?

ASLP5. We would like to get your thoughts on scaling up or spreading best practices.

- a. How would you go about identifying programs that are ready to participate in scaling up or using best practices?



- b. Are there any other issues that you would suggest around scaling up?

### **Toward a pan-Canadian Antimicrobial Action Plan (PCAAP)**

As mentioned in the information sheet, we are planning a pan-Canadian Action Roundtable in June 2016. The overall objective of the proposed Action Roundtable is to reach consensus on an approach and key activities that would support moving toward a pan-Canadian multi-sectoral Antimicrobial Stewardship Action Plan. In advance, we would like to identify potential areas and priority activities to include in that Action Plan.

PCAAP1. Have a look at the **Table 2**. First look at the potential area and rate the degree to which you think it is important to include in the Action Plan. Then briefly explain your rating.

<b>Table 2 – Identifying Potential Areas and Activities to Include in the Action Plan</b>		
<b>Potential Area to Include in Action Plan</b>	<b>On a scale of 1-5, where 1 is of low importance and 5 is of high importance, how important is the area to include in the Action Plan? (circle only one number for each area)</b>	<b>Please explain your rating as to why the area is important or not to include in the Action Plan</b>
a. <b>Evidence informed best practices</b> (e.g., addressing prescribing practices and prudent antibiotic use).	<div>1 2 3 4 5</div> <div>Low High</div> <div>Importance</div>	
b. <b>Management and organization of the stewardship program</b> (e.g., including leadership, expertise, team membership and roles, an effective change management process, adequate funding).	<div>1 2 3 4 5</div> <div>Low High</div> <div>Importance</div>	
c. <b>Knowledge exchange and translation</b> (e.g., training, education and awareness for	<div>1 2 3 4 5</div> <div>Low High</div> <div>Importance</div>	

<b>Table 2 – Identifying Potential Areas and Activities to Include in the Action Plan</b>		
healthcare professionals and the public; regular updates and communication to ensure providers have rates and trends of antimicrobial prescribing and are aware of new antimicrobials).	<b>Importance</b>	
<b>d. Evaluation and metrics</b> (e.g., monitoring data through local labs, measuring success of interventions and areas to improve, providing feedback and follow-up).	<b>1 2 3 4 5</b> <b>Low High</b> <b>Importance</b>	
<b>e. Patients</b> (e.g., education, accountability).	<b>1 2 3 4 5</b> <b>Low High</b> <b>Importance</b>	
<b>f. Other areas? (please indicate, rate and explain)</b>	<b>1 2 3 4 5</b> <b>Low High</b> <b>Importance</b>	

PCAAP2. To what extent should an antimicrobial stewardship action plan reflect different contexts/circumstances of the provinces/territories? (One size fits all or responsively adapted to jurisdictional context?)

PCAAP3. What areas and settings should we prioritize in advancing antimicrobial stewardship? For example, acute care hospitals, primary health care, public health, long term care settings, other settings?

PCAAP4. What do you see as the obstacles of building a national consensus on an antimicrobial stewardship action plan? (Probe: How might these obstacles be addressed?)

## **Knowledge Exchange and Translation (KET)**

Antimicrobial Stewardship is an accreditation standard for Canadian hospitals making knowledge exchange and translation an important activity.

KET1. In **Table 3**, please list best practice tools (e.g., guidelines) and/or training programs that you are aware of related to antimicrobial resistance and use for health care providers and/or patients

<b>Table 3 – Best Practice Tools (e.g., guidelines) and/or Training Programs for Health Care Providers and/or Patients re: Antimicrobial Resistance</b>	
<b>Target Group</b>	<b>Best Practice Tools (e.g., guidelines) and/or Training programs</b>
<b>Health care providers</b>	a.
	b.
	c.
<b>Patients</b>	a.
	b.
	c.

KET2. Where are the gaps in best practice tools (e.g., guidelines) and/or training programs?

KET3. What are the facilitators to enhance the use and spread of best practice tools (e.g., guidelines) and/or training programs in Canadian hospitals, healthcare and community settings?

### **Links to other areas (LO)**

While the focus of this work is on antimicrobial stewardship, we recognize that stewardship is closely connected to both surveillance and research.

LO1. Are there any key points that you would like to raise with respect to the links between *surveillance and stewardship*?

LO2. What about the links between *research and stewardship*?

### **Final Questions (FQ)**

FQ1. In **Table 4**, please indicate any *key articles, reports and publications plus individuals or organizations* that you would like to bring to our attention on this matter.

<b>Table 4 – Key Articles, Individuals or Organizations</b>	
<b>Key articles, reports and publications</b>	
a. _____ _____	
b. _____ _____	
c. _____ _____	
<b>Individuals or organizations</b>	
<b>Name/organization</b>	<b>Contact info</b>
a. _____	_____
b. _____	_____
c. _____	_____

*Thank you for your time!*

## 8.2 Appendix B – Leading Programs Identified by Key Informants

Level in the System	Name of Notably Performing Unit As Identified by KIs
<b>International</b> (e.g., countries, sub-national units, and organizations outside of Canada—US, UK, Europe, Australia).	<ul style="list-style-type: none"> <li>• <b>Australia</b> <ul style="list-style-type: none"> <li>○ Bond University has been a local centre for stewardship research led by Chris Del Mar.</li> <li>○ Australia also has national-level accreditation standards for hospital antimicrobial stewardship. Key contacts include Lindsay Grayson and Peter Collignon.</li> </ul> </li> <li>• <b>Belgium</b> <ul style="list-style-type: none"> <li>○ The Belgium Antibiotic Policy Coordination Committee (BAPCOC) is engaged on projects mostly related to public awareness campaigns. BAPCOC has also financially supported the development of antibiotic management teams in hospitals.</li> </ul> </li> <li>• <b>Croatia</b></li> <li>• <b>Denmark</b></li> <li>• <b>European Union</b> <ul style="list-style-type: none"> <li>○ ABS International Project, administered through the European Centres for Disease Prevention and Control</li> <li>○ Eurosurveillance, an academic journal associated with the EU, measures the use of antimicrobials in the 27 EU countries as well as the UK and Israel.</li> </ul> </li> <li>• <b>Indonesia</b></li> <li>• <b>The Netherlands</b> <ul style="list-style-type: none"> <li>○ The Dutch Working Party for Antimicrobial Policy (SWAB) publishes guidelines on antimicrobial use and administers a national resistance surveillance program (Nethmap).</li> <li>○ The Inter-sectoral Coordination Mechanism for the Control of Antimicrobial Resistance (ISKRA) was created with the help of a Dutch funding program</li> </ul> </li> </ul>

Level in the System	Name of Notably Performing Unit As Identified by KIs
	<p>(MATRA) engineered to help southeastern European countries aiming to join the EU to meet the EU standards for civil society and government.</p> <ul style="list-style-type: none"> <li>• <b>Scotland</b></li> <li>• <b>Sweden</b></li> <li>• <b>United Kingdom</b> <ul style="list-style-type: none"> <li>○ National Health Service Antimicrobial Stewardship Efforts have been impressive, especially as they relate to <i>C. difficile</i>.</li> <li>○ The British Dental Association has nascent programming on Stewardship.</li> <li>○ The Imperial College has developed an iPhone app designed to improve the quality of antimicrobial prescribing.</li> </ul> </li> <li>• <b>United States</b> <ul style="list-style-type: none"> <li>○ Get Smart and Get Smart for Healthcare Programs, organized through the Centres for Disease Control and Prevention.</li> <li>○ Executive Order 13676: Combatting Antibiotic-Resistant Bacteria.</li> <li>○ United States Association for the Prudent Use of Antibiotics.</li> <li>○ Infectious Diseases Society of America and Society of Healthcare Epidemiologists of America collaborations on Stewardship.</li> <li>○ US HMOs tend to invest very strategically in IT including electronic health records. This makes surveillance and feedback much more efficient.</li> </ul> </li> </ul>

Level in the System	Name of Notably Performing Unit As Identified by KIs
	<ul style="list-style-type: none"> <li>○ The United States Veteran's Administration is closely involved in research on Stewardship.</li> <li>○ The Johns Hopkins Hospital hosts a stewardship program championed by Dr. Sara Cosgrove.</li> <li>○ Kaiser Permanente – a US HMO – uses employs reimbursement disincentives for certain kinds of prescribing habits in some states, for example, Georgia.</li> <li>○ California Senate Bill 739 deals specifically with hospital stewardship. At the time of this writing, California is the only state in the US to enact stewardship legislation.</li> <li>○ The California Medical Association runs a program called 'California Aware', which involves monitoring individual provider performance based on HEDIS measures in collaboration with payers and sends that information to providers as a form of feedback along with educational materials.</li> <li>○ State of South Dakota hosts a collaborative forum to bring together hospitals and LTC facilities for the purposes of sharing experiences on stewardship.</li> <li>○ State of Colorado holds a statewide collaborative forum on stewardship, framed around more common indications where antibiotic use is often appropriate.</li> <li>○ Georgia State Health Department administers an 'Honour Roll' for hospitals successful in meaningfully reducing antimicrobial useage.</li> </ul> <ul style="list-style-type: none"> <li>● <b>World Health Organization</b> <ul style="list-style-type: none"> <li>○ WHO Essential Medicines Group</li> </ul> </li> </ul>

Level in the System	Name of Notably Performing Unit As Identified by KIs
<p><b>National</b> (ie. programming related to stewardship crossing provincial boundaries)</p>	<ul style="list-style-type: none"> <li>• <b>Accreditation Canada</b></li> <li>• <b>Canadian Antimicrobial Resistance Surveillance System (CARSS)</b></li> <li>• <b>Canadian Association of Hospital Dentists</b></li> <li>• <b>Canadian Nosocomial Infection Surveillance Program (CNISP)</b></li> <li>• <b>'Choosing Wisely'</b></li> <li>• <b>'Do Bugs Need Drugs'</b> <ul style="list-style-type: none"> <li>○ Note that while this program originated in Alberta and then spread to British Columbia, its materials are available digitally across the country.</li> </ul> </li> <li>• <b>Partners for Appropriate Anti-Infective Community Therapy (PAACT)</b></li> </ul>
<p><b>Provincial</b> (i.e., programming in specific provinces in Canada).</p>	<ul style="list-style-type: none"> <li>• <b>British Columbia</b> <ul style="list-style-type: none"> <li>○ Provincial Infection Control Network of British Columbia</li> </ul> </li> <li>• <b>Alberta</b> <ul style="list-style-type: none"> <li>○ Alberta Health Services has taken action on stewardship at the level of drug formularies as well as in antimicrobial useage surveillance. Because Alberta has only one regional health authority, there may be a certain reduction in the duplication of services across health regions.</li> <li>○ Alberta hosts a working group developing sophisticated 'adjusted utilization metrics' for surveillance and benchmarking purposes.</li> <li>○ An iPhone application called 'Spectrum Calgary' has been developed in Calgary, which recently won an award from Accreditation Canada and Canada Health Infoway. This application integrates local pathways and guidelines and uses the local antibiogram (a</li> </ul> </li> </ul>



Level in the System	Name of Notably Performing Unit As Identified by KIs
	<p>summary of local antimicrobial susceptibilities and resistances). The application can help interpret local guidelines in light of the local epidemiology in order to help guide prescriber behaviours.</p> <ul style="list-style-type: none"> <li>○ Calgary has developed an advanced antimicrobial stewardship fellowship program (1-2 years post infectious disease fellowship training) recognized by the faculty of postgraduate education and pending recognition by the Royal College of Physicians and Surgeons.</li> <li>○ Calgary's stewardship landscape includes innovations like the use of a computerized order entry system and is developing a series of electronic antimicrobial order sets (ie. a set of treatment plans arranged by diagnosis. The idea here is that once a diagnosis is registered, the software generates a management plan that the prescribing physician may then opt into or modify based on her clinical experience).</li> <li>• <b>Ontario</b> <ul style="list-style-type: none"> <li>○ Antimicrobial Stewardship Program under the Adopting Research to Improve Care (ARTIC) initiative organized by the Council of Academic Hospitals of Ontario (CAHO).</li> <li>○ Programming from Public Health Ontario</li> </ul> </li> <li>• <b>Quebec</b> <ul style="list-style-type: none"> <li>○ Institute National d'Excellence en Santé et en Services Sociaux (INESS)</li> <li>○ Association des Médecins Microbiologistes-Infectiologues du Québec (AMMIQ)</li> </ul> </li> </ul>

Level in the System	Name of Notably Performing Unit As Identified by KIs
<p><b>Local</b> (e.g., programming at regional, municipal levels including local acute care hospitals and primary health care organizations).</p>	<ul style="list-style-type: none"> <li>• <b>Noted Hospital-Based Stewardship Programs</b> <ul style="list-style-type: none"> <li>○ Vancouver General Hospital Antimicrobial Stewardship Program</li> <li>○ Mount Sinai-UHN Antimicrobial Stewardship Program</li> <li>○ Toronto East General Antimicrobial Stewardship Program</li> <li>○ Centre Hospitalier Universitaire de Sherbrooke Antimicrobial Stewardship Program</li> <li>○ Hôpital Charles-Lemoyne Antimicrobial Stewardship Program</li> <li>○ McGill University Health Centre Antimicrobial Stewardship Program</li> </ul> </li> <li>• <b>Noted Community-Based Stewardship Programs</b> <ul style="list-style-type: none"> <li>○ Programming from the BC Coastal Health Authority</li> <li>○ Décision Plus family medicine training program in eastern Quebec</li> </ul> </li> </ul>