Knowledge Brokering for Infectious Diseases Public Health in Canada

Part 1: Position Paper

September 2014

Project Consultant: Barbara Clow, PhD

National Collaborating Centre for Infectious Diseases

Centre de collaboration nationale des maladies infectieuses

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Acknowledgements and Disclaimer

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List of Acronyms

AMMI	Association of Medical Microbiology and Infectious Disease Canada
AMR	Antimicrobial Resistance
ARO	Antimicrobial Resistant Organisms
BCCDD	British Columbia Centre for Disease Control
CAAN	Canadian Aboriginal AIDS Network
CATIE	Canadian AIDS Treatment Information Exchange
CETAR	Communications and Education Task Group on Antimicrobial Resistance
CIHR	Canadian Institutes for Health Research
CMA	Canadian Medical Association
CNCD	Chronic and Non-Communicable Diseases
CPHA	Canadian Public Health Association
CPHO	Canadian Public Health Officer
GBD	Global Burden of Disease
HC	Health Canada
ICID	International Centre for Infectious Diseases
IDPH	Infectious Diseases Public Health
KB	Knowledge Broker(ing)
KSTE	Knowledge Synthesis Translation and Exchange
KT	Knowledge Translation
KTE	Knowledge Translation and Exchange
NCC	National Collaborating Centres for Public Health
NCCAH	National Collaborating Centre for Aboriginal Health
NCCDH	National Collaborating Centre for Determinants of Health
NCCEH	National Collaborating Centre for Environmental Health
NCCHPP	National Collaborating Centre for Healthy Public Policy
NCCID	National Collaborating Centre for Infectious Diseases
NCCMT	National Collaborating Centre for Methods and Tools
NWAC	Native Women's Association of Canada
PHAC	Public Health Agency of Canada
SRC	CIHR Social Research Centre in HIV Prevention
STBBI	Sexually-transmitted and Blood-borne Infections
STI	Sexually-transmitted Infections
TDR	WHO Special Programme for Research and Training in Tropical Diseases
WHO	World Health Organization

Executive Summary

Purpose

Approaching its tenth anniversary, the National Collaborating Centre for Infectious Diseases (NCCID) recognized the need to re-assess and re-envision its approach to knowledge translation (KT) in the field of infectious diseases public health (IDPH). To support this goal, NCCID commissioned an independent consultant to undertake an environmental scan and analysis of the key challenges, needs, gaps, and opportunities in IDPH in Canada. Specific objectives of the scan and analysis included:

1. Describing the landscape of IDPH, including current KT priorities;
2. Detailing the development of KT theory and practice, with an emphasis on public health in general and infectious diseases in particular;
3. Assessing the types of KT products and approaches that have the greatest promise for advancing public health outcomes at all levels in the Canadian public health system (local, regional, provincial, federal, national);
4. Comparing and contrasting the mandates and work of a range of organizations involved in KT for IDPH;
5. Defining a specific, innovative KT role for NCCID (a niche) in the current and future landscape of IDPH in Canada.

Approach

The environmental scan involved seven data collection components: two narrative reviews of grey and peer-reviewed literature on IDPH and on KT theory and practice; a series of key informant interviews with public health stakeholders representing diverse disciplines, sectors, and jurisdictions; a survey conducted on-line and at the 2014 Canadian Public Health Association Conference; a review of the findings of NCCID scans and consultation documents from the previous 18 months; consultations with NCCID staff, and; a review of organizations working in the area of infectious diseases public health and/or public health knowledge translation. The consultant worked closely with NCCID senior staff to analyze the data collected and to develop a new vision for the organization.

Findings and Analysis

The information and data collected demonstrate a continued need for attention to persistent and emerging infectious diseases in public health. As the 2013 Report from the Chief Public Health Officer of Canada noted, there is a role for “working together and sharing knowledge” to

prevent illness and to respond flexibly. Priorities for knowledge translation were both varied and shared, with three cross-cutting themes emerging: the need for evidence related to determinants of infectious diseases, relative importance and burden of illness.

The results of the analysis confirm that, ten years after the inception of the NCC program, "there continues to be a need to strengthen Canada's public health capacity. More specifically, there is an on-going need for effective knowledge synthesis, translation and exchange (KSTE) mechanisms to enhance evidence-informed decision making in public health in support of programs and policies that protect and promote the well-being of the public" (1). The analysis further suggests that renewed efforts to support and advance KT in IDPH may be especially important and challenging for a number of reasons. First, the field of IDPH is vast and constantly changing, which complicates priority-setting as well as evidence-informed decision-making for public health practitioners and policy-makers. Second, the theory and practice of KT are underdeveloped in the field of IDPH, making it difficult to identify both promising approaches and tested practices. Third, while many agencies and individuals are working on diverse aspects of IDPH, there is a need in Canada for a coordinated approach to KT for IDPH, a central hub that would provide more opportunities for public health and infectious diseases researchers, policy makers, and practitioners to engage with each other, to share knowledge, and to foster collaboration across disciplines, sectors and jurisdictions. NCCID is uniquely positioned to fill this niche as a central hub for IDPH KT in Canada for a number of reasons:

1. NCCID's main priority is KT in IDPH;
2. NCCID has a national mandate, allowing it to work across jurisdictions and to address national priorities and issues of national significance;
3. NCCID has access to content specialists across diverse disciplines, sectors, and jurisdictions, enabling it to address cross-cutting themes in IDPH while remaining flexible and responsive in the face of emerging infectious diseases and pressing needs for knowledge and knowledge exchange;
4. NCCID has the ability to bring together public health practitioners – its principal target audience – with researchers, policy makers, and other stakeholders, thereby supporting the CPHO's call for greater collaboration and sharing of information to enhance the prevention, control, and treatment of infectious diseases;
5. NCCID works at arms-length from government and academia and it has a reputation as a reliable and credible source of information with public health policy-makers, planners, practitioners, and with the general public.

The model of knowledge broker has potential to address many of the challenges posed by KT for IDPH. A knowledge broker is an individual or organization with ready access to conceptual and practical expertise *and* the ability to foster linkages among those who generate and those who use knowledge. Indeed, the strength of knowledge brokering lies not so much in the ability to answer every question, but in the ability to facilitate engagement among those who have the questions, those who may have answers, and those positioned to take action on evidence. A knowledge broker has credibility with many different stakeholders and so can facilitate the formation of multi-sectoral, multi-disciplinary, and multi-jurisdictional knowledge sharing networks and partnerships.

Emerging Vision

To date, NCCID's work has tended to focus on the creation of KT products and, to a lesser extent, strategic partnerships to support evidence-informed decision-making in public health. Much of this work has been well-received. But there is also evidence that the reach and impact of NCCID's KT efforts are not yet optimal and questions have arisen about duplication or overlap of work among the NCCs as well as between the NCCs, PHAC, and other organizations working on KT in the area of public health.

The findings of this analysis suggest that NCCID should consider adopting the model of knowledge broker to advance the reach and relevance of the organization's efforts to meet complex, evolving, and on-going information needs of IDPH in Canada. NCCID could act as a knowledge broker in the following ways:

- strengthening existing relationships and establishing new partnerships with research, policy, and practice experts;
- facilitating connections, discussion and exchange of knowledge;
- responding to questions from stakeholders with information or referrals;
- working with stakeholders to identify knowledge gaps and promising practices in IDPH interventions;
- identifying and maintaining a database of experts, organizations, and reliable sources of IDPH information;
- interpreting and translating evidence to support decision making and priority setting in public health and IDPH;
- developing and disseminating relevant tools and methods;
- organizing integrated events on persistent and emerging issues in IDPH.

NCCID should consider acting both as a generalist and a specialist knowledge broker. As a generalist in IDPH, NCCID could work with evidence and stakeholders to explore and address cross-cutting themes and issues. As a specialist in IDPH, NCCID could broker evidence and engagement around a select group of issues and diseases that are of enduring and/or emerging relevance in IDPH. This combined approach to knowledge brokering could allow NCCID to support sustainable, collaborative, multi-sectoral partnerships while remaining responsive and accountable in the face of emerging issues and outbreaks.

Next Steps

This position paper represents the foundation for strategic planning and action for NCCID during the next 30 months. The goal is to further refine the vision for the organization and to make organizational change to realize this vision. If NCCID decides to move to a knowledge broker model, the following steps are recommended:

1. **Develop an implementation strategy and plan.** An implementation strategy and plan should be created to support NCCID as it transitions into the new role of knowledge broker. The strategy should outline the phases of organizational change while the plan should describe work that will be undertaken to stabilize, transition, and transform the organization during the second half of the 2014-15 fiscal year and for the following two fiscal years (2015-2017) under an amended Contribution Agreement.

2. **Elicit further input from stakeholders**. Respondents to the NCCID survey expressed interest in contributing further to this environmental scan. NCCID should follow-up with those who provided their contact information, as well as others in the NCCID network. Additionally, NCCID should assess whom else among potential and current stakeholders should be solicited regarding proof of concept for this Position Paper and the Vision Statement. This input would be in addition to any regular evaluations of specific activities and products NCCID undertakes.

3. **Fulfill existing commitments and stabilize existing partnerships.** While the environmental scan and position paper were in process, NCCID has continued to work with partners to address persistent and emerging issues in IDPH. It should stabilize its work and partnerships in these areas in preparation for transitioning to the knowledge broker model.

4. **Establish processes for setting priorities and determining content domains**. NCCID will need to strike a balance to meet the call from stakeholders to be both KT specialists and KT generalists in IDPH. It should consider developing criteria and tools

for assessing the potential for emerging issues and opportunities to help NCCID realize its vision.

5. **Identify core content areas**. Drawing on the findings in this position paper and on the aforementioned tools and processes, NCCID should establish content priorities. These might include brokering evidence and exchange in established content areas, such as HIV and other STBBIs, STTIs, AMR, influenza and ILI, Outreach and the NDDB, and addressing key cross-cutting themes, such as Burden of Disease, to expand the organization's reach and relevance.

6. **Pursue emerging KB opportunities**. Stakeholders identified a number of specific opportunities that NCCID could explore, including becoming involved in CIHR signature initiatives and working more closely with the Public Health Agency of Canada on federal priority issues. Stakeholders also noted the importance of collaborating with researchers, policy makers, and public health practitioners working in the area of chronic and non-communicable diseases (CNCD) because there are critical links between CNCD and ID. As with content areas, NCCID will need to develop mechanisms for identifying strategic partnership opportunities on an on-going basis.

7. **Develop an evaluation strategy**. Once the vision and implementation strategy and Plan are finalized, NCCID should develop a specific evaluation framework and process that will enable the organization to assess the merits of the KB approach to IDPH KT, the value of this model for NCCID, and the extent to which that model is being realized through organizational change.

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1. Introduction

The National Collaborating Centres (NCCs) for Public Health were created "to promote and improve the use of scientific research and other knowledge to strengthen public health practices and policies in Canada" (2). The NCCs aim to "synthesize, translate, and share knowledge, making it useful and accessible to policy-makers, program managers, and practitioners. They identify knowledge gaps, stimulate research in priority areas, and link public health researchers with practitioners to build strong practice-based networks across Canada" (3).

Six NCCs were established across the country in 2005 under Contribution Agreements with the Public Health Agency of Canada (PHAC). Each centre has a national mandate to collaborate with a variety of partners and stakeholders on a specific area of public health: Aboriginal Health, Determinants of Health, Environmental Health, Healthy Public Policy, Infectious Diseases, and Methods and Tools (3).

The National Collaborating Centre for Infectious Diseases (NCCID) is hosted by the International Centre for Infectious Diseases (ICID), an independent not-for-profit corporation based in Winnipeg, Manitoba. NCCID's mission is to protect the health of Canadians by informing public policy and better equipping public health practitioners in their role of preventing and controlling emerging and re-emerging infectious diseases. This has been done by:

- facilitating the integration of evidence on infectious diseases into public health programs, policies, and practices;
- encouraging and supporting collaborative responses among relevant stakeholders to public health issues and needs in the area of infectious diseases.

The primary audiences for the NCCs are public health practitioners, researchers, and policy makers. NCCID has also included among its audiences other sectors interested and involved in understanding and managing infectious diseases, such as clinical specialists, infection prevention and control practitioners, educators and emergency preparedness planners, research funders, and not-for-profit organizations. NCCID has concentrated its efforts on supporting knowledge translation with these audiences in the interests of improving infectious diseases public health research, policy and practice.

NCCID's recent knowledge translation (KT) efforts have focused on: sexually-transmitted and blood-borne infections

Since its inception in 2005, NCCID has developed more than 200 projects, delivering a variety of knowledge products and knowledge exchange opportunities, such as:

- More than 35 comprehensive evidence reviews;
- More than 40 shorter reviews of evidence (Purple Papers);
- More than a dozen fact sheets and posters;
- A dozen workshops and key facilitated meetings;
- Nearly a dozen webinars.

(STBBIs), such as *Chlamydia* and HIV; Influenza and influenza-like illnesses; emerging infectious diseases, such as MERS Co-V, H7N9 and Ebola Virus Disease; antimicrobial resistance (AMR); the creation of a Notifiable Diseases Database (NDDB)[1], and; supporting public health practitioners to reach out to vulnerable populations (4). To date, much of NCCID's work has involved the creation of KT products to support evidence-informed decision-making in public health and some of these products have been well-received. For example, a recent evaluation of the NCCs program by Health Canada (HC) and PHAC noted the usefulness of NCCID's work on AMR as well as the value of a series of rapid reviews on emergent communicable diseases (1). But there is also evidence that the reach and impact of NCCID's KT efforts is not yet optimal and questions have arisen about duplication or overlap of work among the NCCs as well as between the NCCs, PHAC, and other organizations working on KT in the area of public health (1).

Approaching its tenth anniversary, NCCID commissioned an environmental scan and analysis of the key challenges, needs, gaps, and opportunities in infectious diseases public health (IDPH) in Canada with a view to improving its existing approach to KT. Specific objectives of the analysis include:

1. Describing the landscape of IDPH, including current KT priorities;
2. Detailing the development of KT theory and practice, with an emphasis on public health in general and infectious diseases in particular;
3. Assessing the types of KT products and approaches that have the greatest promise for advancing public health outcomes at all levels in the Canadian public health system (local, regional, provincial, federal, national);
4. Comparing and contrasting the mandates and work of a range of organizations involved in KT for IDPH
5. Defining a specific, innovative KT role for NCCID (a niche) in the current and future landscape of IDPH in Canada.

The results of the analysis confirm many of the findings of the HC/PHAC evaluation: ten years after the inception of the NCC program, "there continues to be a need to strengthen Canada's public health capacity. More specifically, there is an on-going need for effective knowledge synthesis, translation and exchange (KSTE) mechanisms to enhance evidence-informed decision making in public health in support of programs and policies that protect and promote the well-being of the public" (1). This analysis suggests that renewed efforts to support and advance KT may be especially pressing for IDPH; first, because the theory and practice of KT are

[1] The NDDB is a database of the diverse policies and protocols for notifiable diseases used in jurisdictions across Canada. See www.nddb.ca

underdeveloped in this field, and; second, because continual shifts in the landscape of infectious diseases complicate evidence-informed decision-making.

NCCID has recognized the need to re-envision and revise its approach to KT for IDPH. As detailed in this Position Paper, the role of "knowledge broker" has great potential as a new niche for NCCID to support IDPH in Canada. A knowledge broker is an individual or organization with ready access to conceptual and practical expertise *and* the ability to foster linkages among those who generate and those who use knowledge. A knowledge broker has credibility with many different stakeholders and so can facilitate the formation of multi-sectoral knowledge sharing networks and partnerships. NCCID can act as a knowledge broker in a variety of ways, including:

- identifying and developing reliable sources of information;
- interpreting and translating evidence to support decision making and priority setting in public health and IDPH;
- developing and disseminating relevant tools and methods;
- establishing partnerships with research, policy, and practice experts;
- responding to questions from stakeholders with information or referrals;
- linking stakeholders to identify research gaps and promising practices in IDPH interventions;
- organizing integrated events on persistent and emerging issues in IDPH,

Knowledge brokers are often generalists rather than specialists. In other words, the strength of knowledge brokering lies not so much in the ability to answer every question, but in the ability to foster connections among those who have the questions, those who have answers, and those positioned to take action on evidence. NCCID will act as a generalist knowledge broker, working with evidence and stakeholders to explore and address cross-cutting themes and issues in IDPH. NCCID can also add value to this generalist approach by acting as a specialist knowledge broker for a select group of issues and diseases that are of enduring and/or emerging relevance in IDPH. This combined approach to knowledge brokering will enable NCCID to facilitate sustainable, collaborative, multi-sectoral partnerships while remaining responsive and accountable in the face of emerging issues and outbreaks.

This analysis was not undertaken as a review or evaluation of NCCID's past work nor as a prescription or detailed template for future directions. Rather it was designed to help inform an emerging vision for NCCID as the premier knowledge broker for IDPH in Canada, a key hub for evidence, expertise, partnerships and collaborations.[2] The analysis led to the development of

[2] These are the same parameters used by the National Collaborating Centre for Determinants of Health in its 2010-2011 environmental scan*, Integrating Social Determinants of Health and Health Equity into Canadian*

this document – a position paper – as well as an emerging vision statement, and an implementation strategy. They will serve as foundational documents for testing the merits and on-going relevance of the knowledge brokering model for NCCID and for addressing the present and future KT needs for IDPH in Canada.

2. Structure of the Analysis

Analysis begins in Section 3 of this position paper, with a description of the methods. Sections 4 and 5 discuss the context for NCCID's work in knowledge translation and exchange for infectious diseases public health in Canada, specifically the landscape of IDPH and the development and state of knowledge of KT. Section 6 analyzes the results of interviews, consultations, and a survey with stakeholders. Section 7 of the report compares and contrasts NCCID's mandate with that of other organizations working in the area of IDPH. Section 8 describes an emerging vision for NCCID and proposes next steps for testing and evaluating this vision. References and supporting information are found at the end of the position paper.

3. Methods

The environmental scan was comprised of seven data collection components: two reviews of grey and peer-reviewed literature; a series of key informant interviews; a survey; NCCID scans and consultation documents from the previous 18 months; consultations with NCCID staff, and; a review and assessment of organizations working in the area of infectious diseases public health and/or public health knowledge translation. To accommodate a tight timeline, responsibility for data collection and analysis was shared between the project consultant and the staff of NCCID.

3.1 Literature Reviews

Two reviews of grey and peer-reviewed literature were undertaken. Both were conducted as narrative reviews because they were designed to draw from representative literature and critically analyze broad fields of knowledge rather than assess evidence on narrowly-focused topics (5). One review, undertaken by the Project Consultant, focused on IDPH. The intent of this review was to understand the origins, development, and current state of knowledge and action on IDPH research, policy, and practice, with a view to identifying challenges and

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Public Health Practice: Environmental Scan (Antigonish, NS: National Collaborating Centre for Determinants of Health, St. Francis Xavier University). Retrieved June 5, 2014 from http://nccdh.ca/resources/entry/scan/.

opportunities. Documents from peer-reviewed and grey literature were retrieved through an on-line search of four databases, CINAHL (EBSCO), Academic Search Complete, Sociological Abstracts and PUBMED, as well as Google Scholar. A combination of search and MESH terms were used (depending on the search engine), including “infectious disease*”, “communicable disease*”, “burden of disease*”, “burden of illness*”, “emerging disease*”, and “health” and “public health”. Initial searches in these databases returned thousands of documents dealing with a host of specific infectious diseases as well as with pressing issues in IDPH, such as emerging infections and global burden of disease (GBD). The dataset was reduced to approximately 200 documents by: focusing on review articles and reports of IDPH past and present; eliminating documents that were narrowly or exclusively focused on laboratory research, clinical testing, and disease surveillance systems, and; reaching saturation on specific topics. Additional searches were conducted on specific topics not readily captured in the original search, such as historical developments in IDPH, and to follow-up on topics or issues raised by key informants, such as the human microbiome. Publications from the last 10 years were given priority, although some documents retrieved and reviewed were published before 2004. In-paper citations were manually searched to ensure seminal conceptual or discussion papers were not missed.

The other review, conducted by the NCCID Program Manager, focused on the theory and practice of knowledge translation and exchange. The purpose of this review was to determine the current state of thinking about KT, including the challenges and opportunities associated with various theoretical models and practice approaches. Documents from peer-reviewed and grey literature were retrieved through an on-line search of four databases, CINAHL (EBSCO), Academic Search Complete, Sociological Abstracts and PUBMED, as well as Google Scholar. Search and MESH terms used (depending on the search engine) were “evidence base*”, “knowledge translation”, “knowledge exchange”, “knowledge broker*” in combination with “health”, “public health” and “infectious disease*”. An initial focused search returned fewer than 50 papers; subsequent searches were broadened to be more inclusive of the health field and knowledge translation theory, returning over 200 papers. Publications from the last 10 years were given priority, although some documents retrieved and reviewed were published before 2004. In-paper citations were manually searched to ensure seminal conceptual or discussion papers were not missed.

Both reviews generated information that will be used to inform NCCID’s decisions about its approach to knowledge translation and exchange for infectious diseases public health.

3.2 Key Informant Interviews

A list of key informants was developed by NCCID staff with input from the Project Consultant. Prospective key informants were identified with the goal of capturing opinion from specialists in

KT, public health and/or infectious diseases working in various jurisdictions across the country as well as from the diverse audiences served by NCCID (Table 1). Of the list of 20 key informants identified, a total of 12 were interviewed during a period of four weeks (Appendix 1). One of the key informants identified in the initial list referred the Project Consultant to other individuals deemed to be better prepared to answer questions about IDPH and another informant indicated a preference to convey input – and that of other colleagues – to the head of the organization, creating a rich body of feedback from a single interview.

Table 1. Stakeholder Interview Matrix

Position/Role	Level/Scope	Research	Policy/Practice	KT
Infectious disease specialists	Local/Regional/ National/International	Y		
Senior Representatives from CIHR	National	Y		Y
Infectious disease public health researchers	Local/Regional/ National/International	Y		
Provincial Chief Medical Officers of Health	Regional/Local		Y	Y
Regional Senior Medical Officers of Health	Regional/Local		Y	Y
Senior Scientists at PHAC	National		Y	
CIHR KT specialists	National			Y
Independent KT specialists	National/International			Y
KT and public health specialists	National/International	Y	Y	Y

The Project Consultant developed a key informant interview guide (Appendix 2) with feedback from NCCID senior staff.[3] The guide was circulated to all of the key informants when they were invited to be interviewed and then again several days prior to the interview. The Project Consultant conducted all of the interviews by telephone, taking fields notes and coding the information manually. Time and resource constraints made it impossible to tape, transcribe, and electronically code the interviews.

[3] Some of the interview questions were modelled on those developed for the National Collaborating Centre for Determinants of Health 2010-11. These questions were revised to address the context and mandate of NCCID and new questions were added.

3.3 Survey

Survey data were collected in two stages, using similar survey tools (Appendix 3 and 4). NCCID staff developed an initial survey tool to be administered at the annual Canadian Public Health Association conference in May 2014. The goal of the survey was to take advantage of a prime opportunity to raise awareness of NCCID's work among public health researchers, practitioners, and policy makers as well as to gather input from stakeholders. The survey was divided into six separate questions and conference participants were invited to answer one or more questions, randomly selected. Fifty-one participants provided 69 answers to selected survey questions. After the conference, the survey was also posted on the NCCID website. Once the environmental scan was fully underway, the Project Consultant worked with NCCID staff to revise and repost the survey to gather more information about NCCID's products and processes. The survey closed July 28, 2014. During that time, another 29 respondents completed the survey.

A total of 80 respondents filled in part or all of the survey. Two respondents answered questions in French while the rest filled out the survey in English. Respondents included representatives from:

- Nine of the 10 provinces and one of the three territories;
- All levels of the public health system – federal, provincial, regional, local;
- Public health researchers, policy-makers, planners and managers, and practitioners.

3.4 Recent NCCID Consultations

In 2013 and 2014, NCCID produced three documents that provided useful background and context for this analysis. Two were proceedings from national workshops hosted by NCCID in March 2013. One workshop brought together 52 people from federal, provincial/territorial and regional public health jurisdictions as well as various professional organizations and universities, for a two-day knowledge exchange on partner notification for sexually-transmitted infections (STIs) (6). The event was a mid-point in the on-going work of the NCCID staff and colleagues on this subject. The consultation was designed to provide directions for NCCID under its new leadership, as well as contribute to networking and information sharing.

The second event, held in the same month, launched a proposed new body of work on influenza and influenza-like illnesses (ILI) (7). NCCID, working with its sister centres (NCC for Aboriginal Health, NCC for Determinants of Health, NCC for Environmental Health, NCC for Healthy Public

Policy and NCC for Methods and Tools), brought together 35 individuals representing federal, provincial/territorial and regional public health jurisdictions as well as various professional organizations, for a one-day consultation on knowledge gap and knowledge needs related to influenza and ILI. NCCID had developed many knowledge products during the Influenza A H1N1 pandemic of 2009-2010, but the 2013 consultation's main goal was to identify priority questions related to public health planning for annual seasonal influenza.

The third document is a summary of information gathered through an environmental scan and from testing out new methods for evaluating NCCID's program of work for internal purposes.

3.5 Consultations with NCCID Staff

The Project Consultant met individually and collectively with all six members of the NCCID staff. The purpose of these consultations was two-fold: to gather information about past priorities and current work; to draw on the knowledge, expertise, and insight of the staff to learn more about challenges to and opportunities for innovation in KT for IDPH.

3.6 Review of Organizations

A review of organizations working in the areas of IDPH and KT was undertaken by NCCID staff with input and support from the Project Consultant. The purpose of the review was to assess the ways in which NCCID's mandate, priorities, and approaches to KT are distinct from and/or complementary to the work of other organizations. It proved challenging to develop an effective search strategy for a couple of reasons. On the one hand, there appear to be few organizations with an explicit focus on KT and IDPH. An initial Google search of agencies involved in "infectious diseases" and "knowledge translation" in Canada retrieved fewer than 10 organizations with websites containing these two terms in vision or mandate statements or descriptions of their work. On the other hand, a more general search of organizations working in the area of infectious diseases returned hundreds of names. This result was not surprising, given that NCCID has already partnered with dozens of agencies, institutions, and public health authorities that engage in various degrees of KT in IDPH. It became clear that a different approach was needed to identify comparators.

A decision was made to focus on one disease – HIV/AIDS – as an exemplar. A web-based search identified 89 agencies, organizations, and projects working in the field of HIV/AIDS operating in and across multiple jurisdictions. The website of each organization was scanned for KT mandates and priorities and for activities that explicitly or implicitly supported KT. This information was then analyzed and categorized in relation to NCCID's mandate and activities.

4. The Context of Infectious Diseases Public Health

Those working in the field of IDPH have many of the same needs and face many of the same barriers as other public health policy-makers and practitioners. For example, Canada's complex public health system can make it difficult to share new knowledge and to build effective responses to both communicable and non-communicable diseases (8). But an analysis of the history and current state of IDPH suggests that those working in the area of infectious diseases face distinctive challenges arising from persistent issues as well as significant shifts in the landscape of both infectious diseases and public health. Moreover, this analysis demonstrates that ten years after the creation of the NCCID, the need for timely, accessible, and credible information about infectious diseases is as important as ever.

Ten years after the creation of NCCID, the need for timely, accessible, credible information about infectious diseases is as important as ever.

4.1 The Development of IDPH

Historically, infectious diseases have been among the principle causes of morbidity and mortality and the threat of infectious diseases was responsible for the rise of the public health movement (9). English social reformers, such as Edwin Chadwick, became increasingly concerned in the early 19th century about the poor, including the state of their health. Chadwick and his contemporaries did not know that germs caused infectious diseases, but they recognized there was evidence of a link between environmental conditions and health. He championed the first Public Health Act, which was introduced in 1848 and was designed to diminish the burden of illness by improving the water supply, waste disposal, sewage and drainage systems, and road surfacing and cleaning (10). The first recorded "epidemiological" study of infectious disease was similarly conducted before the development of germ theory, during the 1854 cholera epidemic in London. John Snow, an English physician was able to trace the source of infection to a local water supply by talking to local residents and tracking patterns of cholera cases. He has been hailed as the "father" of modern epidemiology (11).

In the 1860s, Louis Pasteur first articulated the germ theory of infectious diseases. Initially, there was considerable skepticism about his work. For example, Rudolf Virchow, a German doctor and biologist who had contributed to the development of cell theory, was vehemently opposed to Pasteur's conclusions. He argued that disease was social rather than biological in origin, rooted in poverty and disadvantage (12). Indeed, Virchow believed that the germ theory was a hindrance rather than a boon to disease prevention and cure because it undermined the need for social and political action, Despite the objections of Virchow and others, germ theory gradually served to shift understanding of the causes of infectious diseases from environments to microorganisms (13), Joseph Lister was one of the first to develop a practical test of Pasteur's theory. In the 1870s, he began using carbolic acid on surgical instruments, wounds and incisions, dressings, and his own hands to prevent post-operative and post-trauma infections. Germ theory also led to the development of antimicrobial medicines. In 1910, Paul Erhlich, a German scientist, introduced the first effective treatment for syphilis, Salvarsan, and many other antimicrobial agents, as they were later called, were discovered or developed in the 20th and 21st centuries (14).

Persistent Challenges: Pathogens, Poverty, and Public Health

Although Virchow and Pasteur disagreed about the origins of infectious diseases, they were both right. Germs are the biological causes of infectious diseases, but the social, economic, and political conditions in which people live also drive the spread and impact of infectious diseases.

The twin challenges of fighting pathogens and eradicating poverty continue to underpin IDPH today, as they did in the past.

While sanitary reforms helped to curtail the spread of communicable diseases and medicines helped to treat them, immunization became a cornerstone of infectious diseases prevention (15). Edward Jenner first used inoculation in 1796 to prevent smallpox infections and Pasteur created the first rabies vaccine in the 1880s – another proof of his germ theory. Antitoxins and vaccines for diphtheria, tetanus, anthrax, cholera, typhoid, tuberculosis, and yellow fever were available by the 1930s and vaccines for other common communicable diseases, including mumps, measles, rubella, and polio, were developed in the 1950s and 1960s. Immunization research is on-going as new infectious diseases emerge.

Public health measures to prevent, manage, and treat infectious diseases improved markedly during the 20th century. The incidence and prevalence of many communicable diseases, such as cholera and diphtheria, dropped dramatically (16). The mortality and morbidity associated with illnesses that could be prevented by childhood vaccination, such as measles and mumps, declined and, in some countries, were largely eliminated (17). A coordinated international immunization and treatment campaign also resulted in the eradication of smallpox in 1980 (18). Post-surgical and post-traumatic infections became more manageable. Treatments for infectious diseases became more plentiful and more effective. In other words, the tide of infectious diseases began to turn, especially in the developed world. In 1900, pneumonia and influenza, tuberculosis, and diarrhea and enteritis were the leading causes of death in North

America (19-21). By the 1920s, heart disease was the primary cause of death (for men and women combined) and by the 1950s, infectious diseases had been relegated to fourth or fifth place as a cause of mortality, behind cardiovascular diseases, cancer, and accidents. Life expectancy also increased markedly during the same period, in large part due to the prevention and better management of infectious diseases.

4.2 The Current State of IDPH

Despite these impressive gains, infectious diseases continue to affect the health of the public, Indeed, in 2013 the Chief Public Health Officer of Canada (CPHO) described infectious diseases as "the never-ending threat" (21). A variety of factors contribute to the on-going challenge of preventing, controlling, and treating infectious diseases.

First, there are literally hundreds of infectious diseases in the world. Some, such as syphilis and malaria, have been around for centuries, while others, such as HIV, HPV, and SARS, are "emerging" – they are new or have only recently been identified (22). Many of these diseases affect significant portions of the population in Canada. According to a 2010 study by the Ontario Agency for Health Promotion and Protection, "each year in Ontario, there are over 7,000,000 infectious disease episodes … [not including] many mild but commonly occurring infections that do not come to the attention of clinical or public health services"" (17). Populations in Canada, as elsewhere, are also being exposed to a wider variety of infectious diseases as a result of climate change, displacement of populations by natural disasters, and travel (23,24). For example, climate change has been implicated in rising rates of vector-borne communicable diseases. West Nile Virus appeared in Canada for the first time in 2002 and the incidence of Lyme Disease has been increasing as higher temperatures in southern Canada have allowed for the spread of mosquitoes and ticks north from the United States (25-27). Some research further suggests that climate change is likely to contribute to natural disasters, such as droughts, floods, and heatwaves, that create conditions conducive to the proliferation of infectious diseases (28).

Second, the sheer number and variety of microorganisms with the potential to cause illness is daunting. According to the World Health Organization (WHO), there is an "ever-increasing range of infections caused by bacteria, parasites, viruses and fungi" (29). Pathogenic microorganisms are also ubiquitous: they are found in the air, water, and soil, in foods, and in animals, insects, and parasites. Further, the human body is home to vast microbial communities, referred to as the human microbiome, on the skin, in saliva and other body fluids, and on the mucosal linings of the mouth, lungs, gastrointestinal tract, and vagina (30). Experts on the Human Microbiome Project have estimated that there are ten times as many microorganisms in the human body as there are cells (31). Many of these microorganisms are necessary for human health, but others such as some types of *Escherichia coli* and *Staphylococcus aureus*, are known pathogens. As a

result, IDPH faces the challenge of addressing the role of microorganisms in health and in illness as well as understanding the health impacts of altering bacterial flora.

Third, infectious diseases that had previously been well-controlled are "re-emerging" as public health threats. For example, rates of some childhood illnesses, such as measles and whooping cough, are rising because vaccination programs vary considerably around the world. According to a recent review of childhood vaccinations, some 22 million children globally are not fully immunized, contributing to masses of preventable deaths (32). Children in low- and middle-income countries are least likely to be fully immunized, but rates of childhood immunization in high-income countries, such as Canada, are also uneven. For example, the Public Health Agency of Canada reported that between 2002 and 2012, 96 % of children in Canada had been vaccinated, but rates were much lower among First Nations children living on reserve (33,34). Education, ethnicity, geography and other determinants of health contribute to variable rates of immunization, but it is also the case that some parents are refusing vaccination in the belief that it is unsafe, unpleasant, or unnecessary (35).

Fourth, the growing phenomenon of antimicrobial resistant organisms (ARO) – also referred to as antimicrobial resistance (AMR) – similarly poses a new threat to public health. The intensive use of antimicrobial agents to treat infectious diseases in humans and animals has led to the development of resistant strains of tuberculosis, HIV, gonorrhoea, and malaria, among others (29,36), As a result, many medications that had previously worked well against infectious diseases are no longer effective or not as effective as in the past. For example, in 2012 the WHO reported 450,000 new cases of drug-resistant tuberculosis worldwide (29). If the numbers of AROs and rates of AMR illnesses continue to rise, there may be dire consequences for human health. According to the World Economic Forum, "arguably the greatest risk … to human health comes in the form of antibiotic-resistant bacteria. We live in a bacterial world where we will never be able to stay ahead of the mutation curve. A test of our resilience is how far behind the curve we allow ourselves to fall" (37).

Fifth, IDPH faces the challenge of addressing the complex relationship between infectious and non-infectious diseases. Although non-communicable chronic diseases and accidents claim more lives than infectious diseases, infections often contribute to morbidity and mortality associated with heart disease, cancers, etc. Further, while media coverage tends to focus on outbreaks and epidemics, such as the 2014 outbreak of Ebola in West Africa, the health effects of infectious diseases can long outlast the acute stages and lead to chronic illness (38,39). Polio is a classic example. Most people who contract the virus do not fall sick and those who do generally experience flu-like symptoms and recover in a few days. In a small percentage of cases, however, infection leads to temporary or permanent paralysis and a condition known as "post-polio syndrome", which involves a cluster of debilitating symptoms such as intense fatigue, muscle atrophy, breathing disorders, and cognitive and emotional problems (40). Many

"emerging" infectious diseases, such as HIV, Hepatitis C, and Lyme Disease, may similarly cause chronic disabilities.

While some infectious diseases can result in chronic health problems, others can cause chronic diseases. For example, in the 1980s a German scientist, Harald zur Hausen, discovered that certain strains of Human Papilloma Virus (HPV) have the potential to cause skin, cervical, and other kinds of cancer (41). Further, research on the human microbiome suggests that there is an association between microorganisms and a diverse array of chronic health conditions, including arthritis, inflammatory bowel disease, obesity, psoriasis, and childhood-onset asthma (42). The nature of these relationships is not yet well understood, but they point to an important role for infectious diseases public health in the prevention of chronic diseases as well as in the mitigation of chronic health problems (31,42).

4.3 The Burden of Infectious Diseases on Public Health

Infectious diseases claim fewer lives than in the past, particularly in the developed world, but they nonetheless represent a considerable burden on the health of populations. The terms "burden of illness" and "burden of disease" appear regularly in the literature and are often used interchangeably to denote the risk for and prevalence of specific diseases in a given population and/or their economic impact (43-45). Many studies of burden of disease focus on chronic and non-communicable diseases or related risk factors, such as smoking and obesity (46,47). It is less common to see references to the burden of infectious diseases (17), but the volume and virulence of infectious diseases combined with new sources of infection, new opportunities for transmission, and newly-resistant microorganisms have created a serious threat to public health.

Around the world, infectious diseases exact a tremendous toll in human life and suffering. The WHO estimated that in

Positioning NCCID

Key Concept Paper: Burden of Illness

Public health decision-makers must determine priorities for programs and interventions in the context of finite resources, diverse demands on health care systems, and often conflicting evidence. "Burden of illness" is a public health concept used to determine relative importance of an infectious disease and also relative risk to populations. .

Current models for assessing burden of illness usually focus on morbidity and mortality and they may also include attention to economic factors (costs to health systems and to productivity in the labour market). These models do not typically account for upstream causes, although there is an understanding that social determinants and health inequities are critical factors for burden of illness in populations.

NCCID could consider developing a **Key Concept Paper** to bring together biomedical models of burden of illness (such as the GBD) with theory and evidence on health equity/inequity and determinants of health. Using Influenza as an example the Key Concept Paper could demonstrate how public health interventions on upstream causes (and causes of the causes), and downstream prevention and treatment (such as vaccines) are part of a more nuanced and complex description of burden, including longer term health, economic and social outcomes in a population.

2013 communicable diseases claimed the lives of nearly 9.5 million people, accounting for 17 % of all deaths (48). [4] Infectious diseases were also responsible for millions more living in less than optimal health (45,48). Rising rates of AROs also contribute to the mounting burden of infectious diseases. According to the WHO, "patients with infections caused by bacteria resistant to a specific antibacterial drug generally have an increased risk of worse clinical outcomes and death, … than patients infected with the same bacteria not demonstrating the resistance pattern in question" (29). As with most other developed countries, Canada enjoys much lower rates of mortality and morbidity from infectious diseases, but their impact is not negligible. According to a 2010 study in Ontario, infectious diseases account for "82,881 health-adjusted life years (HALYs) annually", meaning that many people die prematurely as a result of infections or live for years after an infection with compromised health (17). These estimates are likely conservative because they do not include the role of sepsis and other infections in morbidity and mortality rates for non-communicable diseases and accidents.

Infectious diseases also represent a significant economic burden for individuals, families, communities, populations, systems, and sectors. According to the Public Health Agency of Canada's Economic Burden of Illness in Canada (EBIC) database (49), in 2008 alone selected infectious diseases cost close to $5 billion in drug expenditures, physician and hospital care, and lost productivity due to illness and/or premature death.[5] These figures underestimate the economic impact of infectious diseases because they do not measure other important costs, including out-of-pocket expenses for patients and their families, such as care-giving, transportation and accommodation, homecare equipment, etc. They also do not track the costs of reduced productivity among employees who attend work while sick – a phenomenon referred to as "presenteeism". Indeed, in the case of infectious diseases, presenteeism is likely to drive up the economic burden of illness because it encourages the spread of disease to other employees and further decreases productivity. Antimicrobial resistance also drives up healthcare costs (29).

While everyone is at risk of contracting infectious diseases, the burden of illness is not evenly distributed across populations. Those living in conditions of social and economic deprivation are not only more likely to be exposed to infectious diseases, but also to experience poorer health

[4] These figures do not include deaths from chronic diseases with a known infectious disease component, such as cervical cancer, or deaths from chronic diseases that are hastened by infection

[5] "The EBIC 2005-2008 report includes estimates for direct and indirect costs. Direct costs refer to health care expenditures for which the primary objective was to improve and prevent the deterioration of health status. Three direct cost components were estimated in this report: hospital care expenditures, physician care expenditures and drug expenditures. Indirect costs refer to the dollar value of lost production due to illness, injury or premature death". Retrieved July 25, 2014 from http://www.phac-aspc.gc.ca/ebic-femc/index-eng.php.

outcomes as well as detrimental social and material consequences. According to the WHO's Special Programme for Research and Training in Tropical Diseases (TDR),

> *Major epidemics emerge and chronic conditions cluster and persist wherever poverty is widespread. Lack of food, shelter, security and social protection make people more vulnerable to infections, while affected populations are often unable to obtain even the most basic means of prevention and care. Poverty creates conditions that favour the spread of infectious diseases and prevents affected populations from obtaining adequate access to prevention and care. Ultimately, … social, economic and biological factors interact to drive a vicious cycle of poverty and disease from which, for many people, there is 'no escape'*(50).

These "infectious diseases of poverty", as they have been dubbed by TDR, are more prevalent in low- and middle-income countries, but they are also found in impoverished sub-populations in high-income countries, including Canada (50). Tuberculosis is a case in point. Aboriginal people in Canada are not only among the most impoverished populations in the country, they "also experience disproportionate rates of tuberculosis at 26.4 times the rate of Canadian-born non-Aboriginal people" (51,52). While it is important to recognize that poverty breeds infectious diseases and deepens the impact of infectious diseases, it is also critical to realize that poverty intersects with other forms of disadvantage (53-57), increasing the risk of exposure and transmission as well as negative health outcomes. For example, poverty alone does not explain the gap in rates of TB between Aboriginal and non-Aboriginal populations in Canada: a history of colonization and racism as well as geographic isolation are also contributing factors (58). In other words, infectious diseases that "cluster where poverty is widespread" also proliferate where inequities are endemic.

It is critical to realize that poverty intersects with other forms of disadvantage, increasing the risk of exposure, transmission and poor health outcomes.

4.4 Implications for NCCID

In 2013, the Chief Public Health Officer (CPHO) of Canada acknowledged that "the threat of infection in a developed country does not seem as critical as it does in a less developed one" (21). But he argued that the dangers posed should not be underestimated and cannot be ignored because:

> *Canadians are still getting sick from infectious disease. Some of the sickness is becoming long-term and treatment-resistant, and creates situations of vulnerability. Over the past 40 years, we have seen over 35 new diseases emerge, others that mutated in response to human actions and many that*

> *resulted from our interactions with animals and the environment. These threats make it clear that we cannot let our guard down* (21).

Understanding the history and current state of infectious diseases underscores the importance of IDPH as well as the challenges it poses. Public health practitioners and policy makers must grapple with infections such as STIs, TB, and respiratory illnesses that are persistent realities (21). Every year, for instance, they must make preparations for and decisions about seasonal influenza. At the same time, public health practitioners and policy-makers must contend with outbreaks and emerging infections that may be difficult to anticipate and address. SARS is an example of a communicable disease that appeared suddenly and unexpectedly in Canada, and which required a rapid, intensive, and coordinated public health response. Some infectious diseases, such as Lyme Disease, are spreading into Canada from other parts of the world as a result of climate change while other communicable diseases, such as Ebola Virus Disease, may be introduced by travellers. In both cases, new infections contribute to the burden of illness in Canada. Public health practitioners and policy makers must also think about "up-stream" factors, such as the relationship between infectious and non-communicable diseases and the role of the determinants of health in infectious diseases.

All of the factors that complicate the control, prevention, and treatment of infectious diseases also create challenges for NCCID as an organization tasked with translating knowledge to support and advance IDPH in Canada. Ten years after the foundation of NCCID, it is clear that there is still a pressing need for more evidence and more effective use of evidence in relation to many aspects of infectious diseases, including:

- the relative importance of infectious diseases;
- the burden of infectious diseases;
- modes of exposure and transmission;
- portals of entry;
- reservoirs of infection;
- proximal and distal determinants of health and infectious diseases
- treatments and other interventions, and;
- AMR.

But it is also clear that NCCID cannot address all of these needs and gaps. It must either focus its KT efforts on a few specific diseases and issues or consider exploring cross-cutting themes, such

as burden of illness. Both approaches have strengths and limitations. The former role would enable NCCID to make a deep impression in selected areas of IDPH, while the latter would position the organization to engage with and support the broader community, align its activities with current and future federal priorities, and complement the work of PHAC and other public health agencies.

5. The Context of Knowledge Translation

Given the range of public health concerns associated with and arising from infectious diseases and the pace of change in the field of IDPH, it is an on-going dilemma for public health decision-makers and practitioners to identify policy and program priorities and to determine the best allocation of resources. In some cases, there may be little research to support decisions, but even when research on infectious diseases is abundant, it may not be known to and/or used by health policy-makers and practitioners. Knowledge translation is meant to address this problem. By ensuring that information is mobilized from those who produce it to those who use it, KT can contribute to effective and cost-effective IDPH. The NCCs were established to fill these gaps in KT for public health and a decade later the need is still urgent. While the literature on knowledge translation reveals a wide array of theories and practices, as this section illustrates there is limited evidence to support the value of one approach over another, particularly in relation to IDPH. A recent evaluation of the NCCs indicates that an emphasis on knowledge synthesis and dissemination of knowledge products has not optimally advanced the interests of the organizations or the public health community. The history and current state of KT suggests that knowledge brokering may represent a better approach for NCCID because it would allow the organization to address cross-cutting themes in the complex field of IDPH while fostering engagement, collaboration, and knowledge exchange among multi-sector stakeholder groups.

5.1 The Development of KT

According to Rich, “the notion of adapting knowledge to the needs of society dates back to the Greeks and is a theme running through much of Western thought” (Rich quoted in (59)). Interest in using evidence to improve public health is not a new phenomenon. For instance, John Snow’s work on the cholera epidemic in 19th century London did not end with his successful identification of the Broad Street well as the source of disease. He brought his findings to local authorities and he has been credited, by some, with ending the epidemic when he convinced them to shut down the well (11). Historically, knowledge producers and knowledge users relied on “diffusion” to share information. Diffusion involves the unmanaged, natural circulation of information and ideas through chance conversations and encounters (60).

This approach may have worked well for John Snow and a local London neighbourhood where the research and practice communities were relatively small and well-connected. But for many years, Snow's findings had relatively little influence on practitioners and policy-makers elsewhere, despite the fact that he published his work (61, 62), Moreover, as the public health system grew and researchers proliferated and specialized, it was increasingly impractical to rely on personal interactions or even limited publication to share new knowledge.

Backer and others have described three main waves of "knowledge utilization" theory and practice in the 20th century (59,60). The first wave began in the 1920s and focused on the production and uptake of information and innovation by individuals. The second wave, which started in the 1960s, emphasized organizational as well as individual utilization of knowledge. By the 1990s, with the third wave, knowledge theory and practice had shifted from "simple transmission to full-scale application", involving systems or sectors, such as government, as well as organizations and individuals (60).

Three waves of knowledge use have been described:

1. *Diffusion to individuals*
2. *Organizational knowledge use*
3. *Full-scale application involving systems and sectors, organizations and individuals*

In the field of health and medicine, the phrase "knowledge translation" first appeared in the literature in the 1970s (63). Consistent with Backer's characterization of waves of knowledge utilization, proponents of knowledge translation initially emphasized individual and organizational uptake and then shifted to include systems uptake. Greenhalgh and colleagues have described the first as "bench to bedside" KT, which focused on translating laboratory findings into diagnostic and treatment applications, and the second as "campus to clinic" KT, which emphasized the integration of health services research into policy and practice (63). By the late 1990s, the phrase "knowledge translation" had become entrenched in the Canadian health sector, in no small measure because the newly-formed Canadian Institutes for Health Research (CIHR) – the premier health research funder in the country – actively promoted it. CIHR first encouraged and then required clinical and other health researchers applying for funding to consider how their studies could be applied to improve health and to explain how they planned to bring their research findings to "end-users" – practitioners, policy makers, and the public.

Proponents maintained that KT was different from diffusion and other approaches to knowledge dissemination, but the distinctions were not always clear. For example, many theories and practices of knowledge utilization have tended to be hierarchical and linear, treating information as a commodity to be pushed by knowledge producers down a one-way street or pipeline into the waiting arms of knowledge users (60). As late as 2006, for example, Lomas – among others – was describing knowledge translation in just this way, as

a process in which researchers actively conveyed their findings to practitioners who passively received them and, it was hoped, used them (64), Similarly, many theories and analyses of knowledge translation are based, if only implicitly, on an assumption that healthcare systems function mechanistically with evidence leading directly to changes in practices and policies, and improved health. This view was also common in earlier approaches to knowledge utilization and, as Kitson has pointed out, it is at odds with a more robust and realistic view of healthcare systems and sectors as organic and dynamic (65).

Yet some versions of KT did exhibit elements that were distinctive from earlier approaches to knowledge utilization, particularly the recognition that relationships among those who produce and those who use information are fluid and complex. For instance, in 2000, CIHR defined knowledge translation as "a dynamic and iterative process that includes the synthesis, dissemination, exchange, and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products, and strengthen the healthcare system" (CIHR 2000, as cited in McLean et al (66)). In this definition, effective KT requires active participants at both ends of a two-way street. As Greenhalgh and Weringa have written, successful knowledge translation was "dependent on 'supply' or 'push factors' (availability of evidence; appropriate packaging, e.g. in 'evidence-based actionable messages'; credible knowledge brokers and opinion leaders); *and* 'demand' or 'pull factors' (e.g. local knowledge champions; political support for implementation of particular research evidence; strategic presence on local decision-making bodies)" (63) [emphasis added]. Increasingly the phrase "knowledge translation and exchange" has been used to capture the interdependency and interactions among knowledge users and producers.

5.2 The Current State of KT

Mounting enthusiasm about KT has not necessarily been matched by increasing clarity or consensus about what it was or how to do it. For example, as recently as 2009, Straus and colleagues referred to an unpublished study by McGibbon that identified more than 90 terms to describe the use of research in practice settings (67). In 2006, Graham and colleagues registered their surprise at "how difficult it was to actually find meaningful and consistent definitions [of knowledge translation] despite the considerable and growing interest in the topic" (68). In their review of 33 research funding agencies in nine countries, they found 29 different terms used to connote some aspect of knowledge translation (Table 2). Many terms were used interchangeably or their meanings were conflated; sometimes they were "used as nouns to describe the entire process that results in the use of knowledge by decision makers" and at others, they were "used as verbs to represent actions or specific strategies taken to cause the uptake to occur" (68).

Table 2. Twenty-nine terms found by Graham et al. to describe the process of moving research evidence to practice.	
Applied health research	Knowledge translation
Capacity building	Linkage and exchange
Competing, cooperation, co-optation	Popularization of research
Diffusion	Research into practice
Dissemination	Research mediation
Exploitation	Research transfer
Getting knowledge into practice	Research translation
Impact	Science communication
Implementation	Teaching
Knowledge communication	The "third" mission
Knowledge cycle	Translation
Knowledge exchange	Translational research
Knowledge management	Transmission
Knowledge mobilization	Utilization
Knowledge transfer	

Similarly, many different models and frameworks have been developed in an effort to depict the stages and processes of knowledge translation. The sheer volume of work in this area attests to the keen interest in KT and the desire to "get it right". As with definitions of KT, however, the variety of models serves to muddy the waters rather than to clarify what knowledge translation is and how it "works". In many cases, frameworks identify what needs to be done without describing how to do it.

Moreover, despite close to a century of theorizing and practising knowledge utilization, including a decade or more of work on knowledge translation and exchange, research is still not making its way consistently into practice and policy (66,69). As Grimshaw and colleagues concluded in 2012,

> *One of the most consistent findings from clinical and health services research is the failure to translate research into practice and policy. As a result of these evidence-practice and policy gaps, patients fail to benefit optimally from advances in healthcare and are exposed to unnecessary risks of iatrogenic harms, and healthcare systems are exposed to unnecessary expenditure resulting in significant opportunity costs* (70).

The WHO has dubbed this problem the "know-do gap" (71) while others refer to it as the research-practice gap (60). Regardless of what it is called, it is a well-recognized phenomenon in the health sector (72), and it has created growing concern among policy makers and researchers "that the fruits of their investment in health research are not

reaching the public, policy makers and practitioners with evidence-based practices" (60) (see also 73-75).

The literature suggests that there are a variety of factors that complicate the translation of knowledge into practices and policies to improve public health. The first barrier to KT is that there is considerable disagreement about what kinds of knowledge should be translated (60,73). On the one hand, Grimshaw and colleagues argue that the results of randomized-control trials (RCTs) represent the best evidence and, as a result, they conclude that systematic reviews or syntheses of RCTs should be the basic unit of knowledge for translation activities (70). Others agree that the rigour of RCTs makes them well-suited for evidence-informed decision-making about specific single public health interventions. RCTs that establish the efficacy of vaccines and vaccine programs are good examples of the use of evidence to inform infectious diseases public health decision-making.

The literature suggests there are a variety of factors that complicate the translation of knowledge in practices and policies to improve public health.

On the other hand, researchers such as Green and colleagues point out that RCTs test only specific kinds of public health interventions in highly-controlled conditions with narrowly-defined study parameters (60). While they may produce important knowledge about vaccine efficacy, for example, they cannot shed light on other relevant questions, such as public perceptions of vaccine programs. The results of RCTs may also not be relevant for many public health settings because controlled study conditions do not replicate real-world conditions (76). They cannot address the "geographic spread and diversity of community settings, the role of mass media and social networks, [or] the multiple additional levels at which community or regional interventions must be implemented" (60). Other kinds of research evidence, such as survey results, data from qualitative interviews or focus groups, ethnographies, etc., are better able to address these kinds of research and practice questions and, consequently, are just as vital as RCTs in knowledge translation for IDPH (60).

Welch and colleagues have critiqued the inability of systematic reviews (or perhaps more correctly, the unwillingness of systematic reviewers) to consider health equity issues, by either ignoring health equity factors or excluding studies which provide context about inequity (111). The weight given to systematic reviews as the "best" form of knowledge translation for public health therefore needs to be critically assessed.

While empirical evidence is highly valued by researchers and practitioners, it is just one form of knowledge upon which public health practice is based. In a 2011 study, Kothari and colleagues found that front-line public health workers draw upon both *explicit* and *tacit* knowledge in their day-to-day practice (77). Explicit knowledge tends to be theoretical, acquired through basic and

continuing education, public health directives and notices, etc. while tacit knowledge is "knowledge-in-practice developed from direct experience and action; highly pragmatic and situation specific; subconsciously understood and applied; difficult to articulate; usually shared through interactive conversation and shared experience" (77). Practical wisdom and shared experience among peers are critical aspects of the design and delivery of effective public health interventions, but this type of information is much more difficult to collect, codify, and translate (63).

A second, salient cause of the know-do gap lies in the fact that knowledge producers and knowledge users operate in different contexts and are frequently unaware of or even indifferent to each other's needs, priorities, constraints, and opportunities. For example, policy makers have been criticized for the research-practice gap (78). Masuda and colleagues go so far as to suggest that the lack of action on health inequities arises not merely from a gap in knowledge, but also as a result of intentional choices related to "productivity, prosperity, austerity, or competitiveness, common in neoliberal approaches to health governance (79). Practitioners and researchers have also tended to blame each other for the failures of knowledge translation, pointing "variously at tradition-bound practitioners, who insist on practicing their way and believe they know their patients or populations best, and at the smugness of scientists believing that if they publish it, practitioners and the public will use it" (60). Certainly there is tension between researchers' insistence on "fidelity in the implementation of evidence-based practices and the need for practitioners to exercise some professional discretion in adapting such practices to their patients, populations, and circumstances" (60). Further, research on knowledge translation suggests that much of the evidence being translated does not match practitioners' needs, the circumstances in which they work, or the realities of their clients' lives (60). Even the presentation of research evidence, both the language and formats used, seems to be geared more towards other researchers than to the practice or policy communities (60, 80). According to Fromoso and colleagues, some practitioners complained that evidence is "often not completely intelligible, [and does] not explain what it really adds to existing knowledge, or which clinical/organizational context to place it in. They concluded that such knowledge transfer was neither accessible nor appealing" (80) . Similarly, traditional "lecture-and slide-shows" formats for conveying new evidence to practitioners in continuing education settings have been shown to be relatively ineffective in changing practice (81).

Public health involves not only researchers and practitioners, but also decision-makers, funders, NGOs, and the public at large (60,75). According to Masuda and colleagues, conventional KT practice often revolves around the erroneous assumption "that stakeholders share a common aim, understanding and ability to work together. This assumption implies that barriers to knowledge translation arise mainly from procedural constraints (e.g., organizational obstacles, resource constraints, or time), as opposed to epistemological distances or uneven power

relations (79). In fact, to be effective, KT has to address a variety of social, political, professional, and organizational contexts, all of which are shaped by specific values, priorities and constraints. Lomas and Brown, for example, undertook a study of the Ontario Ministry of Health's commitment to evidence-informed policy. Participants in the study described policy-making as a balance of political interests, public demand, budgetary constraints *as well as* the ready availability of the evidence they sought (82) [emphasis added]. Straus and colleagues likewise noted that challenges to effective knowledge translation exist at many different levels, "including the health care system (e.g., financial disincentives), the health care organization (e.g., lack of equipment), health care teams (e.g., local standards of care may not be in line with recommended practice), individual health care professionals (e.g., variations in knowledge, attitudes and skills in critically appraising and using evidence from clinical literature) and patients (e.g., low adherence to recommendations)" (67).

A third factor in the research-practice gap involves the lag between production and dissemination of evidence. Green and colleagues have likened the research-to-practice continuum to a pipeline or funnel: research questions are fed into the funnel and pass through multiple filters to ensure accurate, excellent results. The problem is that "the total attrition in the funnel and the lapse between research and medical practice indicates that it takes 17 years to turn 14% of original research to the benefit of patient care (60). By the time research questions are answered, they may no longer be relevant to policy or practice. Moreover, important information, particularly "negative" findings, may be filtered out along the way as researchers regard them as unpublishable. As a result, practitioners are deprived of evidence that might help them to recognize when an intervention is not appropriate or useful.

Fourth, knowledge translation is often ineffective because many of those expected to accomplish it do not have the necessary skills and there are limited opportunities or requirements to acquire this expertise. For instance, in 2011, Mishra conducted a review of academic curricula for public health education in Canada and found that only 14 of 37 university programs provided value statements about KT activities in the program goals or in the course objectives, and only 10 programs offered KT training (83). Similarly, Reitmanova noted that medical schools have been slow to provide "medical students and health professionals engaged in research with sufficient opportunities to examine more closely the facilitators and barriers to utilization of research evidence in policymaking and implementation or the effectives ness of their research communication strategies" (84), Phillipson pointed out that if academics are to be "seriously" expected to rethink the ways in which they communicate their findings, "they will need to find strategies for doing so without compromising key aspects of their work." She noted that knowledge translation in any of its forms requires a shift in thinking from the value of research findings as meritorious in their own right, to "conceptualizing knowledge as a commodity to be packaged for application"(85). It also means that researchers require institutional recognition of and support for knowledge translation work.

At the same time, it is not just researchers who need more and better knowledge translation skills. According to Straus and colleagues, "A common challenge that all decision-makers (i.e., clinicians, patients, managers, policy-makers) face relates to the lack of skills in knowledge management and infrastructure (i.e., the sheer volume of research evidence currently produced, access to research evidence, time to read and the skills to appraise, understand and apply research evidence)" (67). They estimate that a general internist would need to read 35 or more articles each day to keep abreast of developments in the field. Faced with the enormity of the task, many practitioners abandon the effort (86), potentially resulting in less than optimal care for patients. As with researchers, knowledge translation skills have not been a standard feature in most educational curricula for health care practitioners (87,88). In policy and practice settings, there is also a need for institutional support for the acquisition and utilization of new knowledge (89).

According to Backer, the third wave of knowledge utilization is characterized by an emphasis on "full-scale application" of evidence in policy and practice settings. While this is, arguably, the intended outcome of all KT, researchers have begun explicitly to study the application end of KT, using new paradigms such as "Implementation Science" and "Program Science". Because both of these research methods are relatively new (90), their definitions and the kinds of research they encompass remain somewhat fluid (91,92). However, there appears to be a consistent commitment to understand the kinds of evidence that are needed and can be acted upon in specific contexts, which is different from many KT approaches that treat evidence as fairly generic and therefore applicable in all or many practice settings. According to Blanchard and colleagues, public health program science involves "the systematic application of theoretical and empirical scientific knowledge to improve the design, implementation and evaluation of public health programmes. The endpoint for Program Science is the population level impact on [health] … by optimising the

Positioning NCCID

Facilitated Discussions: Antimicrobial Resistance

Antimicrobial resistance (AMR) is a complex problem that requires collaboration among many organizations and individuals, at all levels from the local to the global (vertically) and across a wide spectrum of sectors (horizontally). The problem is further complicated by potential conflicts of interest within governments (e.g. between departments), between governments, and with industry. The knowledge that is needed for rational and cost-effective strategies is similarly complex and draws from many sources.

Finding solutions to AMR will therefore depend on many factors, one of which is the translation and exchange of information and knowledge regarding prevention and control strategies and options for action.

Building on its past role in AMR knowledge brokering, NCCID could plan to broaden its network and deepen its capacity as a broker and collaborator for AMR knowledge translation in Canada. NCCID could facilitate multi-sectoral gatherings to allow governments and researchers to come together to review evidence and options for action, such as attributable causes for AMR in Canada, prevention and control through augmented surveillance, and coordination of information in animal and human public health. At the same time, NCCID could help coordinate discussions regarding knowledge gaps, such as evidence for effective strategies and interventions, including refinement and focus of current knowledge needs.

choice of the right strategy for the right populations at the appropriate time; by doing the right things the right way; and by ensuring appropriate scale and efficiency" (93,94). These approaches to KT appear promising in both national and international contexts (95).

5.3 Knowledge Brokering as Promising Practice

Deas and colleagues – as well as others – have concluded that knowledge utilization depends, first and foremost, on context – policy, practice, research (74). As a result, they argue that there is no single approach to KT that can be undertaken or be effective in all situations. The concept of "knowledge brokering" emerged in the late 2000s as a strategy for advancing and supporting KT activities across a variety of settings (96). A knowledge broker is an individual or organization with ready access to conceptual and practical expertise *and* the ability to foster linkages among those who generate and those who use knowledge. Rather than relying on a single approach to KT, a knowledge broker engages knowledge producers and end-users in a number of ways: working with practitioners and policy makers to identify issues for research; working with researchers to enhance knowledge translation skills; bringing knowledge producers and users together to establish shared goals and gain an appreciation of the constraints and opportunities of research, practice, and policy contexts (96). Conklin and colleagues define the role of knowledge broker as follows:

> *The knowledge broker adapts to the social and technical affordances of each situation, and fashions a unique and relevant process to create relationships and promote learning and change. The ability to work with teams and to develop relevant models and feasible approaches are critical knowledge broker skills. The knowledge broker is a leader who wields influence rather than power, and who is prepared to adopt whatever roles and approaches are needed to bring about a valuable result* (97).

Armstrong and colleagues speculated that knowledge translation products and activities were unlikely to contribute to change unless they were linked to a process of knowledge management (98). Knowledge brokers – be they agencies or individuals – could contribute to knowledge translation by creating knowledge management processes that involve multi-level exchanges of knowledge (in all its facets) and the explicit goal of integrating evidence in practice. An Australian study by Haynes and colleagues exemplifies the role of knowledge brokers and the idea of knowledge management. They found that researchers who were deemed 'highly influential' accepted "the need for some active facilitation of research understanding by the public, practitioners and/or policymakers. They strove to support research utilisation in multiple ways: encouraging policymaker participation in research development; increasing the relevance, utility, timeliness and accessibility of research findings; monitoring and

capitalising on emerging policy opportunities; and nurturing positive relationships with other researchers, policymakers and the media" (99,100).

Knowledge brokering appears to have a certain amount in common with Implementation Science and Program Science, both of which focus on tailoring products and activities to specific contexts. But it differs from these other paradigms in that it seeks to engage knowledge producers and knowledge users of all kinds in their own contexts and to create bridges that span the research-practice gap.

5.4 Implications for NCCID

Despite more than a century of theorizing about and testing models of knowledge utilization – and ten years of work by the NCCs and other organizations – the know-do gap persists in many areas of health and public health. There is consequently an on-going need for efficient and effective KT in public health. While the need is evident, the solution is not. The history and current state of KT demonstrates that there are many different ways to address the gap between research and practice, none of which has proved wholly effective on its own.

The history and current state of KT demonstrate that there are many different ways to close the know-do gap, none of which is wholly effective on its own.

KT in IDPH may also pose distinctive challenges for a number of reasons. First, the field is complex and ever-changing, comprising many different types and sources of infection, emerging and re-emerging infectious agents, and a multiplicity of prevention, control, and treatment contexts. As a result, the evidence and KT required to support practitioners and policy makers to address infectious diseases is equally vast and diverse, potentially increasing gaps in evidence and delays in translating knowledge.

Second, KT theory and practice in IDPH are relatively under-developed. Much attention has been devoted to understanding and bridging the research-practice divide in general, but most of this literature either does not address infectious diseases at all or does so only in the context of developing countries and in relation to infectious diseases that do not pose a significant public health threat in Canada (94,101,102). HIV and other STIs are an exception, but generally the discussion of KT in this literature involves descriptions of particular KT activities or laments about failure to adhere to testing and treatment guidelines (103).

Nevertheless, there are lessons to be learned from the study of KT in other areas of health and public health. The literature demonstrates that, by and large, traditional methods of diffusion, didactic instruction, and uni-directional knowledge dissemination have not been successful in shifting individual attitudes and practices, organizational and professional culture, or public health systems. Research suggests, instead, that managing how evidence is presented and to

whom, with attention to competing types of knowledge and practice or policy priorities, are critical. Knowledge brokering represents a promising approach to KT for IDPH and a promising way forward for NCCID. Because it involves fostering a web of knowledge sharing relationships – rather than a single pipeline of information – it allows for efficient and timely KT across many different contexts. As such, knowledge brokering can support the recommendations for IDPH presented in the 2013 CPHO report:

> *We must remain vigilant. We must continue our efforts to prevent illness from the many known, harmful communicable agents in our midst and also plan for the unknown and unexpected threats that may also emerge. We can do this through active monitoring of diseases here and around the world and through improving our ability to flexibly respond to these diseases. By working together and sharing knowledge we can play a part in protecting global health* (21).

6. Stakeholder Consultations

A critical component of data collection for this analysis involved polling NCCID's stakeholders for their views on the challenges and opportunities of IDPH KT in Canada. Results from the stakeholder consultations reinforce the findings from the literature review and have similar implications for NCCID. IDPH involves diverse public health researchers, practitioners, policy-makers, and other stakeholders who are working in different contexts. The scale and variety of their KT needs and preferences make it challenging for NCCID to determine both its content priorities and its approach to KT. Fortunately, some common themes also emerged in the stakeholder consultations, which may help to inform NCCID's strategic planning. The information gathered from stakeholders also demonstrated implicit and explicit support for the knowledge broker model of KT.

6.1 The Challenges of Diversity

Responses to the survey and interviews and consultations with NCCID staff revealed that the stakeholder groups for IDPH are numerous and heterogeneous – as are their evidence and knowledge translation needs and preferences. For example, groups with a vested interest in IDPH include:

- Qualitative and quantitative researchers in infectious diseases and/or public health, who may be based in universities, government, community-based organizations, and practice settings;

- Diverse decision-makers in all levels of government and throughout the public health system, such as those responsible for infectious diseases surveillance, immunization programs, disease-specific or event-specific practice guidelines and protocols, emergency planning and management, and, public health resource allocation;
- Public health practitioners of all kinds, including medical officers of health and other public health physicians, public health nurses, public health inspectors, health care-associated infection prevention and control practitioners, and health promotion specialists;
- Primary care physicians, infectious disease clinical specialists, nurse practitioners, midwives;
- Non-governmental organizations and the general public.

In some cases, the roles and responsibilities of individuals in these sectors overlap. For example, Chief Public Health Officers are both senior government policy advisors and public health practitioners. In other cases, there may be close collaboration among various stakeholder groups, such as between public health program managers and front-line practitioners. But interview and survey respondents also reported that IDPH stakeholders are often “siloed”, unwilling or unable – for various reasons – to communicate and collaborate. The sheer number of jurisdictions, sectors, and agencies tasked with managing IDPH in Canada creates barriers (8). The differing needs and realities of researchers, policy makers, and practitioners can also hinder knowledge translation: one key informant characterized these differences as a conceptual, political, and economic “gulf”, a comment that echoes the findings of the literature review on KT and the research-practice gap.

NCCID and IDPH stakeholders also operate in a variety of contexts: they live and work in different parts of the country; they serve diverse populations; they grapple with different types or rates of diseases; they have access to different amounts and types of resources. Key informants pointed to a number of examples where evidence and policies or programs might be relevant in one setting, but inappropriate or ineffective in another. For instance, one respondent noted that anonymous screening for HIV makes sense in jurisdictions with high prevalence rates, but may be less cost effective in jurisdictions with small numbers of people testing positive for HIV. Consequently, while stakeholders generally agreed on the need for more and better evidence as well as improved access to information, their opinions about IDPH priorities as well as their knowledge and knowledge translation needs were wide-ranging.

Among the different infectious diseases identified as priorities for IDPH in Canada were:

- STBBIs, such as HIV, Hepatitis, *Chlamydia*, and Syphilis;

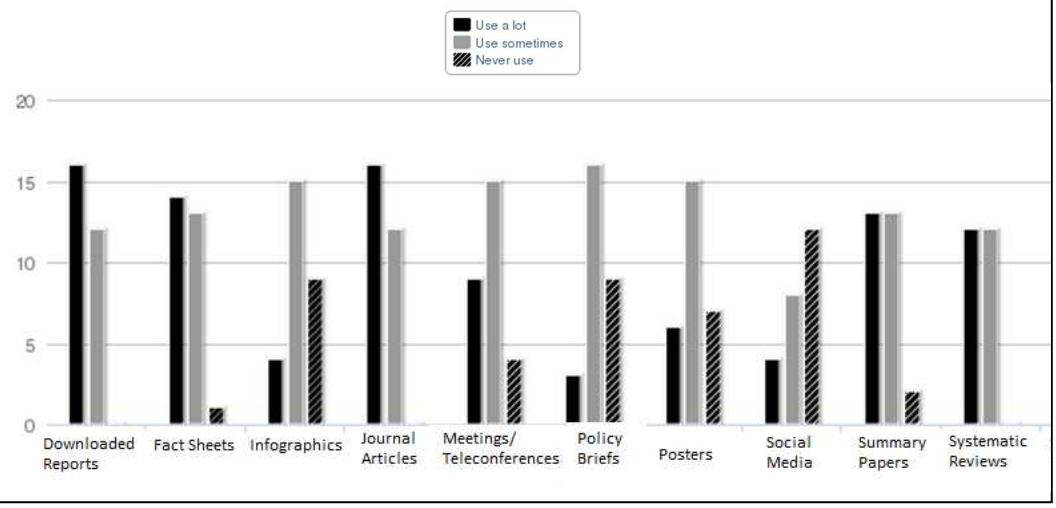
- respiratory infections, such as Influenza and SARS;
- emerging diseases, such as Lyme Disease, Chikungunya, and Ebola Virus Disease;
- re-emerging diseases, such as measles and tuberculosis.

Similarly, stakeholders named a number of policy, program, and practice issues that they believe require more attention and/or investment, such as: food inspection standards; up-to-date infectious diseases prevention and control guidelines; best practices to address AMR and ARO; immunization protocols and programs; emergency preparedness and infectious diseases, and; the health of Aboriginal peoples in Canada.

Stakeholders reported using a broad array of evidence sources, including research databases and peer-reviewed journals, a host of government and organizational websites, conference and workshop presentations, colleagues and manager, and 'credible" email and other social media. One key informant and several survey respondents suggested that an on-line "repository" or clearinghouse of up-to-date information on infectious diseases that is accessible to all would be a helpful resource. Respondents also favoured a variety of approaches to knowledge translation and a variety of products (Figure 1). Reports, fact sheets, systematic reviews, journal articles and summary papers – particularly those that could be down-loaded – were popular. In person meetings and workshops, teleconferences and webinars were also identified as useful approaches to gaining and sharing information. Support to attend knowledge sharing events was mentioned as important because public health practitioners are finding there are increasingly fewer resources and opportunities for gatherings.

Figure 1. Preferred KT formats among on-line survey respondents

On-line survey respondents were currently most likely to use downloaded reports, journal articles, and webinars and least likely to rely on social media, policy briefs, and infographics.

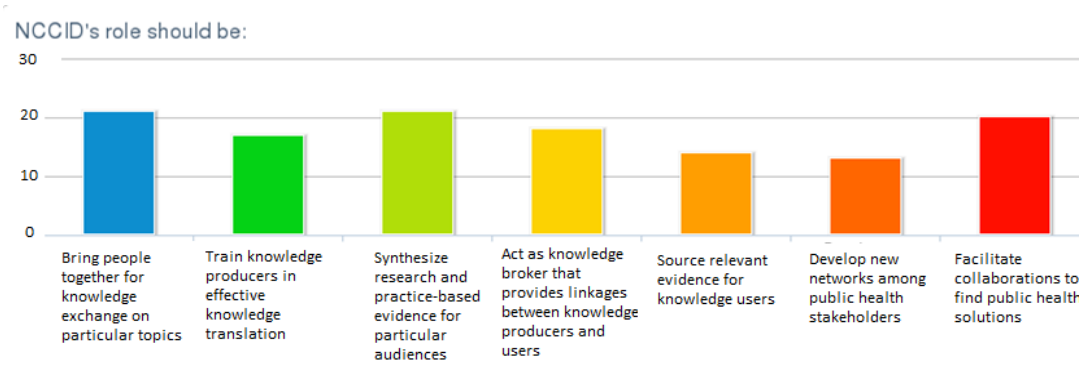


Key informants were asked their opinions about whether NCCID should adopt a “specialist” or a “generalist” approach to KT. Specialization was defined as focusing in-depth on a small number of infectious diseases or particular at-risk populations. Generalization was defined as working to address broader issues in IDPH, such as jurisdictional variations in public health policies and programs in Canada. One respondent felt that, from a KT perspective, specialization offered the greatest likelihood of knowledge uptake and therefore the greatest potential to have an impact on infectious diseases. Conversely, another respondent stated that NCCID should adopt a generalist approach because the role of specialist is already filled by government and researchers providing information on particular infectious diseases and their management. But most respondents resisted choosing one approach over the other, maintaining that attention to both specific diseases or populations and cross-cutting themes was necessary to support IDPH.

On-line survey respondents, when asked to choose from a list of possible KT roles for NCCID, likewise endorsed many different functions (Figure 2). Interestingly, knowledge synthesis was one of the top choices among on-line survey respondents, suggesting an on-going need for a traditional approach to KT, but respondents also identified knowledge brokering, specifically, as an important role for NCCID and were interested in other activities, including support for engagement, networking and collaboration, that are characteristic of the knowledge broker model.

Figure 2. Preferred role for NCCID among on-line survey respondents

On-line survey respondents were provided with a list of possible roles for NCCID and were asked to indicate all that apply.



6.2 The Potential of Shared Perspectives

Although survey respondents and key informants differed on content areas and formats for KT products, many of them were clear about the need for more evidence on interventions in general. For example, one respondent referred to rising rates of *Chlamydia* and asked for information about control measures and how feasible these might be, given limited public health budgets. Another wanted to know what the evidence said about the appropriate length of treatment for TB and multidrug resistant TB. One survey respondent identified the need for more information about contact screening for measles, including differences in local, regional, and federal approaches, as well as best and promising practices. Several informants asked for information about the value and cost-effectiveness of screening programs for various infectious diseases, including HIV, Hepatitis C. Many also indicated a need for evidence about AMR, in general, as well as about best practices for prevention and control of AMR and guidelines for stewardship of antimicrobial agents in practice settings and in the agri-food sector.

A number of respondents also indicated the need for educational materials that could support interventions by making complex information appealing and accessible to patients and the general public. One person mentioned wanting to experiment with infographics, but most of those who discussed educational materials seemed to be mainly concerned with raising awareness about the threat of infectious diseases and easy measures to combat transmission. One informant also suggested that NCCID should consider working with the education system to begin raising awareness among children, youth, and parents about simple measures to prevent the spread of infections.

Positioning NCCID

Webinar: Preventing *Chlamydia*

Chlamydia is a persistent sexually transmitted infection in Canada, with prevalence and incidence rates rising steadily in the past two decades. Partner notification and case follow-up are part of public health control for STIs, including *Chlamydia*, along with surveillance, education, screening and treatment. Public health STI teams can find there are too many positive *Chlamydia* tests and are forced to neglect some partners of cases.

Practitioners have asked for guidance on how best to prioritize cases of *Chlamydia* and partner notification when it is not possible for all cases or partners to receive public health follow-up. While research has been done to explore novel approaches to case and partner follow-up, there is no evidence to guide public health planning in a way that addresses the caseload versus capacity issue.

NCCID could invite public health practitioners at all levels to a virtual forum to discuss their solutions. The most recent resources on partner notification and links to relevant guidelines could be circulated as background information. As host, NCCID could pose questions about priority populations (e.g. age, infection history, infection site, testing sites, etc.) and approaches to cases (e.g. when to open a case), and contacting partners, inviting participants to submit questions and ideas before or during the on-line event to share their ideas for workable solutions. The resulting decision-making rubric could then be disseminated and brokered by NCCID for further discussion and refinement.

6.3 Cross-cutting Themes

In addition to shared interest in evidence on interventions, three broad, inter-related themes surfaced in the data: the drivers of infectious diseases; the relative importance of infectious diseases; the burden of infectious diseases. In each case, informants emphasized the need for credible, up-to-date evidence about these issues and for tools that would help them to set priorities for policy and practice, to allocate limited resources to the best effect, and to manage public anxiety. These cross-cutting themes identify important content issues in IDPH, but they also lend themselves to a generalist approach to KT. As a result, they could inform and/or focus NCCID's strategic planning as well as allow NCCID to pilot test the knowledge broker model as a more effective approach to KT for IDPH in Canada.

6.3.1 Determinants of Infectious Diseases

Many survey and interview respondents pointed to the importance of addressing *determinants* of infectious diseases in IDPH. Some references were implicit, as in the case of respondents who mentioned or acknowledged the heightened vulnerability of some populations to infectious diseases. Many of these comments focused on the health of Aboriginal populations in Canada. Others comments were more explicit, naming the determinants of health as key drivers of exposure to and transmission of infectious diseases, and of poor health outcomes. In keeping with the literature on "infectious diseases of poverty", these respondents argued that working "upstream" was critical to the prevention of infectious diseases and mitigation of harms. Some acknowledged that focusing on the determinants of health is a challenge for policy-makers and practitioners in IDPH because so much of their time is spent responding to real or perceived threats from infectious diseases. Another informant pointed out that it is a slow and costly process to influence the determinants of health, which reduces its appeal for policy-makers and funders. Nevertheless, many were convinced that it is necessary, as one informant stated, to address "the causes of the causes" of infectious diseases.

In keeping with the literature, respondents argued that working upstream was critical to the prevention of infectious diseases and mitigation of harms.

Informants identified climate change as another, increasingly important, driver of infectious diseases. Vector-borne diseases, in particular, are finding new, fallow territory as temperatures climb. Unlike "infectious diseases of poverty", illnesses associated with global warming and other types of environmental degradation may not seem to be driven also by the social determinants of health, at least not in developed countries. For example, Lyme Disease and Chikungunya Virus, which are spread by ticks and mosquitoes respectively, can affect anyone who works outdoors or participates in outdoor activities, such as golfing, camping, hunting, and fishing. While these infections are not yet concentrated in disadvantaged populations in North America, those at the lower end of the socioeconomic gradient may be at greater risk because

they have fewer choices about where they work and fewer resources to prevent infection or to deal with long-term health effects.

6.3.2 Relative Importance of Infectious Diseases

Survey and interview respondents also identified the need for evidence about the *relative importance* of infectious diseases. Among the key informants, this was interpreted in a number of different ways. Some respondents did not use the term, but made implicit reference in their comments about the determinants of health. They acknowledged, for example, that some populations are more vulnerable than others to contracting infectious diseases. In other words, some infectious diseases have greater importance for some populations than for others, as in the case of TB amongst Aboriginal populations in Canada. This way of thinking about the relative importance of infectious diseases clearly shares much in common with ideas about the determinants of infectious diseases, but it also serves to expose an important issue in IDPH. Because communicable diseases tend to cluster in disadvantaged populations, screening may also be concentrated in these populations, with the result that affected individuals in the general population may be missed. For example, one respondent noted that screening for Hepatitis C is usually recommended for injection drug users and others engaged in risky behaviours, but universal screening has identified cases of Hepatitis C in individuals with no known risk factors. While such individuals may be outliers, they may also represent an emerging at-risk population that has, as yet, unidentified risk factors. Hepatitis C may assume greater importance for this population and, therefore, for IDPH.

Other respondents made explicit reference to the need to weigh the importance of specific infectious diseases. For example, at the time of this analysis, the media and public health experts are paying close attention to the spread of Ebola Virus Disease. The WHO has declared it to be a global threat and some Canadian experts are treating it as a public health emergency (104). An outbreak of Ebola Virus Disease in Canada would be alarming, to be sure, but the absolute and relative risks of exposure in Canada are small compared with contracting *Chlamydia* or Influenza. Similarly, considerable effort has gone into crafting public health messages about Lyme Disease, although fewer than 600 cases have been diagnosed across Canada since 2009 (105). It is important for public health practitioners to have evidence about threats such as Ebola Virus Disease and Lyme Disease not necessarily because of the burden of morbidity and mortality, but because of the level of concern and interest of the public, the media, and governments – and the expectation that public health practitioners will undertake appropriate health protection and disease prevention measures,

Some respondents referred to the perceived relative importance of infectious versus non-communicable diseases. They pointed out that health promotion messages in recent years have focussed on raising awareness about behaviours that contribute to chronic diseases, such as

smoking, eating poorly and lack of physical activity. According to some informants, public health approaches to chronic and infectious diseases may sometimes conflict, resulting in contradictory messages to the public. For example, policy-makers and practitioners may be asked to assess the risks of engaging in outdoor activities, which can increase the chances of exposure to Lyme Disease (105), against the risks of inactivity, which may contribute to heart disease. One respondent commented that, similarly, advising people not to swim in the wake of flooding or heavy rainfall might protect them from exposure to infections, but it does not necessarily contribute to their overall health. It might also distract attention and effort from more important sources of infectious diseases, such as lapses in the management of water sources and sewage.

6.3.3 Burden of Infectious Diseases

The third theme that surfaced in the survey and interviews was *burden of illness.* Consistent with the literature, many respondents used the term to denote the prevalence of infectious diseases as well as their economic impact. Both of these meanings were linked to the determinants of infectious diseases and the relative importance of infectious diseases. Some respondents observed that the burden of infectious diseases weighs more heavily on disadvantaged populations. Others described the need for evidence that distinguishes between the "true burden" of infectious diseases and perceived risk of exposure.

Stakeholders explored the implications of changes or variations in the burden of infectious diseases for health policy-makers, planners, and practitioners. Some informants pointed to marked variations in the incidence and prevalence of infectious diseases across Canada. For example, influenza outbreaks are not evenly distributed across the country (106). Similarly, in 2012, rates of positive HIV tests ranged from a high of 17 per 100,000 of population in Saskatchewan to less than 1 per 100,000 of population in New Brunswick and Nunavut (107). In other words, specific infectious diseases impose a greater or lesser burden in different jurisdictions and among diverse populations. These kinds of variations pose serious challenges for IDPH because they require striking a balance between prevention and treatment standards and tailored responses to local needs. For instance, anonymous screening for Hepatitis C or HIV may make sense in jurisdictions with high rates, but would not be cost effective in jurisdictions where rates are low.

Some informants also linked increases in the burden of infectious diseases with rising rates of AMR. Antimicrobial resistant organisms contribute to higher rates of mortality and morbidity because they do not respond to existing treatments. Further, they drive up health care costs – for systems and for individuals – because treatment alternatives are expensive to develop and purchase. Stakeholders concluded that public health policy-makers, planners, and practitioners

need evidence of burden to help them address over- and inappropriate prescribing of antimicrobial agents for humans as well as indiscriminate use in food animals.

6.4 Implications for NCCID

Stakeholders confirmed the findings from the literature reviews on IDPH and KT. The diversity of their backgrounds and the contexts in which they work as well as the range of issues that concern them reflect the shifting landscape of infectious diseases as well as the complexity of the public health system in Canada. Their preferences for KT products and processes are equally diverse, which may be due, in part, to the under-development of KT theory and practice for IDPH. There is limited evidence to recommend one approach to KT over another, with the result that practitioners and policy-makers gravitate toward products and processes that are familiar and seem to work in their own contexts.

The range of needs, perspectives, opinions, and practices identified by IDPH stakeholders highlights a central challenge for NCCID and, indeed, for any organization working on KT for IDPH. One organization cannot be all things to all people. Choices will have to be made about NCCID's priorities for and approaches to knowledge translation in IDPH given its current resource base. Cross-cutting themes identified by stakeholders may serve as a guide for NCCID, positioning it to have the greatest impact on the IDPH community as a whole, rather than on specific sectors.

At the same time, the diversity described by stakeholders confirms the need for an approach to KT that can accommodate differences in context and content at the same time that it facilitates nimble responses to the changing landscape of infectious diseases. Many stakeholders offered implicit and explicit support for a generalist approach to KT, which is consistent with the knowledge brokering model and would lend itself well to addressing cross-cutting themes in IDPH.

In addition, stakeholders named a variety of specific openings for advancing IDPH in general and for NCCID's work in particular. Many of these opportunities would allow NCCID to test a new focus on cross-cutting themes and the knowledge brokering model. For instance, stakeholders identified prospects for collaboration with the Canadian Institutes for Health Research. CIHR is currently working on a number of large "signature initiatives" that involve all 13 Institutes. Because infectious diseases figure in the work supported by each Institute, these signature initiatives represent a promising opportunity for NCCID to establish its relevance in every area of health research. For example, the recently-launched "Pathways to Health Equity for Aboriginal People" includes attention to the burden of tuberculosis among indigenous peoples in Canada and another planned initiative on environments and health will likely include work on

the effects of climate change on the spread of vector-borne infectious diseases and the role of the agri-food sector in rising rates of AMR. NCCID senior staff have already been in touch with the Institute of Population and Public Health and the Institute for Infection and Immunity regarding potential collaboration on the Pathways to Health Equity for Aboriginal People.

Interviews with key informants also served to identify opportunities for deepening existing partnerships and developing new collaborations with PHAC and with other NCCs. For example, NCCID could work with PHAC on knowledge and translation that complements some of its priority areas, including tuberculosis, STBBIs, and AMR. Similarly, NCCID could support efforts to augment information about infectious diseases on PHAC's Best Practice Portal, which currently focuses on chronic and non-communicable diseases. At the same time, there is considerable potential in the complementarity between NCCDH's work on health equity and a possible focus on "infectious diseases of poverty" and "burden of infectious diseases" at NCCID. NCCID's involvement with the CIHR signature initiatives would also position the organization to work more closely with the NCCAH and the NCCEH.

Finally, key informants suggested that NCCID might take a lead role in evaluating and synthesizing evidence about "Program Science" and "Implementation Science" as promising practices in the field of knowledge translation. NCCID could also facilitate dialogue about and testing of these models of knowledge translation.

7. Review of Organizations

Public health practitioners and policy-makers draw, as much as possible, on published, peer-reviewed literature for the latest evidence in their fields. Reviews of the history and current state of both IDPH and KT theory and practice demonstrate the challenges of relying on these sources of information: the literature is vast and diverse, making it difficult to identify and assimilate credible, relevant research findings; there are significant gaps in the research, and; research suggests that didactic, uni-directional KT process do not have the greatest reach of utility for public health audiences. As NCCID stakeholders have indicated, they also turn to government, research projects, conferences, professional associations, and NGOs in an effort to bridge the know-do gap in IDPH. In order to assess these sources of IDPH knowledge and to scope out a potential KT niche for NCCID, a review of organizations involved in knowledge translation related to infectious diseases and public health was undertaken by NCCID staff as part of this environmental scan.

As mentioned in the description of methods, there are many dozens of agencies, organizations, and projects that address aspects of infectious diseases; many of these also consider the public health implications of infectious diseases and engage in some form of KT. It was beyond the

scope of this project to sift through the websites and related materials of all these organizations and projects, yet it was also necessary to find reasonable comparators for NCCID. A decision was made to focus on agencies working in the area of HIV/AIDS as an example of the organizational landscape of IDPH. Although there are still dozens of organizations working on HIV/AIDS in Canada, none is in the unique position of NCCID to undertake and advance KT for IDPH as a whole.

7.1 A Complex Landscape

A focused web search identified 89 organizations, agencies, and projects with an interest in and activities related to HIV/AIDS (Appendix 6). They tend to be concentrated at the regional, provincial/territorial, and national levels, but some also undertake international and local work (Table 3). Many have multiple mandates and/or are engaged in a variety of activities, such as research, advocacy, or health care services, that may or may not include KT (Table 4). Considered collectively, these organizations, agencies, and projects illustrate the complexity of the institutional landscape for KT in IDPH as well as a need that NCCID can help to meet.

Table 3. Number of Organizations found by Jurisdictional Scope	
International	1
National	32
Provincial/Territorial	23
Regional	25
Local	8
Total	89

Table 4. Areas of Activity Named for Organisations found	
Advocacy	29
Coalition, networking	14
Knowledge or research dissemination	42
Knowledge Translation	11
Research	24

Some organizations, such as the Canadian Medical Association (CMA) and the Native Women's Association of Canada (NWAC), have a stated interest in HIV/AIDS, but it not their primary focus. NWAC, for example, has a mandate to advance the health and wellbeing of a specific population and infectious diseases such as HIV/AIDS and TB figure in their work because Aboriginal women are disproportionately affected by these diseases. As a result, NWAC may not be in a position to engage a diverse array of stakeholders in HIV/AIDS or to address cross-cutting themes in IDPH that have implications for HIV/AIDS.

Other organizations, such as the Canadian AIDS Treatment Information Exchange (CATIE), the Canadian Aboriginal AIDS Network (CAAN), and the Pacific AIDS Network, undertake dedicated work on HIV/AIDS (108,109). The focus on one disease in these organizations is a decided strength, in that it enables them to address many different aspects of the disease. But it can also make it more challenging for them to explore cross-cutting infectious disease themes, such as

AMR or the relative importance of infectious diseases, or the relationship between HIV/AIDS other public health considerations such as emergency preparedness. These organizations have a strong commitment to certain types of KT, namely advocacy and public education, and they have been effective in raising awareness about HIV. But they are not necessarily in a position to fully engage with stakeholders in the policy and research communities. Indeed, policy makers may encounter barriers to forming partnerships with organizations that are explicitly or implicitly undertaking advocacy work.

Provincial, territorial, and local health authorities undertake public and professional education about HIV/AIDS – as well as other infectious diseases, but KT is not their primary mandate. For example, the British Columbia Centre for Disease Control (BCCDC) and PHAC both disseminate information about HIV/AIDS, but a large part of their work involves surveillance and the coordination of prevention and treatment efforts. Local and regional health authorities are likewise engaged in educational activities, particularly with patients and the public, but their main job is health care planning and service delivery. Government agencies, at all levels, are also hampered in their KT efforts by perceptions that they are not always objective sources of information or guidance. As the most recent evaluation of the NCC program concluded, “Many key informants … felt that the arms-length relationship between the NCCs and the Public Health Agency elevated the perceived credibility of the NCC products, due to the level of independence the NCCs have from the political environment associated with that of any federal government department/agency” (1),

Multi-jurisdictional KT is also a challenge for health authorities because staff may have few opportunities to meet with colleagues outside their geographic areas. As a result, it is harder for them to exchange information and experience. Implementation and evaluation of prevent, control, and treatment protocols in one context may also have limited value or relevance in other settings, but local and regional health authorities may not be in a position to recognize these differences. National and provincial/ territorial agencies have more latitude for collaboration and consultation, but budgetary and political cycles may hamper the development of sustained and sustainable partnerships. Some research teams working on HIV/AIDS, such as the CIHR Social Research Centre in HIV Prevention (SRC) are pan-Canadian or multi-jurisdictional and therefore have more openings for knowledge exchange. But even when these research projects have a stated commitment to KT, it tends to focus on peers, students, and the general public and could be limited by grant duration.

While this review of organizations has focused on HIV/AIDS, similar patterns are evident in other areas of IDPH. Many organizations that undertake KT in IDPH are specialists – they focus on particular content (a single infectious disease or disease group), on specific audiences (their own professional membership, researchers or patients, for example), or on political or administrative jurisdictions (regional health authorities, provinces). What is missing from this landscape – and

what is needed – are organizations that can take a "generalist" approach to KT in IDPH. According to Frank, a key reason for the creation of the National Collaborating Centres for Public Health was the lack of capacity and expertise in KT and public health for (110). Ten years later, as this review of organizations demonstrates, the gap remains, particularly in the area of IDPH.

7.2 Implications for NCCID

In keeping with the organizational landscape of IDPH, NCCID has tended to support a specialist approach to KT, synthesizing and translating knowledge on certain enduring and emerging diseases, especially HIV and other STBBIs and H1N1. Recently, NCCID has begun to take a more generalist approach, addressing cross-cutting themes such as AMR and influenza-like illnesses, and building a pan-Canadian database of protocols for notifiable diseases, as well as developing rapid reviews of emerging infections in the last year (MERS Co-V, H7N9, Ebola Virus Disease and EV-D68).

This analysis suggests that NCCID should build on its specialist activities and partnerships, but also consider moving more fully and purposefully towards a generalist approach. NCCID is uniquely positioned to take on the role of knowledge broker for IDPH for a number of reasons:

1. NCCID's main priority is KT in IDPH;
2. NCCID has a national mandate, allowing it to work across jurisdictions and to address national priorities and issues of national significance;
3. NCCID has access to content specialists across diverse disciplines, sectors, and jurisdictions, enabling it to address cross-cutting themes in IDPH while remaining flexible and responsive in the face of emerging infectious diseases and pressing needs for knowledge and knowledge exchange;
4. NCCID has the ability to bring together public health practitioners – its principal target audience – with researchers, policy makers, and other stakeholders, thereby supporting the CPHO's call for greater collaboration and sharing of information to enhance the prevention, control, and treatment of infectious diseases;
5. NCCID works at arms-length from government and academia and it has a reputation as a reliable and credible source of information with public health policy-makers, planners, practitioners, and with the general public.

As a knowledge broker, NCCID will be able to share, strengthen, and broaden the work of KT in IDPH. It can build on existing collaborations, such as those with CATIE and CAAN in the areas of HIV and STBBIs and those with the Association of Medical Microbiology and Infectious Disease

Canada (AMMI) and the Communications and Education Task Group on Antimicrobial Resistance (CETAR) in the area of AMR. Similarly, NCCID has established a focus and begun a program of work related to influenza and influenza-like illnesses, which includes building partnerships and helping to network researchers and public health practitioners across the country. NCCID can also create new or renewed partnerships with organizations and individuals working in other areas of IDPH. For example, in the past, NCCID has had intermittent engagement with stakeholders in the area of TB and this is an important area for knowledge brokering. There are also ample opportunities for NCCID to foster stronger relationships with provincial and sub-provincial health authorities and other public health structures.

8. An Emerging Vision for NCCID

8.1 Summary

Although public health has historically focused on the prevention and control of infectious diseases, there has been a growing trend in Canada – as well as elsewhere – towards prevention and management of non-communicable diseases and non-communicable chronic health problems such as cancer and cardiovascular diseases, obesity, smoking, and substance overuse. But, for a number of reasons, there is an on-going, even growing, need for public health action to address infectious diseases. The transmission of emerging and persistent infectious diseases is changing as a result of a variety of factors, including international travel and climate change. Increasing numbers of microorganisms have also become resistant to antimicrobial treatments, compromising the ability to treat infections. While non-communicable diseases are among the leading causes of morbidity and mortality, infectious diseases continue to impose a great burden on populations and health systems, with increasing expectations of governments to prevent and control them. Many microorganisms are the cause of chronic infectious diseases that can lead to cancer and other chronic non-communicable diseases. Furthermore, infections are still important contributing factors to morbidity and mortality, even if they are not considered the underlying cause.

Public health practitioners require timely, reliable, and relevant evidence to support their efforts to address the threat and impact of infectious diseases. But there is often a gap between knowledge on infectious diseases and the development and implementation of public health policies and practices. Sometimes researchers are not investigating issues that are important to policy makers and practitioners; sometimes the results of research are not making their way into the hands of policy makers and practitioners. There is consequently an on-going need to support the mobilization and utilization of evidence to prevent, control, and treat infectious diseases.

8.2 Vision Statement

Many agencies and individuals are working on diverse aspects of infectious diseases public health (IDPH), but there is a need for a central hub for knowledge translation of IDPH in Canada to provide more opportunities for researchers, policy makers, and practitioners to engage with each other, share knowledge and build partnerships across sectors and jurisdictions. NCCID was created for this purpose and remains ideally positioned for this role. As an organization without typical government bureaucratic or jurisdictional limitations, NCCID can provide a platform to draw together evidence and expertise on IDPH from a wide range of contributors. In this way, it can foster knowledge translation and dialogue on issues of national significance while also supporting the application of evidence in regional and local contexts.

NCCID can foster knowledge translation and dialogue on issues of national significance while also supporting the application of evidence in regional and local contexts.

NCCID should consider adopting the model of knowledge broker to respond to these on-going needs in IDPH knowledge in Canada. A knowledge broker is an individual or organization with ready access to conceptual and practical expertise *and* the ability to foster linkages among those who generate and those who use knowledge. A knowledge broker has credibility with many different stakeholders and so can facilitate the formation of multi-sectoral knowledge sharing networks and partnerships. NCCID could act as a knowledge broker in IDPH in the following ways:

- strengthening existing relationships and establishing new partnerships with research, policy, and practice experts;
- facilitating connections, discussion and exchange of knowledge;
- responding to questions from stakeholders with information or referrals;
- working with stakeholders to identify knowledge gaps and promising practices in IDPH interventions;
- identifying and maintaining a database of experts, organizations, and reliable sources of IDPH information;
- interpreting and translating evidence to support decision making and priority setting in public health and IDPH;
- developing and disseminating relevant tools and methods;
- organizing integrated events on persistent and emerging issues in IDPH.

Knowledge brokers are often generalists rather than specialists. In other words, the strength of knowledge brokering lies not so much in the ability to answer every question, but in the ability to foster connections among those who have the questions, those who have answers, and those positioned to take action on evidence. NCCID could act as a generalist knowledge broker, working with evidence and stakeholders to explore and address cross-cutting themes and issues in IDPH. NCCID could also add value to this generalist approach by acting as a specialist knowledge broker for a select group of issues and diseases that are of enduring and/or emerging relevance in IDPH. This combined approach to knowledge brokering would enable NCCID to support sustainable, collaborative, multi-sectoral partnerships while remaining responsive and accountable in the face of emerging issues and outbreaks.

8.3 Next Steps

This position paper represents the foundation for strategic planning and action for NCCID during the next 30 months. The goal is to further refine the vision for the organization and to make organizational change to realize this vision. If NCCID decides to move to a knowledge broker model, the following steps are recommended:

1. **Develop an implementation strategy and plan.** An implementation strategy and plan should be created to support NCCID as it transitions into the new role of knowledge broker. The strategy should outline the phases of organizational change while the plan should describe work that will be undertaken to stabilize, transition, and transform the organization during the second half of the 2014-15 fiscal year and for the following two fiscal years (2015-2017) under an amended Contribution Agreement.
2. **Elicit further input from stakeholders**. Some respondents to the NCCID survey expressed interest in contributing further to this environmental scan. NCCID should follow-up with those who provided their contact information, as well as others in the NCCID network. Additionally, NCCID should assess whom else among potential and current stakeholders should be solicited regarding proof of concept for this Position Paper and the Vision Statement. This input would be in addition to any regular evaluations of specific activities and products NCCID undertakes.
3. **Fulfill existing commitments and stabilize existing partnerships.** While the environmental scan and position paper were in process, NCCID has continued to work with partners to address persistent and emerging issues in IDPH. It should stabilize its work and partnerships in these areas in preparation for transitioning to the knowledge broker model.
4. **Establish processes for setting priorities and determining content domains**. NCCID will need to strike a balance to meet the call from stakeholders to be both KT specialists and

KT generalists in IDPH. It should consider developing criteria and tools for assessing the potential for emerging issues and opportunities to help NCCID realize its vision.

5. **Identify core content areas**. Drawing on the findings in this position paper and on the aforementioned tools and processes, NCCID should establish content priorities. These might include brokering evidence and exchange in established content areas, such as HIV and other STBBIs, AMR, influenza and ILI, and addressing key cross-cutting themes, such as Burden of Disease, to expand the organization's reach and relevance.

6. **Pursue emerging KB opportunities**. Stakeholders identified a number of specific opportunities that NCCID could explore, including becoming involved in CIHR signature initiatives and working more closely with the Public Health Agency of Canada on federal priority issues. Stakeholders also noted the importance of collaborating with researchers, policy makers, and public health practitioners working in the area of chronic and non-communicable diseases (CNCD) because there are critical links between CNCD and ID. As with content areas, NCCID will need to develop mechanisms for identifying strategic partnership opportunities on an on-going basis.

7. **Develop an evaluation strategy**. Once the vision and implementation strategy and Plan are finalized, NCCID should develop a specific evaluation framework and process that will enable the organization to assess the merits of the KB approach to IDPH KT, the value of this model for NCCID, and the extent to which that model is being realized through organizational change.

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Appendices

Appendix 1: List of Key Informants

In alphabetical order

Jaime Blanchard

Professor of Community Health Sciences & Medical Microbiology, Faculty of Medicine, University of Manitoba
Canada Research Chair in Epidemiology and Global Health

Melanie Barwick

Psychologist and Health Systems Scientist
Community Health Systems Resource Group, Department of Psychiatry
Senior Associate Scientist and Scientific Director Knowledge Translation
Child Health Evaluative Sciences, Research Institute
The Hospital for Sick Children

Eilish Cleary

Chief Medical Officer of Health
New Brunswick

Connie Clement

Scientific Director
National Collaborating Centre for Determinants of Health

Emma Cohen

Knowledge Translation and Communications Manager
CIHR Institute for Population and Public Health

Joanne Cook

Northern nurse
National Collaborating Centre for Infectious Diseases Advisory Board

Lesley Dyck

Knowledge Translation Specialist
National Collaborating Centre for Determinants of Health

Heather Medwick
Chief Executive Officer
International Centre for Infectious Diseases

Marc Ouellette
Scientific Director
CIHR Institute for Infection and Immunity
Canada Research Chair in Antimicrobial Resistance

Howard Njoo
Director General, Centre for Communicable Diseases and Infection Control
Public Health Agency of Canada

David Patrick
Director and Professor
University of British Columbia, School of Population and Public Health

Alan Ronald
Distinguished Professor Emeritus
Department of Medical Microbiology, University of Manitoba

Appendix 2: Interview Guide

Introduction

The National Collaborating Centre for Infectious Diseases (NCCID), hosted by the International Centre for Infectious Diseases in Winnipeg, Manitoba, is one of six Centres established by the Public Health Agency of Canada to support evidence-informed public health practice and policymaking. The mission of the Centres is to translate existing and new evidence produced by academics and researchers in public health into accessible and useful information.

NCCID gathers, synthesizes and disseminates current information, and ensures it reaches public health practitioners to the benefit of all Canadians. We also identify gaps in research and knowledge and bring these to the attention of researchers and their funding bodies. NCCID's work ultimately informs public policy and better equips public health practitioners in their role of preventing and controlling emerging and re-emerging infectious diseases.

Purpose

The purpose of this environmental scan is to gather information about challenges to and opportunities for supporting public health actions aimed at addressing infectious diseases. The findings of the scan will be used to help shape the knowledge translation priorities and activities of NCCID over the next five years (2015-2020).

Points of Clarification

These interviews are not being taped, but field notes are being taken and these will be analyzed by the Project Consultant.

Information shared by you will remain confidential and your words will not be quoted nor will you be associated with specific ideas. We you allow us to identify you as one of our key informants?

This interview guide was designed for use with a diverse group of key informants. As a result, you may feel able to answer some questions and not others. Please indicate when you feel that you are not able to answer specific questions or address specific issues.

Interview Questions

1. Please tell me about your work in the area of infectious diseases, public health, and/or knowledge translation and exchange?

2. What do you see as the key challenges/needs/gaps for public health action to address infectious diseases?

3. What opportunities are there for improving public health action to address infectious diseases?

4. Given the number and variety of infectious diseases affecting populations in Canada, does it make sense for NCCID to take on a "specialist" or a "generalist" role in knowledge translation and exchange? (ID/PH/KT) Let me explain how I am using these terms.

   If NCCID adopted a specialist role, it might focus its KT activities on:
   - a few infectious diseases, such influenza or HIV;
   - particular categories of infectious diseases, such as STIs or airborne infections;
   - a few specific target audiences.

   If NCCID adopted a generalist role, it might focus its KT activities on a number of issues with the potential to affect many areas of infectious diseases public health, such as:
   - antimicrobial resistance or co-morbidities;
   - factors that contribute to heightened risk or burden of infectious diseases;
   - factors that contribute to coordinated, horizontal public health responses to infectious diseases.

   Please explain.

5. What types of knowledge translation products and approaches would be most helpful? For example, should NCCID:

   a. Create summaries/reviews of existing evidence in accessible formats
   b. Support opportunities and/or structures for sharing of information between public health staff/organizations, policy makers, and researchers
   c. Facilitate and support critical reflection among public health practitioners, policy makers, and researchers about existing and emerging issues in infectious diseases public health
   d. Maintain databases of infectious diseases policies by jurisdiction (immunization schedules and protocols, reportable diseases frameworks, anti-microbial resistance tracking, etc.)
   e. Other. Please specify.

6. What are two things that the NCCID could do that would have immediate impact to support public health action on infectious diseases? (ID/PH/KT)

7. Before we conclude the interview, I'd like to give you an opportunity to share any other ideas or insights you may have about NCCID, KT and IDPH in Canada.

Appendix 3: CPHA Survey

What BUGS You?

NCCID is taking stock of the best ways to learn, share and act on infectious disease evidence.

What's working and what's not? How can we help you move evidence into action?

Q1: **What infectious disease issue concerns you the most?**

Describe your needs for evidence or knowledge exchange.

Learn more
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Centre de collaboration nationale des maladies infectieuses

What BUGS You?

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What's working and what's not? How can we help you move evidence into action?

Q2: **Where and how do you learn about bugs?**

Where do you go most for information?
(ORGANIZATION, SEARCH ENGINE, PUBLICATION, WEBSITE ETC.)

In what format(s)?
(RANK 1 to 11: 1 = MOST USED)

POSTERS ___ INFOGRAPHICS ___
JOURNAL ARTICLES ___ WEBINARS ___
FACT SHEETS ___ POLICY BRIEFS ___
DOWNLOADED REPORTS ___
SUMMARY PAPERS ___
WORKSHOPS/SEMINARS ___
MEETINGS/TELECONFERENCES ___
OTHER ___ *Type?*_____

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What BUGS You?

NCCID is taking stock of the best ways to learn, share and act on infectious disease evidence.

What's working and what's not? How can we help you move evidence into action?

Q3: **How do you share what you know about bugs?**

How do you share infectious disease evidence so that it's useful for practitioners, planners or policy makers?

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What BUGS You?

NCCID is taking stock of the best ways to learn, share and act on infectious disease evidence.

What's working and what's not? How can we help you move evidence into action?

Q4: **What helps you act on bugs?**

What helps you apply the research lessons or best practices of others to your work in public health?

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What BUGS You?

NCCID is taking stock of the best ways to learn, share and act on infectious disease evidence.

What's working and what's not? How can we help you move evidence into action?

Q5: Where are the bugs in our public health systems?

What barriers prevent Canada's public health network from putting evidence into practice? What's not working? What's missing?

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Qu'est-ce qui vous irrite?

Le CCNMI fait le point sur les meilleures façons d'apprendre, d'échanger et d'agir sur les données probantes liées aux maladies infectieuses. Qu'est-ce qui fonctionne et ne fonctionne pas? Par quels moyens pouvons-nous vous aider à passer des données probantes à l'action?

Q1: **Quelle est la question qui vous préoccupe le plus concernant les maladies infectieuses?**

Décrivez vos besoins en matière de données probantes ou d'échanges d'évidence.

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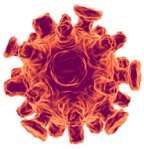
En savoir plus
ccnmi.ca

Centre de collaboration nationale des maladies infectieuses
National Collaborating Centre for Infectious Diseases



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Q2: **Nommez les sources que vous consultez pour vous renseigner sur les microbes.**

Quelles sont les sources que vous utilisez le plus souvent pour obtenir des renseignements?

(ORGANISME, MOTEUR DE RECHERCHE, PUBLICATION, SITE WEB, ETC.)

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Sur quel(s) support(s)?

(INDIQUEZ L'ORDRE D'IMPORTANCE EN ALLANT DE 1 À 11; 1 ÉTANT LE PLUS UTILISÉ)

AFFICHES ___ RÉSUMÉS GRAPHIQUES ___
FEUILLET D'INFORMATION ___ WEBINAIRES ___
ARTICLES DE PÉRIODIQUE ___
RAPPORTS TÉLÉCHARGÉS ___
RÉSUMÉ DE COMMUNICATIONS ___
DOCUMENTS DE POLITIQUE ___
ATELIERS OU SÉMINAIRES ___
RÉUNIONS OU TÉLÉCONFÉRENCES ___
AUTRES ___ *Type?*_____

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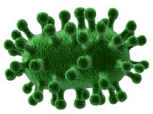

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Q3: **Par quels moyens partagez-vous vos connaissances sur les microbes?**

Par quels moyens échangez-vous avec les praticiens, les planificateurs ou les décideurs sur les données probantes liées aux maladies infectieuses?

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En savoir plus
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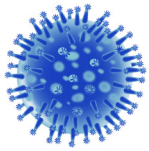
National Collaborating Centre for Infectious Diseases



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Q4: **Qu'est-ce qui vous incite à agir sur les microbes?**

Dans votre travail au sein de la santé publique, qu'est-ce qui vous aide à mettre en application les leçons tirées de la recherche ou les meilleures pratiques des autres?

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En savoir plus
ccnmi.ca

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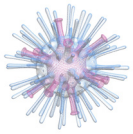

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Q5: Quels sont les pépins dans notre système de santé?

Quels sont les facteurs qui font obstacle à la mise en pratique des données probantes de la part du réseau de la santé publique du Canada? Qu'est-ce qui ne fonctionne pas? Qu'est-ce qui manque?

En savoir plus
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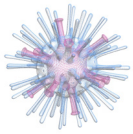

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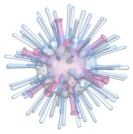

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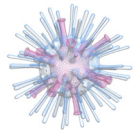

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Centre de collaboration nationale des maladies infectieuses
National Collaborating Centre for Infectious Diseases

BULLETIN DE VOTE

Quel est votre rôle? Infirmière Médecin Responsable de programmes
Conseiller en politiques Chercheur
Responsable de l'application des connaissances
Autre _____

Juridiction : National Provincial Régional Local
Autre : _____

Province ou territoire : YK NT NU NL PE NS NB QC ON
MB SK AB BC Autre _____

PARTICIPEZ À NOTRE CONCOURS
pour gagner un chèque-cadeau d'une valeur de 50 $ d'Amazon, d'iTunes ou de Boston Pizza, selon votre choix!

..... NOM

..... COURRIEL

..... N^{O} DE TÉLÉPHONE

Prière d'écrire lisiblement en caractères d'imprimerie pour qu'on puisse communiquer avec vous si vous gagnez.

☐ **OUI.** J'accepte volontiers de pouvoir fournir d'autres commentaires sur l'analyse de l'environnement du CCNMI.

☐ **OUI.** J'aimerais recevoir des mises à jour par voie de courriel sur les projets du CCNMI liés aux maladies infectieuses.

☐ **NON** merci.

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☐ **NON** merci.

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☐ **NON** merci.

Appendix 4: On-line Survey

Environmental Scan: nccid.ca

Q1: What infectious disease issue concerns you the most?

Describe your needs for evidence or knowledge exchange on this issue.

Q2a: Where and how do you learn about bugs?

What sources of information do you trust or rely upon the most?

Q2b: What formats do you use?

Check all that apply:

Downloaded reports

Fact sheets

Infographics

Journal articles

Meetings/teleconferences

Policy briefs

Posters

Social media

Summary papers

Systematic reviews

Webinars

Workshops/seminars

Q3: How do you share what you know about bugs?

How do you share infectious disease evidence so that it's useful for practitioners, planners or policy makers?

Q4: What helps you act on bugs?

What helps you apply the research lessons or best practices of others to your work in public health? What's working?

Q5: Where are the bugs in our public health systems?

What barriers prevent Canada's public health network from putting evidence into practice? What's not working? What's missing?

Q6: What role do you think NCCID should play?

Check all that apply:

Bring people together for knowledge exchange on particular topics

Train knowledge producers in effective knowledge translation

Synthesize research and practice-based evidence for particular audiences

Act as a knowledge broker that provides linkages between knowledge producers and users

Source relevant evidence for knowledge users

Develop new networks among public health stakeholders

Facilitate collaborations to find public health solutions

Other (please specify)

Please take a moment to tell us about your role in public health.

Nurse

Physican

Policy advisor /maker

Program manager

Knowledge translation

Researcher

Non-governmental organization (NGO) employee

Other (please specifiy)

Appendix 5. Organizations with stated interest in HIV/AIDS in Canada (on-line search)

Organization Type	Organization Name	Sector	Scope (Jurisd'n)	Scope (Disease)	Method of exchange and dissemination	Funding Source	Relevance to NCCID
Advocacy	**Native Women's Association of Canada**	Non-governmental Organization (NGO)	National	Specific populations affected by STIs	work in this area is yet to begin		NWAC is exploring avenues to address the HIV crisis among Aboriginal women and the potential epidemic of HIV infected babies that will bring about its own myriad of social issues to be dealt with. The Health Unit at NWAC intends to develop a working relationship with partner organizations such as the Canadian Aboriginal AIDS Network, the Canadian AIDS Society, Health Canada and other potential partners to research the issue of Aboriginal women and HIV/AIDS and begin to develop tangible projects that will begin to address issues such as vulnerability, and begin to establish gender-specific, culturally appropriate prevention and education initiatives for Aboriginal women.
Advocacy	**Public Health Association of British Columbia**	Not-for-Profit	Regional	Unclear	E-mail; Website; Newsletter; Reports; Other; Conferences; Webinars; Blog		Mission is to preserve and promote the public's health. Association works toward this mission through its activities in disease and injury prevention, health promotion, health protection, and advocacy for healthy public policy
Advocacy; HIV/AIDS Organization	**Manitoba First Nations AIDS Working Group (MFNAWG)**	Not-for-Profit	Provincial/Territorial	Specific populations affected by STIs	Website; Newsletter		Establish linkages with existing First Nations training and educational institutions to facilitate incorporation of HIV/AIDS programs into their health curriculum and programs. Advocate for individual community-based programs which address the continuum of HIV/AIDS care; prevention, education, care, treatment, support and research.Establish a networking system with other HIV/AIDS organizations for community-based research, information and developments and partnerships.
Advocacy; HIV/AIDS Organization	**Mouvement d'information et d'entraide dans la lutte contre le VIH-sida à Québec (MIELS-Québec)**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)			First organization to work on HIV/AIDS in Quebec City. Activities focused among different populations at risk to prevent HIV and other bloodborne and sexually transmitted infections. Campaigns to raise awareness of HIV/AIDS with citizens of Quebec City.
Advocacy; Knowledge Dissemination; Coalition; HIV/AIDS Organization	**The Alberta Community Council on HIV**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	LinkedIn; Twitter; Facebook; Website; Newsletter	"Alberta Health and Wellness and the Public Health Agency of Canada through the Alberta Community HIV Fund"	Network of 11 regionally based AIDS Service Organizations (ASOs) that are HIV/AIDS mission stated or run programs devoted to addressing the care, treatment, support or prevention-education needs of persons living with HIV/AIDS. As recipient of funding from CIHR Research Technical Assistance on HIV/AIDS, ACCH looks to provide member organizations with the necessary skills and support to undertake research by building and strengthen the community-based research capacity of professional researchers and community representatives, including linkages with research partners and opportunities to engage in knowledge exchange.
Advocacy; Professional Association	**Canadian Medical Association (CMA)**		National	Infectious diseases including STIs	Website; Conferences; Journal; Reports		Association of Canadian physicians: publishes CMAJ, CMA librarian service, Accredited learning opportunities, and on-line clinical resources (databases and tools providing evidence-based content such as Point-of-care summaries; Drug Information; Clinical practice guidelines; Clinical updates. Also offers professional development to members).

Advocacy; Public Health Knowledge Translation Specialists; Coalition	**Canadian Aboriginal AIDS Network (CAAN)**	Not-for-Profit	National	Specific populations affected by STIs	Conferences; Newsletter; Journal; Website		Not-for-profit coalition of individuals and organizations which provides leadership, support and advocacy for Aboriginal people living with and affected by HIV and AIDS, regardless of where they reside. Designs material which is aboriginal specific for education and awareness at a national level, and to lessen resource costs of underfunded, regional agencies by distributing and making available these materials wherever possible. Advocates on behalf of Aboriginal people living with HIV or AIDS (APHAs) by giving them forums in which to share their issues and to facilitate the development of healing and wholeness strategies among the infected Aboriginal population.
Advocacy; Research	**PASAN**	Non-governmental Organization (NGO)	Provincial/Territorial	Specific populations affected by STIs	Website; Newsletter; Workshop; Reports; Bulletin	funding from various levels of government health departments	PASAN provides community development, education and support to prisoners and ex-prisoners in Ontario on HIV/AIDS, hepatitis C virus (HCV) and other harm reduction issues. It is the only community-based organization in Canada exclusively providing HIV/AIDS and HCV prevention education and support services to prisoners, ex-prisoners, youth in custody and their families. It is the only National AIDS Hotline specifically for prisoners. Provides support,networking, resources and training for (ASOs) and other community groups across Ontario. Assist ASOs to setup their own prison outreach and support projects. Produces quarterly bulletin, CELLCOUNT, written primarily by prisoners and ex-prisoners.
Advocacy; Research Dissemination	**Canadian Treatment Action Council (CTAC)**	Not-for-Profit	National	Specific type of STI (Disease-specific)	Reports; Webinars; Curricula; Conferences	PHAC (84%), Industry (10%), Other	Works to promote and enable access to treatment, care and support for people living with HIV and Viral Hepatitis co-infection by: informing research and public policy development; promoting awareness of barriers to treatment access and effective policy and programs for overcoming these barriers; equipping people living with HIV and Viral Hepatitis co-infection with the tools and strategies needed to overcome barriers to accessing treatment, care and support; encouraging and facilitating the exchange of access to treatment related information with service providers and organizations serving people living with HIV. CTAC's overall program interventions sought to: create interdisciplinary research on health access; develop and implement policy alternatives; promote good practices in expanding access to health services; increase public awareness and consciousness by addressing stigma.
Advocacy; Research Dissemination; Knowledge Dissemination; Public Health Practice	**Stella**	Not-for-Profit	Regional	Specific populations affected by STIs	Newsletter; Journal; Website; Reports		Raises awareness and educates on different forms and realities of sex work. Front-line, street-level outreach with sex-workers, escorts, masseuses and dancers. Runs drop-in centre and medical clinic reserved for sex-workers, publishes regular publications, and variety of studies and analyses. Participates in a diversity of committees, coalitions, research groups and Boards of Directors.
Coalition; Advocacy; Public Health Knowledge Translation Specialists; Research	**Canadian AIDS Society (CAS)**	Not-for-Profit	National	STIs exclusively	Newsletter; Website; Facebook; Twitter; Conferences; curriculum for high-school; Webinars		Coalition of more than 120 community-based HIV/AIDS organizations across Canada that advocates on behalf of people and communities affected by HIV/AIDS, facilitates the development of programs, services and resources for its member groups, and provides a national framework for community-based participation in Canada's response to AIDS. "Advancing public policy is CAS' primary aim." CAS monitors and analyzes all federal programs, policies, regulations, legislation and processes that are relevant to HIV/AIDS. CAS also works on priority issues such as the development of the Canadian microbicides and vaccines plans, international partnerships, income security, housing, homelessness and other social justice issues.

Coalition; HIV/AIDS Organization; Advocacy; Knowledge Dissemination	**Ontario AIDS Network (OAN)**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Workshop; Facebook	Ontario Ministry of Health and Long-Term Care (AIDS and Hepatitis C Programs, AIDS Bureau); PHAC; BMO Financial Group; Canadian Institutes of Health Research; Federated Health Charities; Gilead; MAC AIDS Fund; Ontario Public Service Union (OPSEU); ViiV Healthcare in partnership with Shire	Coalition of people with HIV and AIDS (PHAs), AIDS Service Organizations and AIDS Service Programs. Offers Skills Development Program series to OAN Member Agencies to build ASO capacity. 2012/13 "marked the final year of OAN staff support for Community Based Research [but] right to nominate the majority of seats on the Board of Directors" of the Ontario HIV Treatment Network will permit a "strong and effective voice in shaping the CBR agenda"
Coalition; Knowledge Dissemination; Research Dissemination; Research	**Pacific AIDS Network (PAN)**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Workshop; Website; Newsletter; Conferences	Provincial Health Services Authority (BC); Canadian Institutes of Health Research (CIHR); CIHR Centre for REACH in HIV/AIDS; Status of Women Canada, PHAC Hepatitis C Program; M.A.C. AIDS Foundation; RBC Foundation; Merck; ViiV	PAN supports, uses, and promotes access to the best, most relevant research and community-based knowledge to improve policies, practices, and programs, via skill-building and capacity development to member organizations, as well as to PHAs. Provide web-based learning and knowledge transfer and exchange opportunities through its KnowledgeConnect programming. Community-based research (CBR) is also part of PAN's mandate and programming, working to: provide Network members training, tools, and information, including research proposal development and knowledge translation strategies; foster working collaborations and relationship building among community members, policy-makers, peer and academic researchers, and funders; facilitate the mobilization of CBR findings into policy, practices and programs.
Health Department	**Public Health Agency of Canada (PHAC)**	Public	National	Infectious diseases including STIs	Webinars; Website; Twitter		A legislated service agency with greater financial and administrative authority than traditional departments led by the Chief Public Health Officer, PHAC's role includes prevention and control of infectious diseases; preparation for and respond to public health emergencies; serving as a central point for sharing Canada's expertise with the rest of the world and applying international research and development to domestic public health programs; and strengthening intergovernmental collaboration on public health and facilitate national approaches to public health policy and planning.
Health Department; Research; Public Health Practice; Research Dissemination; Knowledge Dissemination	**Ministère de la Santé et des Services sociaux (MSSS)**	Public	Provincial/Territorial	Infectious diseases including STIs	Journal; Website; Reports		The mandate of the Ministry directorate known as the Direction générale de la santé publique is to define, promote and update orientations and strategies relative to public health protection and the control of infectious diseases. Its Service de lutte contre les infections transmissibles sexuellement et par le sang (SLITSS) brings together health authorities and professionals to help implement STI prevention activities as well as deliver care and services to those infected and affected; it also designs and develops guidelines in the areas of STI prevention, promotion, protection, screening, health care and services, surveillance, research and development, and expertise. The MSSS co-produces the magazine _The SexEducator, _designed for interveners and educators of secondary-school age youth who conduct sex education interventions. The <http://www.itss.gouv.qc.ca> website provides information to the public about STBBIs, from how they are contracted, forms of protection and treatment.

HIV/AIDS Organization	**Healing Our Spirit: BC Aboriginal HIV/AIDS Society**	Not-for-Profit			Workshop;Speakers bureau; Newsletter		Advocacy; Support programs; Education and prevention; Health care support and programs; Newsletter; Library/resource centre; Volunteers/volunteer development. Education includes holistic, culturally appropriate HIV/AIDS prevention workshops to health professionals, students, communities, youth, incarcerated people, Elders, families and Chiefs and Council. The education program trains speakers living with HIV/AIDS to educate and share their life experiences with Aboriginal communities and organizations.
HIV/AIDS Organization; Coalition	**All Nations Hope Network (ANH)**	Not-for-Profit	Provincial/Territorial	Specific populations affected by STIs	Conferences; Workshop; Website; Newsletter		Network of Indigenous people, organizations and agencies that provides education, support and services to First Nations, Métis and Inuit families and communities experiencing HIV/AIDS and Hepatitis C. Staff are involved in committees, taskforces, boards, gatherings, conferences and research teams.
HIV/AIDS Organization; Research Dissemination; Public Health Practice	**AIDS New Brunswick**	Not-for-Profit	Provincial/Territorial	STIs exclusively	Twitter; Workshop; Website	New Brunswick Department of Health; PHAC; MAC AIDS Fund; TELUS Community Boards	Prevention, Support and Education Programs increase knowledge about HIV, STIs and sexual health among general public, in-school and at-risk youth; hosts annual PLWHIV/AIDS Forum; "Takes part in research projects that drive the evidence base for many organizations' work." Runs needle exchange.
Knowledge Dissemination	**AIDS Saskatoon**	Not-for-Profit	Regional	Specific type of STI (Disease-specific)	Workshop	United Way of Saskatoon and Area	Primary ASO serving Central and Northern Saskatchewan that provides outreach, education, and support for people living with and affected by HIV/AIDS and Hepatitis C. Runs needle exchange.
Knowledge Dissemination	**Canadian Agency for Drugs and Technologies in Health (CADTH)**	Not-for-Profit	National	Unclear	Website; Twitter; LinkedIn; YouTube	federal, provincial, and territorial governments	Pan-Canadian health technology assessment agency providing assessments of the clinical and cost effectiveness of pharmaceuticals, diagnostics, and medical, dental and surgical devices and procedures. It is a major producer of evidence, advice, recommendations and tools that promote the optimal use of drugs and other health technologies. It also plays a key role as a broker by helping to create and nurture an environment for evidence generation and adoption across Canada. CADTH's work to turn research into action involves three integrated programs: knowledge mobilization, the liaison program linking with Canada's health care jurisdictions, and partnerships and strategic initiatives. Its Common Drug Review sees 18 publicly funded drug plans rely on one pan-Canadian process (administered by CADTH) to make decisions about funding and listing pharmaceuticals.The Review compares drugs against available alternatives and evaluating if the drug provides value for money (this includes conducting reviews of the clinical and cost-effectiveness of drugs, and considering patient group input) and provides evidence-based formulary listing recommendations.
Knowledge Dissemination	**Geoconnections**	Public	National	Unclear	Website		GeoConnections is a national partnership initiative led by Natural Resources Canada to facilitate access to and use of geospatial information (tied to geographic locations) through the development, integration and use of the Canadian Geospatial Data Infrastructure (CGDI). The infrastructure itself consists of data, standards, policies, technologies and partnerships that are in place to allow the sharing and visualization of information on the Internet. Among the Top-level Search categories is "Public Health and Disease."
Knowledge Dissemination	**Totally Outright (BC)**	Not-for-Profit	Local	Specific populations affected by STIs	Workshop	Shooting Stars Foundation, PHAC (BC/Yukon Region), Health Initiative for Men; community donations	Intensive leadership workshop for young gay, bisexual, trans, and queer men based on interactive presentations from community leaders and experts in gay men's health. The curriculum includes topics such as STIs and HIV, resilience, harm reduction and positive prevention. Another component is outreach with gay men in the field.

Knowledge Dissemination; Advocacy; Coalition	**Assembly of First Nations (AFN)**	Non-governmental Organization (NGO)	National	Specific populations affected by STIs	Website; YouTube and national awareness campaigns		The AFN Public Health policy area establishes relationships and collaborates with federal government departments and national organizations such as the NCCAH, PHAC, the CPAC, the SOGC etc,. to ensure the ongoing inclusion of First Nations in the development of new strategies to improve the health of First Nations. It maintains a National Public Health Experts Advisory Committee. Engages key stakeholders to ensure First Nations have access to appropriate prevention and treatment responses as part of Pandemic Planning and Emergency Preparedness, a top priority since the H1N1 pandemic, and continues to participate in and support First Nations Emergency Management Network (EMnet). The AFN continues to implement the HIV/AIDS and Sexual Health communication plans with a focus on youth-oriented mediums. In partnership with CAAN for Aboriginal AIDS Awareness Week (AAAW), the National Chief recorded a public service announcement that was disseminated through YouTube and the AAAW website and was featured in CAAN's poster campaign. note: under scope AFN does not focus exclusively on Health or HIV/AIDS
Knowledge Dissemination; Advocacy; HIV/AIDS Organization; Coalition; Public Health Practice	**AIDS Coalition of Nova Scotia (ACNS)**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Workshop; Conferences; Library; ACNS ListServ; Website; Newsletter		Maintains treatment information library including medications, adherence strategies, alternative treatments, diet and nutrition, medication interactions and mental health. Hosts annual Nova Scotia HIV-STBBI Knowledge Exchange and Health Promotion Forum, where health professionals, researchers, community experts and people living with HIV facilitate workshops and presentations. The Forum provides an opportunity for sharing models of practice, skills building opportunities, information sharing and networking.
Knowledge Dissemination; Advocacy; Research; Research Dissemination	**The Community Based Research Centre (CBRC)**	Not-for-Profit	Provincial/Territorial	Specific populations affected by STIs	Conferences; Reports; Twitter; Facebook; Website	PHAC's AIDS Community Action Program (ACAP); Vancouver Foundation; BC Gaming Commission; CIHR; Shooting Stars Foundation; Vancouver Pride Society	Uses community participatory research to develop knowledge about gay men's health and to guide community practice and theorizing on health and social issues. CBRC is dedicated to continuous improvements in gay men's health through research, knowledge transfer and exchange (KTE), strategic innovation and opportunities for training. Every year thousands of gay and bisexual men take part in CBRC surveys and program evaluations. Organizes annual BC knowledge exchange Summit linking volunteers, front-line personnel, public health providers and researchers who work with gay men. Research focus on the social determinants of health looks at structural gaps and social inequities that impact the health of gay, bisexual, two spirit and other men who have sex with men.
Knowledge Dissemination; Coalition	**Healing Our Nations**	Not-for-Profit	Regional	Specific populations affected by STIs	Facebook; Workshop; Website		Educates First Nation people and communities about HIV and AIDS
Knowledge Dissemination; Coalition	**Interagency Coalition on AIDS and Development (ICAD)**	Not-for-Profit	International				Coalition of approximately 100 AIDS service organizations (ASOs), NGOs, faith-based organizations, educational institutions and labour unions. ICAD helps Canadians contribute to international HIV/AIDS work and ensures that the lessons learned from the global response to HIV/AIDS are utilized by Canadian organizations to improve prevention, care, treatment and support work in Canada. "Primary Canadian source of information on HIV/AIDS and development."

Knowledge Dissemination; Public Health Knowledge Translation Specialists	**Do Bugs Need Drugs? (DBND)**	Not-for-Profit	Regional	Unclear	Website; Reports; Twitter		Alberta and BC community education program about handwashing and responsible use of antibiotics, providing educational programs and materials for healthcare professionals and public.
Knowledge Dissemination; Public Health Practice	**Central Alberta AIDS Network Society (CAANS)**	Not-for-Profit	Regional	Specific type of STI (Disease-specific)	Facebook; Twitter; Workshop		Fostering healthy responses to HIV and related issues, through support, education, promotion, prevention, outreach and research in the Alberta Health Service Central Zone, including needle exchange.
Knowledge Dissemination; Public Health Practice; HIV/AIDS Organization	**Vancouver Coastal Health - HIV AIDS**	Public	Regional	Specific type of STI (Disease-specific)	Website; community events and mobile clinics		Amongst other services, VCH HIV AIDS does community outreach - prevention, testing and treatment information through mobile clinics, special events and high risk venues; peer education and capacity building - training and resource support for HIV positive individuals to provide testing and education to their peers; and health care provider resources - HIV/AIDS testing, education and training resources for health care professionals. HIV Resources for Health Care Professionals link has posters and answers to frequently asked questions about the STOP HIV project.
Knowledge Dissemination; Research Dissemination; Public Health Knowledge Translation Specialists	**Canadian AIDS Treatment Information Exchange (CATIE)**	Not-for-Profit	National	Specific type of STI (Disease-specific)	Website; Newsletter; Facebook; Twitter; Webinars; Conferences; Centralized, free national resource distribution through CATIE Ordering Centre	Offers information about HIV and hepatitis C, connects people living with HIV or hepatitis C, at-risk communities, healthcare providers and community organizations with knowledge, resources and expertise to reduce transmission and improve quality of life.	
Laboratories	**Alberta Provincial Laboratory for Public Health**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports		This service provides: specialized diagnostic microbiology tests and programs relating to public health; environmental microbiology services; maintains surveillance of communicable diseases, response to outbreaks of infectious diseases; a reference service for other microbiology laboratories; rapid molecular diagnostic tests for investigation of bacterial and viral etiology, and epidemiological tests for surveillance and typing to characterize infectious disease outbreaks; microbiologic and epidemiologic research, as well as development and testing of new diagnostic techniques applicable to microbiology; training of physicians, microbiologists and laboratory technologists.

Laboratories	**BC Public Health Microbiology & Reference Laboratory**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports		Core functions include: 1. Communicable disease surveillance prevention and control 2. Outbreak and emergency response to communicable diseases 3. Environmental health and food safety 4. Reference, specialized and diagnostic testing 5. Biosafety and Containment Level 3 programs 6. Integrated communicable disease data management 7. Public health policy development and evaluation 8. Laboratory improvement and regulation (Quality Assurance) 9. Training and education of health care and public health works 10. Public health related research
Laboratories	**Cadham Provincial Laboratory (CPL)**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports		Testing, screening and diagnostic information derived from laboratory analysis. research and education. Clients of the CPL include physicians and other practitioners; Manitoba Health staff in support of disease control programs, e.g. sexually transmitted disease and Environmental Health; Medical Officers of Health, Public Health Inspectors, Public Health Nurses to assist in investigating outbreaks and cases of public health significance; Other laboratories, who use CPL as a referral centre for special tests; Investigators and researchers as part of Public Health studies, investigations or research projects.
Laboratories	**National Microbiology Laboratory (NML)**	Public	National	Infectious diseases including STIs	Reports		Canada's main infectious disease public health laboratory (bio-safety level 2 to 4) with responsibility for reference microbiology and quality assurance, laboratory surveillance for infectious diseases, emergency outbreak preparedness and response, training, and research and development. Responsible for identification, control and prevention of infectious diseases. Bacteriology and Enteric Diseases division includes Streptococcus and STI Unit lab.
Laboratories	**Newfoundland and Labrador Provincial Public Health Laboratory**	Public	Provincial/Territorial		Reports; E-mail		Provides early detection of health risks associated with infectious agents, compiles data in support of outbreak investigations and identifies causes of disease to aid in treatment and prevention. Core Functions: Communicable Disease Surveillance, Prevention and Control; Integrated Communicable Disease Data Management; Reference Testing, Specialized Screening and Diagnostic Testing; Environmental Health and Food Safety; Laboratory Improvement and Regulation; Public Health Policy Development and Evaluation; Biosafety, Containment, and Biohazard Spill Response Program; Outbreak and Emergency Response to Communicable Diseases; Public Health Related Research and Development; Training and Education of Health Care and Public Health Workers
Laboratories	**Pandemic Influenza Laboratory Preparedness Network (PILPN)**	Public	National	Unclear	Guidelines		Connected to Canadian Public Health Laboratory Network. Issued guidelines for laboratory testing for the detection of pH1N1. In 2008, PILPN members included representatives of PHAC, Laboratoire de santé publique du Québec, Ontario Public Health Laboratories, Canadian Blood Services, Provincial Laboratory for Public Health (AB), QE II Health Sciences Centre, Saskatchewan Health, Newfoundland Public Health Laboratory, Cadham Provincial Laboratory, National Microbiology Laboratory, BC Centre for Disease Control
Laboratories	**Saskatchewan Disease Control Laboratory**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports	Saskatchewan Ministry of Health	Works with partners to: Provide reference testing;Provide specialized screening and diagnostic testing; Conduct communicable disease detection, surveillance, infection control and prevention; Anticipate, detect and respond to outbreak of communicable disease, food-borne illnesses and pandemic threats; Facilitate and support scientific research and training activities; Provide biosafety, containment, biohazard spill response programs; Serve as a centre for integrated disease and data management; and Develop and evaluate public health policies.

Laboratories; Knowledge Dissemination	**Canadian Network for Public Health Intelligence (CNPHI)**	Public	National	Infectious diseases including STIs	Canadian Integrated Outbreak Surveillance Centre (CIOSC); Response and Resource Management Centre		Under guidance of PHAC and the National Microbiology Laboratory, CIPHI supports multi-jurisdictional data sharing and collaboration through web-based collective of applications designed to facilitate national, integrated, real-time collection and processing of laboratory and epidemiological surveillance data, dissemination of strategic intelligence and coordination of public health response. Its activities focus on six main areas: Knowledge management; Disease specific & syndromic surveillance and reporting; Disease specific pan Canadian alerting and notification; Communication & collaboration; Event management; Laboratory quality systems.
Laboratories; Knowledge Dissemination; Research; Research Dissemination	**Le Laboratoire de santé publique du Québec (LSPQ)**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports; Website; Newsletter		Activity areas include: Specialized services and Infectious Diseases Reference; Laboratory surveillance of infections and integrated data management; Quality assurance programs; Emergency or infectious threats; Biosecurity; Research and development; Knowledge transfer. Under R&D, its seven working groups include research/quality standards, antibiotic resistance, Special Pathogens, enteric infections, sexually transmitted infections; respiratory infections; and, vaccine-preventable infections.
Laboratories; Universities and affiliated research organizations	**Department of Pathology and Laboratory Medicine, Queen Elizabeth II Health Science Centre**	Public	Regional	Infectious diseases including STIs	Reports		The largest clinical laboratory in Atlantic Canada, providing specialized testing and diagnostic consultation for the entire region, as well as environmental testing on non-clinical specimens. The department is a major training site for medical laboratory technologists and cytotechnologists in Nova Scotia. As well, the department is affiliated with the Dalhousie University Department of Pathology, contributing to the education of students. In addition to their own individual research, departmental staff contribute to the research endeavors of Dalhousie University Faculty of Medicine and Capital Health through the development of new diagnostic methods, therapeutic drug monitoring and studies of the natural history of disease.
Professional Association	**Aboriginal Nurses Association of Canada (A.N.A.C.)**	Not-for-Profit	National	Specific populations affected by STIs	Website; Conferences; Reports; Workshop; Facebook; Twitter		Dissemination of information to all levels of community. **To improve the health of Aboriginal people, by supporting Aboriginal Nurses and by promoting the development and practice of Aboriginal Health Nursing.** **Engage in activities related to recruitment and retention, member support, consultation, research and education.**
Professional Association; Advocacy	**Association of Medical Microbiology and Infectious Disease (AMMI) Canada**	Not-for-Profit	National	Infectious diseases including STIs	Position statements		Represents physicians, clinical microbiologists and researchers specializing in the fields of medical microbiology and infectious diseases. Promotion of the diagnosis, prevention and treatment of human infectious diseases, involvement in education, research, clinical practice and advocacy, as well professional development and advocacy initiatives. Under its Strategic Planning Goals and Initiatives, the goal of "Education and Knowledge Translation" is to reduce the impact of infections and antimicrobial resistance through guideline development, networking, and education. The Education / Continuing Professional Development Committee aims to serve as a national resource for Faculties of Medicine in Canada for the development, content and evaluation of curricula and continuing medical education in Infectious Diseases/Medical Microbiology through advocacy, expert consultation, networking and collaborative research.
Professional Association; Advocacy	**Canadian Institute Of Public Health Inspectors (CIPHI)**	Not-for-Profit	National	Unclear	Twitter; Conferences; National ListServ; Facebook; Journal; E-mail		Represents Environmental Public Health professionals across Canada by way of certification, advocacy, education/professional development and professional competencies. Holds annual Education Conference. Publishes the Environmental Health Review (EHR).

Professional Association; Advocacy	**Canadian Pediatric Society (CPS)**	Not-for-Profit	National	Unclear	Journal; Webinars; Website; Conferences	Membership dues, event/conference revenue, publications, grants from individuals, foundations and corporations, government grants	Represents more than 3,000 paediatricians, paediatric subspecialists, paediatric residents, and other people who work with and care for children and youth. Supports professional development needs through position statements, a peer-review journal, and educational opportunities such as an annual conference, online education and regional CME events. Monitors rare diseases and conditions through the [Canadian Paediatric Surveillance Program](http://www.cpsp.cps.ca), and ensures continued research into vaccine-associated adverse reactions and vaccine-preventable diseases through [IMPACT](http://www.cps.ca/en/impact) (Immunization Monitoring Program, ACTive). Offers Education Program for Immunization Competencies.
Professional Association; Advocacy	**Canadian Pharmacists Association (CPhA)**	Not-for-Profit	National		Website; Conferences; Webinars; Twitter; Facebook; Newsletter; Journal		Involved with advocacy (including policies and positions), education (professional development), information (drug and therapeutic related), practice tools and resources, and connection/collaboration on behalf of pharmacists. Helps develop methods of patient care. Invites subject matter experts to sit on Canadian Pharmacists Journal Editorial Advisory Board and the CPhA Editorial Advisory Committee to assist with publication and resource development.
Professional Association; Knowledge Dissemination; HIV/AIDS Organization; Advocacy	**The Canadian Association of Nurses in AIDS Care (CANAC)**	Not-for-Profit	National	Specific type of STI (Disease-specific)	Website; Conferences; Reports		Individual members (Registered nurses, Registered psychiatric nurses, Registered practical nurses and licensed practical nurses, Nurse Practitioners) work in clinical practice, education, research and/or administration. Annual conference hosts workshops and presentations on nursing interventions, research, policy analysis, ethical and legal issues, case studies for nurses, other health care professionals, community-based workers, researchers and academics. Standards Committee is responsible for development and annual review of HIV nursing standards of practice or evidence-based best practice.
Professional Association; Knowledge Dissemination; Research; Research Dissemination; Public Health Knowledge Translation Specialists; Advocacy; Coalition	**Canadian Public Health Association (CPHA)**	Not-for-Profit	National	Infectious diseases including STIs	Website; Conferences; Journal; Webinars; Workshop; Reports; Facebook; Twitter		Advises decision-makers about public health system reform on behalf of membership representing 25+ professions. Advocates for policy change based on improvement and maintenance of personal and community health, according to principles of disease prevention, health promotion/protection and healthy public policy. Acts as liaison and partner with Provincial and Territorial Public Health Associations. Other services and activities include: Program Design and Implementation; Policy Development; Organizational Capacity Building; Program and Project Evaluation; Research; In-House Publishing and Journals; Conferences and Workshops; Networking and Advocacy; Development of Health Educational Materials; Communications and Electronic Media
Professional Association; Public Health Knowledge Translation Specialists; HIV/AIDS Organization	**Canadian Association for HIV Research (CAHR)**	Public	National	Specific type of STI (Disease-specific)	Conferences; Canadian HIV Researcher Database; YouTube; Facebook; Twitter		Composed of over 1,000 researchers and others interested in HIV research, CAHR is organizing body for the Annual Canadian Conference on HIV/AIDS Research. Encourages Canadian researchers to be leaders in knowledge translation and to effectively respond both to the Canadian and global HIV/AIDS epidemics. Fosters collaboration and co-operation among HIV research communities, including basic, clinical and social sciences, epidemiology and public health. CAHR also engages people living with HIV/AIDS and AIDS service organizations in ongoing dialogue and information exchange.
Professional Association; Public Health Practice; Advocacy	**Community Health Nurses of Canada (CHNC)**	Not-for-Profit	National	Infectious diseases including STIs	Website; Workshop; Reports; Conferences		Representing community health nurses and provincial/territorial community health nursing interest groups, CHNC develops discipline-specific standards of practice, core competencies, and a community health nursing certification process so as to increase the knowledge and ability of CHNs and nursing students.

Public Health Knowledge Translation Specialists; Knowledge Dissemination; HIV/AIDS Organization	**CIHR Social Research Centre in HIV Prevention (SRC)**	Public	National	Specific type of STI (Disease-specific)	Website; Workshop; Webinars; Reports; YouTube		Seeks to advance HIV prevention efforts through theoretically and methodologically novel approaches to social science research, capacity building and knowledge transfer and exchange. Strategic objectives include: enabling researchers, front line workers and policy officials from different regions, institutions, and diverse disciplines to collaborate on HIV prevention to increase productivity/impact and to engage in knowledge transfer and exchange with broader prevention and academic communities; build Canadian research capacity through training programs, internships, practicums, exchanges and mentoring opportunities for trainees, students and existing researchers; and through the engagement of HIV experts from outside and within Canada, and researchers who possess relevant expertise outside the HIV field; develop new KTE mechanisms and foster meaningful and collaborative KTE relationships between researchers and key policy, practice and community organizations and coalitions. Activities aim to attract new researchers to the field through research initiatives, public events, publications and ongoing dialogue, and, facilitate e-solutions to support collaboration and action.
Public Health Knowledge Translation Specialists; Knowledge Dissemination; Research Dissemination; Research	**Institut national de santé publique du Québec (INSPQ)**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports; YouTube; LinkedIn; Twitter; Facebook		Public health expertise/reference/advisory/training centre and specialized laboratory/screening service (particularly microbiology and toxicology) in support of Quebec Health and Social Services, regional public health authorities, and health and social services institutions. More specifically: developing knowledge and helping monitor public health and well-being and its determinants; developing new knowledge and research and approaches in health promotion, prevention, and protection; evaluating effects of public policy and health care systems; its public health ethics committee examines health plans and surveys that monitor population health and its determinants.
Public Health Practice	**Population and Public Health, Winnipeg Regional Health Authority (WRHA)**	Public	Regional	Infectious diseases including STIs	Newsletter; Reports		Service Areas include: Communicable Disease Prevention & Management; Environmental Health; Health Equity Promotion; Healthy Sexuality & Harm Reduction; Immunization; Tuberculosis Prevention & Management; Public Health Information Systems; Surveillance.
Public Health Practice	**Toronto Public Health**	Public	Regional	Infectious diseases including STIs	Reports		The goal of TPH's Communicable Disease Control (CDC) directorate is to minimize morbidity and mortality amongst the population through prevention, control, and monitoring programs, including AIDS & Sexual Health Info Line; Communicable Disease Liaison Unit (CDLU); Communicable Disease Surveillance Unit (CDSU); Control of Infectious Diseases/Infection Control (CID/IC); Needle Exchange (The Works); Sexual Health Clinics; Sexually Transmitted Infections program; Tuberculosis Prevention and Control; Vaccine Preventable Diseases.
Public Health Practice; Advocacy	**CACTUS Montréal**	Not-for-Profit	Local	STIs exclusively	Workshop; Reports		Community organization that works with injecting and inhaling drug users, sex workers, and trans people to prevent blood-borne (BBSI) and sexually transmitted infections through various prevention, awareness and educational services and activities. Also participates in regional and national groups.
Public Health Practice; Knowledge Dissemination	**AIDS PEI Community Support Group**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Workshop; Website		The primary HIV/AIDS service organization serving Prince Edward Island providing outreach, education, and prevention through harm reduction and public awareness, and support for people living with and affected by HIV/AIDS and Hepatitis C.
Public Health Practice; Knowledge Dissemination	**AIDS Programs South Saskatchewan (APSS)**	Not-for-Profit	Regional	STIs exclusively	Website; Workshop; Twitter		Serves southern Saskatchewan via programs and services to individuals infected and affected by HIV/AIDS, incorporating an understanding of the determinants of health. APSS "promotes sound HIV/AIDS public policy, funds HIV/AIDS care and prevention projects, and coordinates the delivery of essential HIV/AIDS services... collaborates with government and community partners to pursue comprehensive strategies." Runs needle exchange program.

Public Health Practice; Knowledge Dissemination	**Blood Ties Four Directions Centre**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Workshop; Website	the Friendship Centre, the Federal Ministry of Health and the Yukon Government's Ministry of Health and Social Services	Health Education Coordinator designs and delivers HIV/AIDS and Hepatitis C health promotion programming to Yukon communities. Health Educators provide information on HIV/AIDS, Hepatitis C, safer sex and harm reduction programs to clients of the Outreach Van, plus support services.
Public Health Practice; Research; Research Dissemination	**Public Health Surveillance Unit (PHSU), Vancouver Coastal Health**	Public	Regional	Infectious diseases including STIs	Reports; Conferences; Webinars; Website		Disease surveillance, health assessment, epidemiological investigations and knowledge transfer. The last area includes supporting program monitoring and evaluations, developing best practices, collaborating on research, and building public health capacity. Regular forums, electronic dissemination and contribution to teaching and training. The Unit is located within the Office of the CMHO and is currently made up of a team of epidemiologists, public health information analysts, an administrative assistant and a federal field epidemiologist (Canadian Field Epidemiology Program). In addition, it regularly hosts medical students, Masters in Public Health (MPH) practicum students, and Public Health and Preventive Medicine residents to work on projects related to the Unit's core functions.
Public Health Practice; Research; Universities and affiliated research organizations; Health Department; Knowledge Dissemination; Laboratories	**British Columbia Centre for Disease Control (BCCDC)**	Public	Provincial/Territorial	Infectious diseases including STIs			Public health agency under the BC Provincial Health Services Authority engaged in surveillance, detection, treatment, prevention and consultation services.The Centre provides both direct diagnostic and treatment services for people with diseases of public health importance and analytical and policy support to governments and health authorities. Keeps close ties with clinical, education, research, and other communicable disease-related institutions in BC, Canada and internationally, creating opportunities for scientists, health professionals, university and other partners to contribute their knowledge and experience. BCCDC educational activities include training health professionals and emergency preparedness personnel; it collaborates with UBC and Simon Fraser University to advance public health policy, applied research and clinical teaching. Its research themes include: Efficacy and cost effectiveness, Communication and health policy, Emerging infectious diseases, Food and water borne disease, Vaccine and immunology, Knowledge translation and diffusion of innovation, Mathematical modeling, Genomics, Electronic public health. The PHSA Public Health Microbiology Reference Laboratory is located at BCCDC.
Research Dissemination	**Canadian Antimicrobial Resistance Alliance (CARA)**	Not-for-Profit	National	Unclear	Website; Reports		Online research portal designed to aid and educate Canadian healthcare providers on antimicrobial resistance in Canada, focusing on both community and hospital infections. Features and tools include: Surveillance of pathogens and infections; Antimicrobial usage data; Summary content from major conferences and meetings; Key publications from evidence-based medical literature; Videos. The website continues to grow under my leadership. As Editor-in-Chief, I will continue to work with a multidisciplinary group of Canadian experts to improve this unique, multipurpose, multidisciplinary infectious diseases/medical microbiology content based website which addresses Canadian issues in antimicrobial/ antifungal resistance and antimicrobial/ antifungal usage."
Research Dissemination	**Health Evidence**	Not-for-Profit	National	Infectious diseases including STIs	Website; Workshop		Website hosts 3800+ public health systematic reviews evaluating the effectiveness of public health interventions. Its consultation services assist individuals, teams, divisions and organizations in interpreting research evidence and applying it to program and policy decisions.
Research Dissemination; Advocacy	**Health Initiative for Men (HIM)**	Not-for-Profit	Regional	Specific populations affected by STIs	Website; Newsletter; Facebook; Twitter		Research-based health promotion services, events and online resources aimed at gay men. Research Partner on the following initiatives: CIHR Team in the Study of Acute HIV in Gay Men (BCCDC), Community Health Assessment of Men who Purchase & Sell Sex (CHAPS), ManCount, Momentum Health Study, The Resonance Project; SPACES; COMPASS; Life Course and Gay Men's Health: Implications for Policy and Programs

Research Dissemination; Advocacy; HIV/AIDS Organization	**Canadian Working Group on HIV and Rehabilitation (CWGHR)**	Not-for-Profit	National	Specific type of STI (Disease-specific)	Newsletter; Reports		National, charitable organization that responds to the rehabilitation needs of people living with HIV/AIDS through research, education and cross-sector partnerships. It brings together individuals with HIV, researchers, clinicians, policymakers and community organizations in the HIV, rehabilitation and disability communities to: identify research priorities on disability and rehabilitation related to HIV, advocate for increased funding for research in rehabilitation, improve dissemination of existing research, and develop strategies to integrate research into clinical practice and effective policies.
Research Dissemination; Research; Foundations	**Canadian Foundation for AIDS Research (CANFAR)**	Not-for-Profit	National	Specific type of STI (Disease-specific)	Website; Facebook; Twitter; YouTube	"corporations, groups, and individuals across Canada"	CANFAR awards grants to Canadian researchers at educational, hospital and health facilities, research institutes, and established community service organizations. It funds all aspects of HIV/AIDS research, including: fundamental and applied research; educational and prevention; care; psychosocial initiatives; and, community research.
Research Dissemination; Universities and affiliated research organizations; Research; Public Health Knowledge Translation Specialists; Knowledge Dissemination	**Canadian Institutes of Health Research (CIHR)**	Public	National	Infectious diseases including STIs	Reports		Federal funding agency composed of 13 "virtual" Institutes which bring together health-related networks of researchers, health professionals and policy-makers spanning sectors, disciplines and regions. The Institutes' areas of focus include: Aboriginal Peoples' Health; Health Services and Policy Research; Infection and Immunity (III); and, Population and Public Health. Among CIHR's key, cross-cutting Signature initiatives is the Pathways to Health Equity for Aboriginal Peoples. Strategic research initiatives specific to III include Antibiotic Resistance; Canadian Microbiome Initiative; Hepatitis C Research Initiative; HIV/AIDS Research Program; and, Pandemic Preparedness Strategic Research Initiative.
Research; Advocacy	**Sexuality Education Resource Centre (SERC)**	Not-for-Profit	Regional: Community-based education - Winnpeg and Brandon offices	STIs exclusively	Other; Workshop; Website; Reports; Books; Facebook; Lending library and resources for purchase, translation of resources into different languages, YouTube	Winnipeg Regional Health Authority, United Way of Winnipeg, and Brandon and District United Way. Funding from Canadian Women's Foundation, Government of Canada, Province of Manitoba and the Winnipeg Foundation	Promoting sexual health through education through: Community Education Programs and Workshops; Community Consultations and Outreach; Service Provider Training Workshops and Presentations; and Service Provider Consultations. SERC advances information and research in the sexual health field and participates in a number of projects, as well as ongoing research designed to move forward the information available about sexual and reproductive health.
Research; Advocacy; HIV/AIDS Organization	**Nine Circles Community Health Centre**	Not-for-Profit	Local	Specific type of STI (Disease-specific)	Website; Workshop; Reports; Facebook; Twitter; mailing list, training; Newsletter		Health Promotion and Outreach Team designs, coordinates, and markets Health Promotion educational tools and building awareness for special events, such as the AIDS Walk for Life, World AIDS Day, Sexual Health Awareness Week, Pride week, Spring for Life Awareness and Fundraising and many more. In the Gathering Place individuals can gain knowledge and skills through attending health promotion and capacity building workshops, while connecting with and learning from others in the process. Research: committed to the contribution to local and regional community-based research as a means to understanding and responding to the evolving needs of communities living with, and at risk for HIV/STI.

Research; Knowledge Dissemination; Research Dissemination; Coalition	**Northern Antibiotic Resistance Partnership (NARP)**	Not-for-Profit	Regional	Unclear	Reports; Workshop; Website	Sponsors: CIHR, University of Manitoba, National Microbiology Laboratory	Team of community members, healthcare professionals, educators and research scientists working in partnership to study antimicrobial resistant bacteria causing infections in northern communities. Their sentinel surveillance sites monitor bacterial infections and antibiotic use; their case control study identified risk factors for acquisition of community-associated methicillin-resistant Staphylococcus aureus; and, educational activities share information gained from surveillance with physicians and health care providers, along with advice related to antibiotic resistant organisms and antimicrobial usage; will develop best prevention and control practices for specific organisms (ie. CA-MRSA) or various situations (infection control in remote nursing stations).
Research; Professional Association	**Canadian Association for Clinical Microbiology and Infectious Diseases (CACMID)**	Not-for-Profit	National	Unclear	Conferences; Facebook; Twitter		CACMID actively promotes cooperation, collaborative research, and education amongst microbiologists, and also the development and promotion clinical standards and guidelines. Hosts an Annual Meeting which is designed to address the needs of health care professionals specialized in the areas of infection control, clinical microbiology and infectious disease. **Mission to advance the fields of clinical microbiology and infectious diseases in Canada through education, scholarship, advocacy and the promotion of best practices.**
Research; Research Dissemination; Advocacy; HIV/AIDS Organization	**African and Caribbean Council on HIV/AIDS in Ontario (ACCHO)**	Not-for-Profit	Regional	Specific populations affected by STIs	Website; Workshop; Conferences; Reports; Facebook; Twitter; Social Marketing campaigns		ACCHO provides leadership in the response to HIV/AIDS in African, Caribbean and Black communities in Ontario. The ACCHO Council is made up of researchers, policy makers, services providers and community members from all across Ontario. The Council is structured to ensure that African, Caribbean and Black people drive the implementation of the [Ontario HIV/AIDS Strategy for African, Caribbean and Black Communities 2013-2018](http://accho.ca/Portals/3/documents/ACB_Strategy_Web_Oct2013_En.pdf) (the ACB Strategy). Hosts a Capacity Building Program for agencies that work with African, Caribbean and Black communities throughout the province. ACCHO strives to meet its research goals and objectives through collaborative community-based research projects that are relevant and beneficial to African, Caribbean and Black communities.
Research; Research Dissemination; Coalition; Advocacy; Knowledge Dissemination	**The 595 Prevention Team**	Non-governmental Organization (NGO)	Regional	Infectious diseases including STIs	E-mail; Website; Workshop; Conferences; Reports; Toolkits; Facebook	Health Child Manitoba Healthy Living Seniors and Consumer Affairs Winnipeg Regional Health Authority, Public Health Agency of Canada: Hepatitis C Prevention, Support & Research Program, Public Health Agency of Canada: AIDS Community Action Program	595 works with peers, network members, policy makers, and community leaders to make recommendations regarding the development, implementation and evaluation of sexually transmitted and blood borne infection (StBBI) prevention initiatives based on evidence and best practice with priority populations. Hosts an annual Manitoba Harm Reduction Conference.

Research; Research Dissemination; Foundations	**Canadian Foundation for Infectious Diseases (CFID)**	Not-for-Profit	National	Infectious diseases including STIs	Reports; Website	Pulsus Canada; Pfizer Canada; Astellas USA Foundation; Bill Lowthian Memorial Golf Tournament Fund; Safe Drinking Water Fund; Individuals	Supports research and dissemination of knowledge pertaining to infectious diseases. Partners with AMMI Canada and CHICA Canada among others. Programs include Safe Drinking Water Research Fund, Antimicrobial Resistance Fund, ROAR (Realize Opportunities to Advance Research) Fund to support research into the diagnosis, treatment, prevention and control of infectious diseases. Research priorities include: Antimicrobial resistant organisms; Detection and prevention of nosocomial outbreaks; Detection and control of water-borne pathogens; Rapid detection and identification of non-cultivable pathogens; Emergence and re-emergence of sexually transmitted pathogens; Pandemic influenza preparedness; Immunotherapy for HIV/AIDS and chronic viral hepatitis
Research; Research Dissemination; Knowledge Dissemination; HIV/AIDS Organization; Network	**Ontario HIV Treatment Network**	Not-for-Profit	Regional	Specific type of STI (Disease-specific)	Website; Journal; Webinars; Workshop; Reports; Facebook; Twitter; YouTube; Pinterest		Hosts calendar of Conferences, seminars, gatherings, and other events relevant to the HIV/AIDS research community; provides learning resources for doing community-based research on HIV/AIDS; has research database on HIV/AIDS.
Research; Research Dissemination; Knowledge Dissemination; Public Health Knowledge Translation Specialists; Laboratories	**Public Health Ontario (PHO)**	Public	Provincial/Territorial	Infectious diseases including STIs	Reports; Workshop; Website; Phone; E-mail; Conferences; Webinars	Ontario Ministry of Health and Long-Term Care	A hub organization that links public health practitioners, front-line health workers and researchers to scientific intelligence and knowledge; Services and tools include laboratory services, education, training and evaluation; Virtual Library, a collection of resources and searchable online database of public health journals and articles; Scientific and Technical Advice related to infectious diseases, infection prevention and control; surveillance and epidemiology; Tools and Instruments related to Infection Prevention and Control (IPAC), air quality and environmental monitoring, and analytic tools. PHO research spanag basic to applied approaches with blend of independent investigator-driven projects (discovery research) and directed projects. Along with data and analytics, and professional development, PHO education is delivered online, via workshops, and at annual convention, TOPHC. Formerly Ontario Agency for Health Promotion and Protection (OAHHP).
Research; Research Dissemination; Laboratories; Universities and affiliated research organizations	**BC Centre for Excellence in HIV/AIDS (BC-CfE)**	Not-for-Profit	Provincial/Territorial	Specific type of STI (Disease-specific)	Reports; Website; Workshop	"Core funding for the BC-CfE is provided by the BC Ministry of Health (MoH). This represents $3.05 million per year that flows from the MoH, through the Provincial Health Services Authority (PHSA) via Providence Health Centre... [along with] grants from private donors, industry, and funding agencies."	Responsible for the development, ongoing monitoring and dissemination of comprehensive research and treatment programs for HIV and related diseases. It provides care and treatment to those infected, educates doctors and healthcare professionals throughout BC, and promotes evidence-based social policy. BC-CfE manages the procurement and distribution of antiretroviral (ARV) drugs; monitors clinical, laboratory and epidemiological impacts of highly active antiretroviral therapy (HAART); and generates HIV/AIDS Therapeutic Guidelines. Has inter-disciplinary health care professionals and researchers, with research designed and implemented by teams of physicians, epidemiologists, statisticians, scientists, laboratory technicians, health economists, anthropologists and policy makers.The Centre's six Core programs include Laboratory, Epidemiology and Population Health, Clinical Research Activities, Clinical Education and Training, the Drug Treatment Program, and Addictions and Urban Health Research.

Research; Research Dissemination; Universities and affiliated research organizations	**University of Alberta, Department of Medicine, Division of Infectious Diseases**	Post-secondary Education	Local	Infectious diseases including STIs	Website; Journal; Conferences; Reports		Provides clinical services to all acute care facilities in Edmonton, and consultative service to Northern Alberta and most of the northern territories. Specialty programs in Infection Control, HIV and Hepatitis Care, and Transplant Infectious Diseases have been established, multiplying the opportunities for clinical, epidemiologic and bench research, and for medical education. The Division boasts one of the longest-running and most highly-regarded Canadian postgraduate training programs in Infectious Diseases, and has recently-established a fellowship program in Transplant Infectious Diseases. It continues to enjoy a close working relationship with Provincial and regional microbiology laboratories, and with regional Public Health officials. In an era of increasingly complex, subspecialized, institutionally-based medical care; of pandemic infectious disease; and of multi-drug-resistant pathogens
Research; Research Dissemination; Universities and affiliated research organizations; Laboratories	**University of Calgary Department of Microbiology, Immunology and Infectious Diseases**	Post-secondary Education	Local	Unclear	Journal	National Institute of Allergy and Infectious Diseases, part of the U.S. National Institutes of Health (NIH), Alberta Heritage Foundation for Medical Research (AHFMR)	The Department of Microbiology, Immunology and Infectious Diseases in the [Cumming School of Medicine](http://cumming.ucalgary.ca/) at the University of Calgary aims to promote research and education on infectious and immunological disorders that spans the entire spectrum of 'bench to bedside' investigations. Areas of expertise and interests of the 15 primary members and 50 secondary and adjunct appointees include microbial pathogenesis, microbial genetics, host-pathogen interactions, autoimmune disorders and the development of novel therapeutics.
Research; Universities and affiliated research organizations	**Division of Infectious Diseaes, Dalhousie University**	Post-secondary Education	Regional	Infectious diseases including STIs			Delivers a broad variety of services in patient care and education, conducts research, and participates in local and national committees and organizations. Patients with severe and/or complex hospital and community acquired infections, including HIV, are major **clinical** areas for this Division. Heavily involved in the outpatient care of HIV-infected patients and expanding its involvement in the care of hepatitis B and hepatitis C infected patients. Interdisciplinary outpatient care is provided in close collaboration with dedicated clinic nurses, psychologist, nutritionist, social worker, and pharmacist. The division directs and hosts a primarily family physician staffed walk-in sexually transmitted diseases (STD) clinic. Committed to research with greater than a quarter of its full-time equivalent faculty members devoted to research activities; little about KT on website
Research; Universities and affiliated research organizations	**The CIHR Canadian HIV Trials Network (CTN)**	Public	National		Reports	funded by the Canadian Institutes of Health Research (CIHR), and jointly sponsored by UBC and St. Paul's Hospital (Providence Health Care) in Vancouver.	Partnership of clinical investigators, physicians, nurses, people living with HIV, pharmaceutical manufacturers and others to facilitate HIV clinical trials, including research design, methodology and protocol development; seed funding; infrastructure for researchers; and regulatory support, training and peer-review. CTN's Core Research Model covers four themes -- Clinical Management Science; Co-infections & Concurrent Diseases; Prevention & Vulnerable Populations; Vaccines & Immunotherapies -- meant to support emerging and experienced scientists in generation of new concepts and study protocols leading to rapid translation of research into clinical trials and bedside practice.

Research; Universities and affiliated research organizations; Laboratories	**McMaster University Michael G. DeGroote INSTITUTE FOR INFECTIOUS DISEASE RESEARCH**	Post-secondary Education	Regional	Infectious diseases including STIs	E-mail; Website; Newsletter; Journal; Workshop; Conferences; Reports; Facebook; Twitter; LinkedIn, Google+, Pinterest	Crohn's and Colitis Canada, Early Researcher Awards (ERA)/Province of Ontario, Canadian Institutes for Health Research (CIHR), Michael G. DeGroote, National Institutes of Health, Natural Sciences and Engineering Research Council of Canada, Canadian Foundation for Innovation, McMaster Univeristy, Canada Research Chairs Program, Ontario Institute for Cancer Research, Dalhousie University	The IIDR is founded on principles of interdisciplinary collaboration, research excellence, and commitment to training the next generations of infectious disease researchers and clinicians. Hosts invited guests to speak on their current research. The talks are open to all IIDR faculty and trainees
Research; Universities and affiliated research organizations; Research Dissemination	**Sexually Transmitted Infections Research Network (STIRN), Dalhousie University**	Post-secondary Education	Regional	STIs exclusively	Website; Conferences; Reports; YouTube	Nova Scotia Health Research Foundation	Brings together individuals and organizations from public health, health research, healthcare and community-based organizations to identify the pressing concerns for STI prevention and develop appropriate interventions that involve collaboration between groups and sectors.
Universities and affiliated research organizations	**CoPEH-Canada**	Post-secondary Education	National	Unclear	Website; Conferences; Newsletter		Project by team of Canadian researchers from University of Guelph, UBC, and Université du Québec à Montréal to develop a Canadian Community of Practice in Ecosystem Approaches to Health, aka "ecohealth." Among the community of practice's research, education and practice objectives: to provide a forum to consolidate and extend the Ecohealth approach through collaboration, exchange, and scholarly attention to methodology, pedagogy and knowledge translation; to conduct an integrated program of participatory research and evaluation to examine the networking, educational and capacity building outcomes of the community of practice.
Universities and affiliated research organizations	**The Atlantic Interdisciplinary Research Network for Social and Behavioral Issues in Hepatitis C and HIV/AIDS (AIRN)**						
Universities and affiliated research organizations; Research	**Division of Infectious Diseases in the UBC Department of Medicine**	Post-secondary Education	Local	Infectious diseases including STIs	there is no exchange and dissemination on their website	VGH & UBC Hospital Foundation, Michael Smith Foundation,Canadian Institutes of Health Research (CIHR), Pfizer Canada	The Division of Infectious Diseases in the UBC Department of Medicine is actively involved in combating infectious diseases through patient care, education, and research. We are part of the Faculty of Medicine at the University of British Columbia and work through Vancouver General and UBC Hospitals, St. Paul's Hospital, BC Children's & Women's Hospital, G.F. Strong Hospital, the BC Cancer Agency and the BC Centre for Disease Control. Research conducted on Host Defence and Pathogenesis, including M. tuberculosis, Leishmania, Toxoplasma, E. coli, Staphylococci, Streptococci and Chlamydia. Division hosts an HIV/AID Research Program.

Universities and affiliated research organizations; Research	**Division of Infectious Diseases, Department of Medicine in Ottawa**	Post-secondary Education	Regional	Infectious diseases including STIs	Website; Journal		Research is a major focus and has resulted in high impact publications and success with grant applications. The research covers a range of topics with special focus on HIV, hepatitis C, sexually transmitted infections, hospital-based infection control and infections occurring in international settings. The over-riding goal is to conduct research that is highly translational and results in improved patient outcomes.
Universities and affiliated research organizations; Research; Research Dissemination	**Division of Infectious Diseases in the Department of Medicine at the University of Toronto**	Post-secondary Education	Regional	Infectious diseases including STIs	Website; Journal; Workshop		Provide training in Adult Infectious Diseases to meet the needs and promote the health of the patients and populations, and meet future challenges in the field, including new and emerging infectious diseases and increasing rates of antimicrobial resistance. Faculty and trainees have a broad range of interests spanning clinical management of general and transplant infectious diseases, basic and clinical research, infection control, quality and antimicrobial stewardship, tropical medicine, education practice and scholarships, microbiology, international health and HIV care.
	Coalition des organismes communautaires québécois de lutte contre le sida (COCQ-Sida)	Not-for-Profit	Provincial/Territorial		Twitter; Facebook; Website; Reports		Disseminate effectively, concisely and in a very short time, all news on HIV/AIDS, primarily to coalition members.
	Manitoba Agriculture, Food and Rural Development (MAFRD)	Public			Reports; Newsletter; Twitter; Website; Webinars		Includes the Chief Veterinary Office (CVO), which upholds the health and humane treatment of animals on the farm and in commercial breeding and boarding facilities. Animal Health deals with best practices for biosecurity and veterinary drugs. The Emergency Preparedness page outlines how livestock producers and animal owners can plan for emergencies and evacuations before they occur. Among its 'cornerstones' or departmental priorities is Food Security, Production and Safety, including Biosecurity management practices that limit diseases from either entering or spreading on farms or premises, and traceability systems.

Hosted by the International Centre for Infectious Diseases (ICID), the National Collaborating Centre for Infectious Diseases (NCCID) is one of six National Collaborating Centres for Public Health funded by the Public Health Agency of Canada, each focusing on a different area of public health. NCCID gathers, distils and disseminates current information, technology and resources on infectious diseases and ensures they reach practitioners to the benefit of all Canadians. NCCID's work ultimately informs public policy and better equips public health practitioners in their role of preventing and controlling emerging and re-emerging infectious diseases.

NCCID – Knowledge that's contagious!

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