

Knowledge Translation and the Public Health Inspector: Turning Evidence into Practice

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Abstract

Background: Knowledge translation (KT) is the process of using the best available knowledge to inform decision-making. Public Health Inspectors (PHIs) are tasked with the critical responsibility of protecting public health. However, there is little data available about how effective and consistent current methods of distributing information to professionals across Canada are. The efficacy of KT has implications on the PHI profession and ultimately, public health protection.

Objective: The purpose of this research is to identify how PHIs across Canada take evidence and incorporate it into practice.

Methods: A survey was created with questions focused on determining what information PHIs use when making public health decisions, how PHIs go about finding the information required, and the level of trust invested into each source of data. Questions were formulated with guidance from the National Collaborating Centre of Environmental Health (NCCEH). It was distributed electronically to PHIs via social media and BCIT.

Results: PHIs use evidence-based information to advise their decisions and actions always (43%) or often (46%) in daily practice. Government agencies, professional organizations, peer-reviewed literature, and colleagues are most often used and deemed as reliable resources. Although very frequently used, the internet was seen as neither reliable nor unreliable. 77% of respondents cited that barriers exist that impede their access to evidence-based information. The most common barriers listed were time constraints, costs, and lack of relevant information.

Conclusions: The internet is becoming an increasingly popular means by which knowledge is delivered. However, web-based public health resources need to be more concise, easily accessible, PHI-specific and facilitated by reliable entities to effectively address barriers to practice. Increased communication of evidence, practices, and standards are required between health authorities, government agencies, and PHI professionals to ensure consistent and cohesive protection of public health.

Keywords: Knowledge translation, Public Health Inspectors, PHIs, evidence, public health

Introduction

Worldwide, billions of dollars are spent annually on research initiatives in the field of healthcare. However, some healthcare systems fail to utilize research optimally. There are gaps that exist between the creation of evidence and its use in decision-making

on different levels of healthcare, from researchers, policy-makers, decision-makers, health professionals, and the public (Canadian Institutes of Health Research, 2012). The World Health Organization estimates that approximately 50% of all premature fatalities could be prevented every year through the application of already existing and available knowledge (Canadian Coalition for Global Health

Research, 2012). Due to an increasing call for accountability and the delivery of cost-effective health services, this gap between evidence and application has become a popular topic of research in recent years (Jack & Tonmyr, 2007). This area of study is known as knowledge translation (KT).

Across Canada, government, healthcare organizations, and academia are acknowledging deficits in KT in order to help improve the process of healthcare delivery. Established in 2000 under the authority of the Canadian Institutes of Health Research (CIHR) Act, the Canadian federal funding agency for healthcare research (synonymous with the CIHR) has devoted extensive resources to supporting the translation of research in numerous health disciplines with varied target stakeholders (Baumbusch *et al.*, 2008). For example, the CIHR, in partnership with international organizations, is working towards establishing a permanent, freely accessible national digital repository of peer-reviewed health and life science literature for researchers and knowledge users alike (CIHR, 2009). The Public Health Agency of Canada created 6 national collaborating centers that focus on different aspects of knowledge translation between researchers, policymakers and health practitioners. Provincially, health authorities are proactively addressing the discrepancy as well. For example, Alberta Health Services established a dedicated KT department in 2012 (Alberta Health Services, 2015). In British Columbia, Fraser Health provides a toolkit to help health professionals gain access to, evaluate, and use evidence (Fraser Health, 2009). Vancouver Island Coastal Health conducted the BC Knowledge Translation Needs Assessment among health professionals in June 2012 (Michael Smith Foundation for Health Research, 2012).

PHIs are tasked with the critical responsibility of making educated decisions to protect public health. Health authorities, professional organizations such as CIPHI, and national collaboration centers are guiding the profession towards operating on principles of evidence-based practice and provide resources for development of core competencies (CIPHI, 2005). For example, CIPHI offers a continuing professional

competency program that attempts to unify professional standards of PHIs across Canada. Continued professional development is a component of knowledge translation and incorporates personal growth and professional education and is based on the best available research (Davis *et al.*, 2003). However, inconsistencies in the uptake of knowledge and varying application methodology are still big issues in the field. For example, a methodological discrepancy between food service establishment inspections among individual PHIs is a concern that requires continued attention. Trying to remedy issues in the knowledge translation process requires a balanced approach to enforcing the use of best evidence, making it easily applicable for PHI use, and maintaining professional autonomy.

Knowledge translation is a relatively new area of study that is being used to address an old problem: *how do we take what we know and put it to best use?* Within healthcare, the ultimate goal of knowledge translation is to determine the most effective ways to use evidence-based knowledge in making decisions that protect public health. Currently, there is little to no data available on knowledge translation as it pertains to Public Health Inspectors (PHI). This research project investigates this knowledge deficit. Objectives are to identify where PHIs go for information, how frequently these sources are used, and the level of trust invested. By doing so, points of weakness may be identified in the KT process, whether at the level of research, policy or practice, that can be improved so that PHIs may make the most informed choices when assessing public health risk.

Literature Review

What is Knowledge Translation?

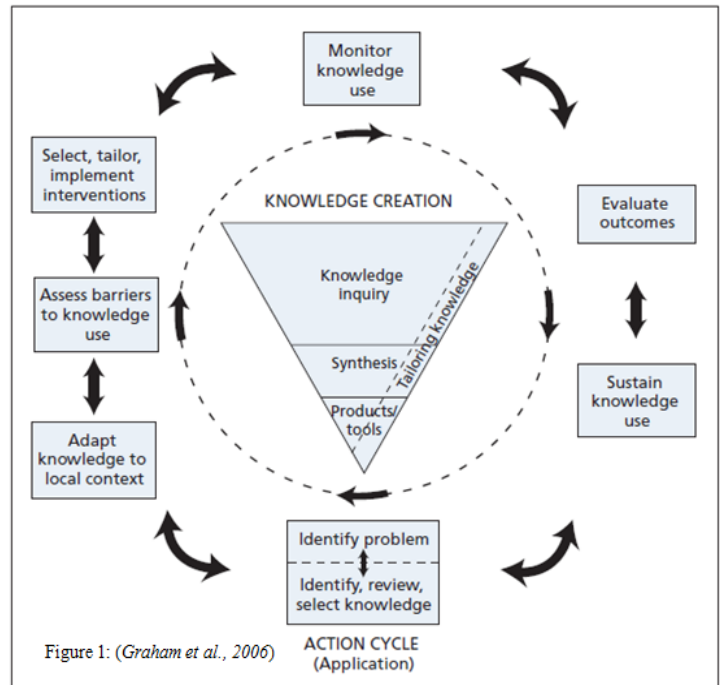
The Canadian Institutes of Health Research (CIHR) defines knowledge translation as a “dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health of Canadians, provide more effective health services and

products, and strengthen the health care system” (2012). Many terms such as “research use”, “knowledge mobilization” and “knowledge exchange” are used in literature to refer to this process (Graham *et al.*, 2006). However, to put it simply, it is the process of taking knowledge and putting it into practical use. Within the realm of healthcare, KT is about ensuring that decision-makers such as managers, policymakers, practitioners, and the public are cognizant of and have access to reliable research evidence that they can use to make educated health-related decisions (Straus, Tetroe & Graham, 2009a).

Adopted by the CIHR, *Graham et al.* created a commonly used conceptual model for KT called the “knowledge-to-action framework”, which divides the process into knowledge creation and its application to yield valuable outcomes for society (2006).

Knowledge creation (in the centre pyramid of Figure 1) is comprised of three key elements: a question, knowledge synthesis, and the creation of tools. First, the process begins by researchers asking questions. Secondly, knowledge is created through conducting primary research (Straus, Tetroe & Graham, 2009b). Thirdly, knowledge is aggregated and tools are created (Straus, Tetroe & Graham, 2009b). Tools such as systematic reviews and meta-analysis are a means of presenting the vast amount of research in a more comprehensive, user-friendly manner (CCGHR, 2012). Likewise, policymakers create practice guidelines that allow the knowledge created to become integrated into a broader pool of information already available for health practitioners to use (CIHR, 2012). Lastly, knowledge is disseminated to target the appropriate audience (CIHR, 2012). Methods of dissemination are user- and context-dependent (Straus, Tetroe & Graham, 2009b).

At every stage of knowledge creation, knowledge producers customize their actions to fit the needs of knowledge users (Graham *et al.*, 2006). By doing so, the ultimate goal of providing decision-makers with knowledge that fulfills informational requirements, facilitates application, and most importantly, sustainably influences their behavior may be attained (CCGHR, 2012). However, some researchers caution



against the assumption that all knowledge must be translated (Straus, Tetroe & Graham, 2009b). For instance, one study found that around 20-30% of patients may get care that is not required or could be potentially damaging (Grimshaw *et al.*, 2012). Therefore, verifying that only quality data is translated helps to ensure that decision-makers are using the best and most valid knowledge to make their decisions.

The action component of the knowledge-to-action framework (that surrounds the knowledge creation pyramid in Fig. 1) was developed to concentrate on facilitating change in healthcare settings and decision-makers (Straus, Tetroe & Graham, 2009a). Actions can ensue simultaneously or step-by-step and is influenced by knowledge creation (Graham *et al.*, 2006). The action cycle begins with a decision-maker identifying a problem, reviewing and choosing knowledge to use. This is where the availability of quality evidence becomes increasingly important as it forms the foundation of a decision-maker’s knowledge base. Next, a decision-maker will contextualize the knowledge to fit their particular circumstances, evaluate factors that affect the use of knowledge, make any needed modifications, and implement their intervention. These steps involve critically analyzing the situation at hand and altering

the evidence available to fit the needs of the target audience. From there, monitoring KT interventions and usage, assessing outcomes of knowledge use, and creating strategies for sustained knowledge utilization occur (Straus, Tetroe & Graham, 2009a).

An example of the KT action cycle (seen in Fig. 1) at play is the Family Controlling and Eliminating Tobacco (FACET) project. This project began with the first step of the action cycle: problem identification. Despite available evidence stating negative health consequences associated with smoking, about 20-30% of pregnant women smoke and 70-90% of new mothers return to smoking a year after giving birth in Canada and the US (CIHR, 2008). Secondly, researchers adapted knowledge to the context of pregnant and new mothers. They found that standard smoking cessation programs did not consider two important factors: couple dynamics and everyday routines (CIHR, 2008). Thirdly, researchers assessed barriers for knowledge use. They broke down barriers such as stigma by instead taking a woman-focused approach as opposed to emphasizing the negative health implications on a fetus or infant (CIHR, 2008). Fourth, the intervention was delivered in the form of a booklet. It was well-tailored to the target audience by drawing upon the research participants' experiences, including activities that enlist support from partners, and methods on how to manage everyday tensions without tobacco use. Next, researchers monitored knowledge use by pilot testing the booklet in 11 communities across BC, gathering feedback through interviews and focus groups from both expecting and new mothers as well as healthcare providers (CIHR, 2008). Lastly, feedback was evaluated and changes were made to the booklet to try to sustain knowledge use (CIHR, 2008). The FACET program worked extensively with other organizations such as the BC Association of Pregnancy Outreach Programs throughout this process (CIHR, 2008). This case study underscores the importance of the KT action cycle. Sometimes, regardless of evidence being readily available, for knowledge translation to occur, action steps such as contextualizing, tailoring, and

continuously modifying interventions are required for knowledge to effectively reach its target audience.

Determinants of Knowledge Translation

At each stage of the KT process, there is a complex set of barriers and challenges that impede the translation of relevant research to evidence-based practice. For the purpose of this review, focus will be on knowledge dissemination between researchers and decision-makers. Reviewing available literature on KT has revealed 2 broad determinants of successful knowledge translation in healthcare settings (Cabana *et al.*, 1999; Straus, Tetroe & Graham, 2009b)

- 1) finding an effective approach to dissemination, and
- 2) knowledge, attitudes, and external factors that impact knowledge uptake on the stakeholder level.

These determinants suggest that effective KT does not only depend on the availability of evidence, but also on the methods and communication tools used to put it into practice.

Finding an Effective Approach to Knowledge Dissemination

Traditionally, KT is a one way process flowing from researchers to knowledge users, called "end-of-grant" KT (CIHR, 2012). However, current research has pushed towards integrated KT, which involves collaboration between researchers and knowledge users at each stage of the research process (CIHR, 2012). Involvement is sought from developing the research question, to evaluating results, to distributing knowledge to be used in practice (CIHR, 2012). Interprofessional collaboration has become increasingly important in effective knowledge dissemination (CIHR, 2012). Equally, the efficacy of KT is dependent on the approach by which information is disseminated to decision-makers. An effective approach is contingent on researchers:

- 1) providing the best available knowledge,
- 2) identifying and tailoring information to the appropriate audience,
- 3) selecting a suitable messenger, and

4) evaluating whether desired outcomes were achieved (Grimshaw *et al.*, 2012).

Researchers assert that focusing on the collaboration and dialogue between researchers and health practitioners and the context of application is just as important as the end deliverables (Baumbusch *et al.*, 2008). The two-communities theory states that researchers and policymakers versus health professionals occupy “different worlds”, creating a divide that inhibits effective dialogue (Johnson, 2005). Parties often do not share a common professional language, culture, concentration, or research agenda (Johnson, 2005). The challenge is to bridge the gap between the worlds. The importance of connecting this gap is underscored by “knowledge broker” roles having become increasingly popular in healthcare settings. Knowledge brokers act as intermediaries between researchers and knowledge users (CIHR, 2012). Brokers help find evidence to shape decisions, evaluate, interpret, and contextualize knowledge (CIHR, 2012). For example, Lang, Wyer and Haynes note that the most successful standardized therapeutic interventions for early goal-directed therapy in septic shock in emergency medicine have a strong integrative and collaborative approach to treatment between emergency physicians and other acute care professionals (2007). This shows that creating interventions that make interprofessional collaboration easier for healthcare practitioners is just as important as using the best available evidence for the success of an initiative.

The KT process begins by evaluating what knowledge is required for translation and how to deliver it. The CIHR defines “dissemination” as an active process by which researchers communicate information to knowledge users by targeting, customizing, and presenting it using strategies that attempt to maximize uptake (CIHR, 2012). The success of this process is dependent on the quality of communication between researchers and knowledge users and how well information is contextualized. Grimshaw *et al.* notes that KT research often emphasize individual studies as the basic unit for KT (Grimshaw *et al.*, 2012). However, researchers argue

that this is only appropriate for other researchers and research funding agencies (Grimshaw *et al.*, 2012). Individual studies rarely provide enough evidence for changes in practice and policy and may be flawed in design or execution (Grimshaw *et al.*, 2012). Therefore, individual studies are ineffective for knowledge dissemination to decision-makers and health professionals (Grimshaw *et al.*, 2012). For instance, despite multiple randomized trials showing that statins reduce the risk of mortality and morbidity in post-stroke patients, statins are severely under-prescribed by health professionals in the US (Graham *et al.*, 2006).

Landry, Lamari, and Amara state that simply providing knowledge does not necessarily result in its uptake or implementation (Schryer-Roy, 2005). A successful dissemination strategy modifies the message to be applicable within the context of the target audience. This means available evidence must be tailored into standardized interventions that best fit the needs of the people it is intended for. Changing the way knowledge is presented can result in vast differences in uptake. As such, knowledge synthesis through systematic reviews and meta-analyses has become an area of focus (Rycroft-Malone *et al.*, 2002). Systematic reviews enhance validity of data in comparison to individual studies (Lavis *et al.*, 2003). For example, one study comparing the mortality rates of for-profit versus not-for-profit hospitals found that patients had a lower risk of death when treated in the for-profit hospitals (Lavis *et al.*, 2003). However, a meta-analysis of more than 26,000 hospitals and 38 million patients revealed the opposite (Lavis *et al.*, 2003). Synthesizing knowledge provides decision-makers and health professionals with a more complete and reliable pool of evidence to make their choices (Rycroft-Malone *et al.*, 2002). With that being said, other researchers have found that systematic reviews were very infrequently used by WHO policymakers (Straus, Tetroe, & Graham, 2009b). This suggests that inconsistencies in KT not only exist among knowledge users, but among producers as well. Therefore, it highlights the importance of modifying knowledge to fit knowledge users’ context. For example, researchers

may produce policy summaries, media strategies, and videos to increase accessibility for policymakers (AICBR, 2011). Johnson 2005 notes that reading educational materials and attending passive educational meetings have been found to be generally ineffective in altering behavior or practice among healthcare professionals (Johnson, 2005). As such, an enormous amount of resources have been invested into expanding contextualized knowledge synthesis and dissemination, as seen by the creation of the NCCEH in Canada and the Cochrane Collaboration, for example (Grimshaw et al., 2012).

Knowledge users are also responsible for helping researchers identify and fulfill their knowledge needs. The Pull approach focuses on the decision-maker's requirement for research findings to validate choices such as an increase in funding for a health initiative (National Collaborating Centre for Determinants of Health, 2012). Not only must researchers have an appropriate approach to dissemination, but decision-makers must also know how to manage and apply the knowledge. Barriers and challenges to this will be discussed in a later section. Knowledge users must learn how to critically evaluate evidence or perform a review of programs and existing knowledge to determine whether changes are required or more research is needed (AICBR, 2011).

Another important factor in the approach to KT is choosing the most appropriate messenger for the target knowledge users (Grimshaw et al., 2012). Researchers state that the credibility of the messenger is of the utmost importance in knowledge uptake (Grimshaw et al., 2012). For example, Lavis *et al.* found that the most credible messengers among public policymakers were representatives from government institutions and established organizations (Grimshaw et al., 2012). Within clinical practitioners, however, Hayward *et al.* noted that practitioner's implementation of guidelines was only influenced by KT from messengers like peers and esteemed professional organizations (Grimshaw et al., 2012). This shows that credibility of the messenger is one component among many that impacts the success of any KT dissemination approach.

Lastly, outcomes need to be evaluated in order to

determine whether interventions stemming from evidence were effective or not. The success of KT in a given setting is very difficult to quantify because of its multi-factorial nature (Bhattacharyya *et al.*, 2010). For example, an intervention that targets health practitioner's behavior may be successful in increasing their intention to prescribe, but external factors such as the availability of medication or public resistance stopped them from doing so (Bhattacharyya *et al.*, 2010). Bhattacharyya *et al.* stresses the importance of healthcare management regularly including evaluation designs into knowledge implementation programs to continuously appraise and increase the quality of services provided (Shea, 2010). With the Exchange approach, it is critical that researchers and knowledge users continue to work together to evaluate what methods are effective and to determine future KT applications (Fraser Health Authority, 2007).

A case study illustrating a successful approach to KT was Guatemala's 2005 strategy to prevent the transplacental transmission of HIV (CIHR, 2012). A team from Canada performed research to inform decisions based on evidence-based policies (CIHR, 2012). They identified three points that needed to be communicated: that the clinical results of the intervention were successful in reducing HIV transmission by 28%, intimate partner violence needed to be addressed as a major risk factor for maternal HIV contraction, and high-risk groups need to be targeted by local health authorities in Guatemala (CIHR, 2012). Once the relevant research was identified, the team sought to target the appropriate audience whose behaviors they wanted to change: 120 national stakeholders including healthcare professionals, prominent decision-makers, NGOs, media contacts, and HIV and family health representatives (CIHR, 2012). The Guatemalan research team acted as the messengers (CIHR, 2012). The dissemination strategy was effective as the team used their established credibility to present their results using face-to-face communication at a dinner event. The team customized their tools by providing stakeholders with a plain language brochure in both English in Spanish (CIHR, 2012). Following this, discussions between

stakeholders and researchers were encouraged (CIHR, 2012). By doing so, the relationship between researchers and knowledge users were developed, helping to facilitate increased use of research results among decision-makers (CIHR, 2012). This case study shows that finding an effective method of knowledge dissemination is a multi-step process that involves interprofessional collaboration, critical analyses of the target audience's context, and finding appropriate methods to carry out interventions.

Barriers to Knowledge Uptake: Knowledge, Attitudes, & External Factors

Despite high quality research translation, challenges operating at the knowledge user level can impede evidence's practical use. The term "acceptability" is used by the National Collaborating Centre for Healthy Public Policy (NCCHPP) to refer to the way in which a public policy or guideline is judged by its stakeholders (2010). Cabana *et al.* conducted a systematic review of 76 published studies about physician adherence and level of acceptability to clinical guidelines (1999). Researchers found over 250 barriers to implementation under 3 headings: knowledge, attitudes, and external factors (Cabana *et al.*, 1999). Under knowledge, a lack of awareness was cited as a key determinant (Cabana *et al.*, 1999). Studies showed that physicians felt that the volume of information was overwhelming, too much time was needed to stay informed, and guidelines were not accessible enough (Cabana *et al.*, 1999). These findings show how important it is to consider the intended audience's environment such as time constraints and potential gaps in understanding.

Knowledge users' negative attitudes and resistance to change also impede implementation. Singer *et al.* assert that the knowledge users' judgment of a policy or guideline depends on how legitimate they deem messengers and the decision-making process (NCCHPP, 2010). Cabana *et al.* found that low levels of use were related to physicians' disagreeing with specific aspects of the guidelines, finding it inappropriate for the context, and not believing that following the guideline would lead to a desired

outcome (Cabana *et al.*, 1999). This underlines the significance of carefully choosing a well-respected agent to disseminate information and knowing about the intended audience.

Social aspects of resistance to behavior change is another important area to consider. During periods of change, health professionals may be dealing with feelings of pessimism, complacency, anger, insecurity, and anxiety (Campbell, 2008). For instance, researchers found that rigidity of the guidelines had an impact on professional autonomy (Cabana *et al.*, 1999). Therefore, physicians were less likely to adhere to guidelines that were more prescriptive if they felt it challenged their independence (Cabana *et al.*, 1999). Change management is an area of research that has also gained popularity in recent years (Campbell, 2008). This concept is directly relevant to KT as it refers to taking old behaviours, introducing new ones, and implementing strategies to sustain changes as new and better evidence comes into play (Lorenzi & Riley, 2000). Reed Gardner, a pioneer in change management, asserts that the success of an initiative is 80% dependent on the way people receive it and organizational issues, and 20% on technical aspects of the initiative itself (Lorenzi & Riley, 2000). For example, a review found that physician's not adopting guidelines was, in part, due to complacency with their regular practices, feelings of insecurity and a lack of self-efficacy (Cabana *et al.*, 1999). There is no one-size-fits-all method of managing change as it is dependent on context (Lorenzi & Riley, 2000). However, it can be as simple as organizations offering health professionals training whenever changes to guidelines occur to help address feelings of anxiety or insecurity, for example. The take-home point is that insufficient management of social aspects of change is a significant barrier to knowledge uptake. Addressing these issues involves a continuous, context-dependent appraisal of evidence, a focus on knowledge user needs, and organizational supports that help to sustain change.

Despite emphasis placed on the effectiveness of research translation, factors inherent to the healthcare setting also play a role in inhibiting changes that

improve KT. For example, health professionals may face challenges to changing their behaviours because they are immersed in a work culture that simply does not value or promote research utilization (Baumbusch et al., 2008). Furthermore, organizational factors such as a lack of support from administration, professional training, financial disincentives, lack of resources, and procedural inconsistencies in healthcare settings influence how and if evidence is used (Grimshaw et al., 2012). Even if healthcare professionals create change by altering their behaviours and paradigms, organizational and systematic supports must be put in place to support and manage these changes.

An example of the interplay of these factors in KT inhibition is the influenza immunization rates of healthcare workers in Canada. Several active, multi-component influenza programs appropriately targeted to healthcare staff have achieved immunization rates of 55 – 70% at best (Canadian Nurses Association, n.d.). The rate is considered very low as the Canadian National Advisory Committee on Immunization recommends a minimum of 90% (CNA, n.d.). This is in spite of widespread research that indicates that healthcare worker immunization leads to significant decreases in worker-patient influenza transmission, morbidity, and deaths. So, why has evidence failed to translate into practical use? Studies show that part of the reason is healthcare workers' knowledge about and attitude towards influenza vaccination (CNA, n.d.). Knowledge barriers identified were workers' misperception of the risk of getting influenza after vaccination, fear of side effects, vaccine inefficacy, and general lack of knowledge about the severity of influenza transmission to patients (CNA, n.d.). External factors cited include time constraints, potential costs, and lack of convenience of accessibility (CNA, n.d.). In addition, a lack of perceived consequences of not getting the vaccine (such as only having to wear a mask at work) may perpetuate the problem within organizational structures (CNA, n.d.).

Failure to use research to make educated public health decisions is apparent among every level of healthcare (Straus, Tetroe & Graham, 2009b).

Changing behavior is an extremely difficult and multifaceted process that requires the examination of an entire healthcare system (Straus, Tetroe & Graham, 2009b). Effective KT and uptake among decision-makers demands collaboration between knowledge producers and potential users by creating common platforms for communication. Interventions must be created in a way that account for circumstances, attitudes, and external factors of the target audience to overcome barriers to use. Lastly, evaluation of the efficacy of KT interventions must be consistent and ongoing to ensure that the needs of knowledge users are being met (Straus, Tetroe & Graham, 2009b). The process of improving knowledge translation in healthcare settings is challenging and slow-moving, however; only by progressing KT can decision-makers most effectively protect public health.

Methods

Materials Used

To systematically gather data for this research project, a survey was created. The survey was a self-administered online questionnaire disseminated by email to currently employed Public Health Inspectors (PHIs) across Canada. Materials utilized include Google Forms; a free online survey development software that was used to create the survey. Microsoft Excel was used to compile data gathered and to create visual aids such as tables and charts. A cover letter and consent form was provided to potential participants stating the purpose of the study and to obtain consent.

Description of Standard Methods

The standard method that was used to perform this study consisted of administering the survey online via email that provided a link to Google Forms. The survey was comprised of questions regarding general demographics such as age, province, level of education, setting and organization of employment, and years of PHI experience. Inquiries were made regarding knowledge sources, perceived trustworthiness, and uptake on public health parameters relevant to PHIs. Participants were given the option to select from a list of preset responses

written by the researcher. Some questions included an “other” option in which participants were able to provide their own written response wherever pertinent. Regarding potentially sensitive issues, participants were given the option of not answering.

Reliability and Validity of Measures

Reliability refers to the ability of an instrument or experiment, when measured repeatedly, to yield the same results (Heacock & Sidhu, 2014a). By implementing a standardized survey by one researcher, the methodology ensured that reliability is high. Online dissemination of the survey minimized administrative variability; clear instructions were provided for all participants, and each question and the available answers were identical among participants. The survey was comprised of mostly close-ended questions; therefore, reliability was increased due to limiting of potentially confounding factors such as the participants’ interpretation of the question and the researcher’s understanding of written responses. Collaboration and guidance was sought from the National Collaborating Centre for Environmental Health (NCCEH) to ensure questions were worded in an objective and clear manner. Additionally, the researcher utilized questions from the 2012 British Columbia Knowledge Translation Needs Assessment Application section to aid in structuring questions objectively (MSFHR, 2012).

The ability of an instrument or experiment to measure what it is supposed to measure is referred to as validity (Heacock & Sidhu, 2014a). To increase internal validity and ensure accurate conclusions regarding PHIs and knowledge translation were extracted, only currently employed Public Health Inspectors in Canada were included in the resulting statistics of the survey. The management and distribution of knowledge is continuously changing and evolving over time. To obtain a more valid picture of the current landscape of KT in the PHI field, only the responses of currently employed PHIs were analyzed.

External validity is the generalizability of the study, the extent to which results can be applied to a

larger, more general population (Heacock & Sidhu, 2014a; Slack & Draugalis, 2001). The intended population contacted in this study included any PHI in Canada but was limited primarily to those employed in British Columbia due to obstacles that impeded widespread distribution of the survey.

Inclusion and Exclusion Criteria

Public Health Inspectors across Canada were asked to participate in this study. Those who did not authorize consent or were not PHIs were excluded from this study.

Ethical considerations

As this study was performed on human participants, autonomy and beneficence were two key ethical concerns that needed to be addressed (Heacock & Sidhu, 2014a). To address issues of autonomy, a cover letter prefaced the survey link that included the following information for participants: the nature and purpose of the study, plans for use of the data, and reassurance of individual confidentiality (Heacock & Sidhu, 2014a). Informed consent was gathered from each participant through the acceptance of the cover letter. The survey did not increase risk above daily living for participants and provided the opportunity to contribute to scientific knowledge, which is cited as an adequate benefit for beneficence (Heacock & Sidhu, 2014a). Furthermore, the survey was reviewed and approved by the BCIT Environmental Health program and members of the NCCEH.

Pilot Study

In January 2015, a pilot study was performed by distributing the survey electronically to 9 PHIs in British Columbia (Bullen, 2014). Although the small number of participants surveyed in the pilot study may not necessarily fully represent the target population, volunteers provided valuable feedback regarding:

- 1) clarity and objectivity of questions,
- 2) length and amount of time it takes to complete,
- 3) whether answer options were appropriate, and
- 4) any additional concerns regarding methodological errors, design, etc.

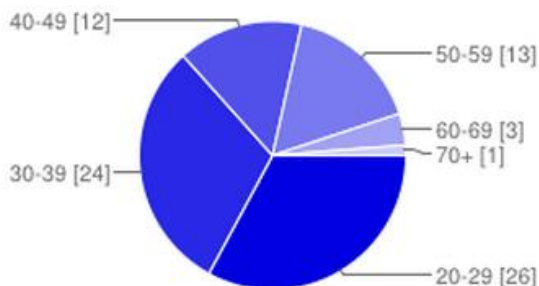
Description of the Data

In this study, the data collected was categorical data, divided into nominal and ordinal data. As per suggestion of the NCCEH, qualitative data in the form of written responses were also collected at the

end of the survey. This data was not numerical in nature and includes participants' methods of sharing information and opinions about how public health organizations can improve upon current methods of knowledge translation in healthcare settings.

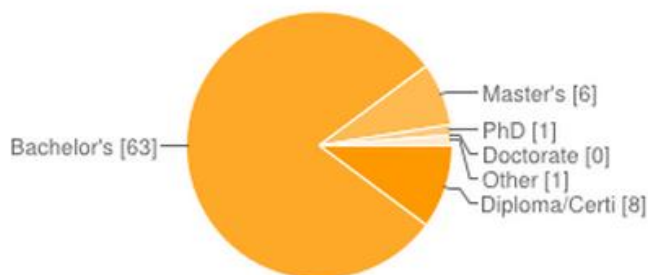
Results

Age:



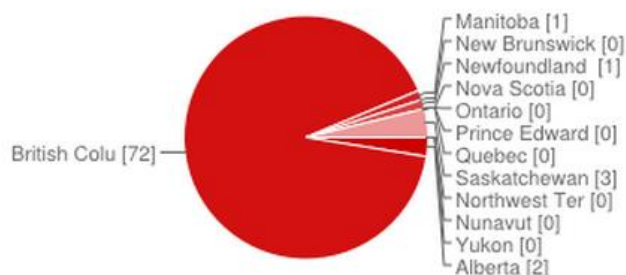
20-29	26	33%
30-39	24	30%
40-49	12	15%
50-59	13	16%
60-69	3	4%
70+	1	1%

Level of education:



Diploma/Certificate	8	10%
Bachelor's	63	80%
Master's	6	8%
PhD	1	1%
Doctorate	0	0%
Other	1	1%

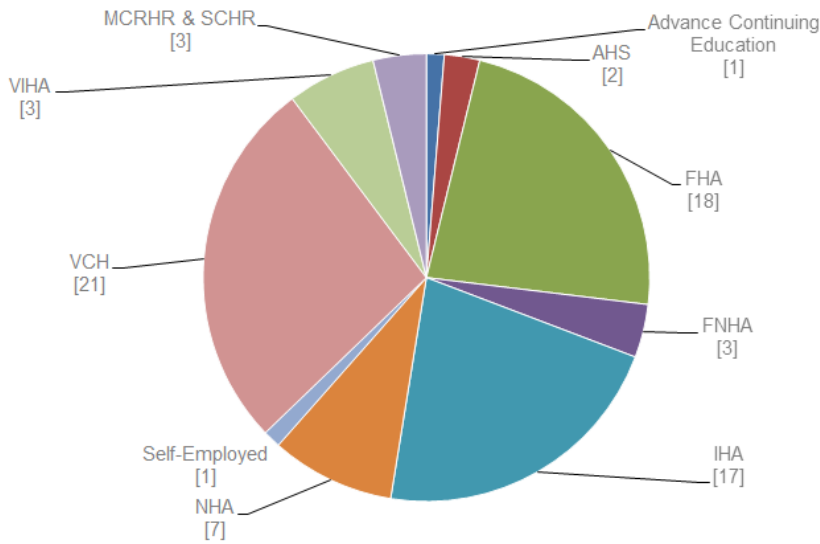
Province/Territory your workplace is located:



Alberta	2	3%
British Columbia	72	91%
Manitoba	1	1%
New Brunswick	0	0%
Newfoundland & Labrador	1	1%
Nova Scotia	0	0%
Ontario	0	0%
Prince Edward Island	0	0%
Quebec	0	0%
Saskatchewan	3	4%
Northwest Territories	0	0%
Nunavut	0	0%
Yukon	0	0%

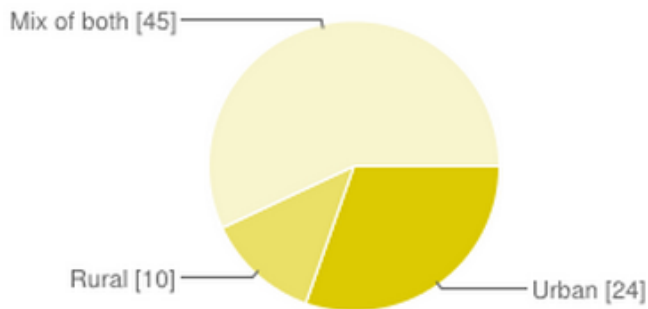
JOB TITLE	# OF RESPONSES	PERCENTAGE
EHO	65	82%
EHO - Community Development	1	1.2%
EHO - Team Leader	1	1.2%
EHO / Tobacco Enforcement Officer	1	1.2%
EHO/Business Owner	1	1.2%
EHO/DWO	1	1.2%
Manager - Environmental Health	4	5%
Practice Consultant	2	3%
Senior EHO	3	4%

What organization/agency/health unit do you work for?



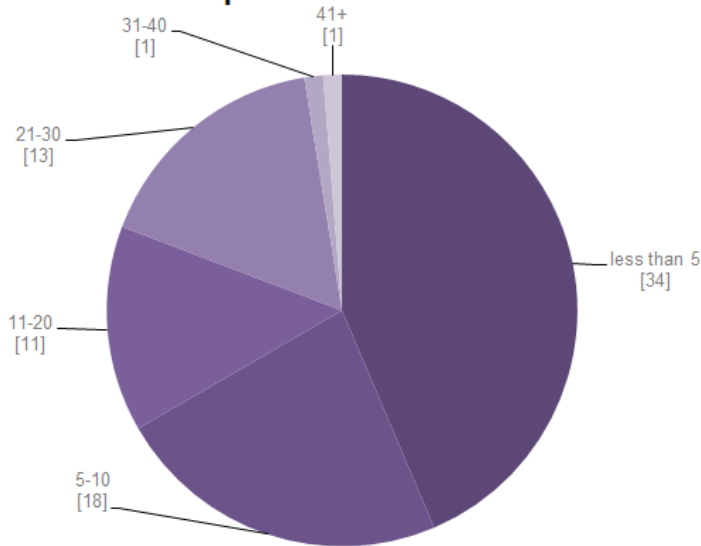
Advance Continuing Education	1	1%
Alberta Health Services	2	2.5%
Fraser Health Authority	18	23%
First Nations Health Authority	3	4%
Interior Health Authority	17	22%
Northern Health Authority	7	9%
Self-Employed	1	1%
Vancouver Coastal Health Authority	21	27%
Vancouver Island Health Authority	5	6.5%
Mamawetan Churchill River Health Region & Sun Country Health Region	3	4%

Do you work in an urban or rural setting?



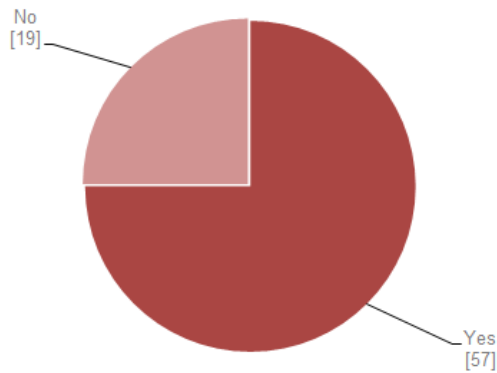
Urban	24	30%
Rural	10	13%
Mix of both	45	57%

Years of PHI Experience



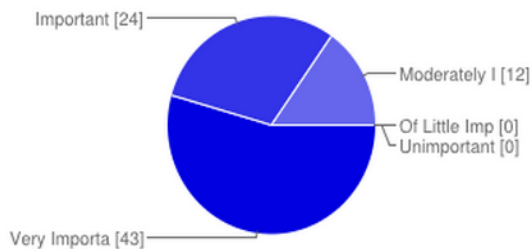
Less than 5	34	44%
5-10	18	23%
11-20	11	14%
21-30	13	16%
31-40	1	2%
41+	1	1%

Are you a member of the Canadian Institute of Public Health Inspectors (CIPHI)?



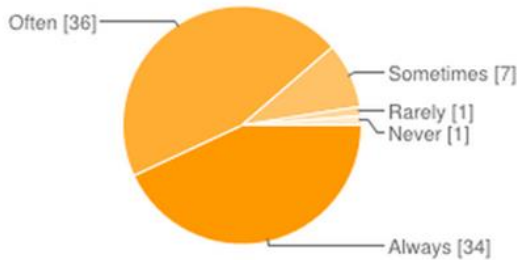
Yes	57	75%
No	19	25%

Knowledge Translation is the process of using research evidence to improve health. Application refers to the development and integration of programs, policies, and services based on research evidence (MSFHR, 2012). How important is this concept of application to your work as a PHI?



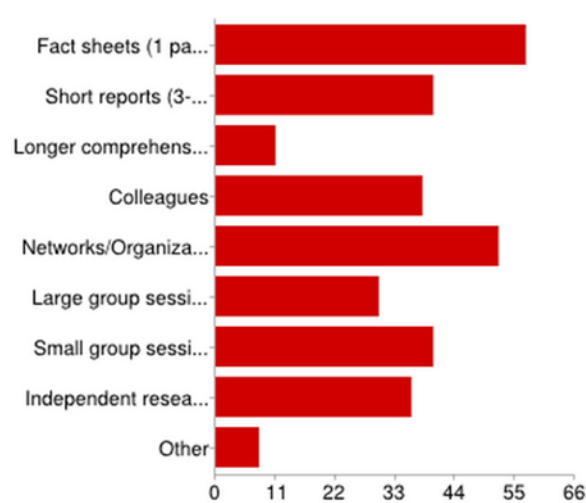
Very Important	43	54%
Important	24	30%
Moderately Important	12	15%
Of Little Importance	0	0%
Unimportant	0	0%

In daily practice, how regularly do you use evidence-based information to advise your decisions and actions?



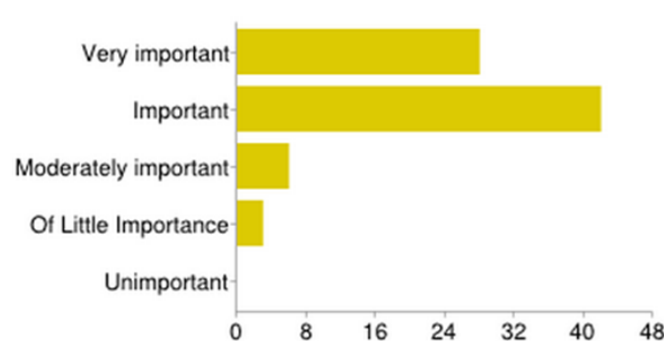
Always	34	43%
Often	36	46%
Sometimes	7	9%
Rarely	1	1%
Never	1	1%

To help you make informed decisions, how do you prefer to learn about a topic in environmental health? Select up to 4.



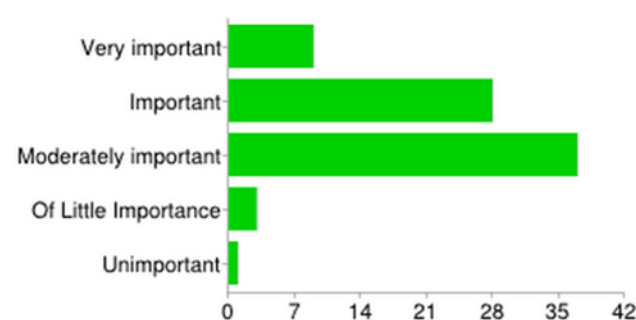
Fact sheets (1 page double-sided)	57	72%
Short reports (3-5 pages)	40	51%
Longer comprehensive reports (5+ pages)	11	14%
Colleagues	38	48%
Networks/Organizations (ex. PHAC, Health Canada, NCCEH)	52	66%
Large group sessions (ex. conferences, seminars)	30	38%
Small group sessions (ex. meetings, workshops)	40	51%
Independent research (ex. internet, library)	36	46%
Other	8	10%

Colleagues [Rate the importance of the following factors influencing your practice:]



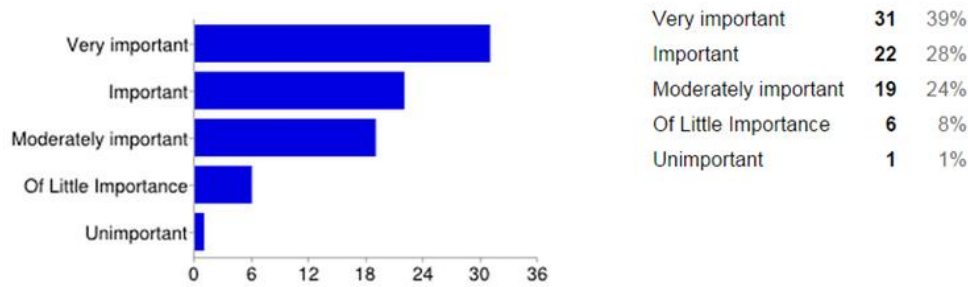
Very important	28	35%
Important	42	53%
Moderately important	6	8%
Of Little Importance	3	4%
Unimportant	0	0%

Entry-level education [Rate the importance of the following factors influencing your practice:]

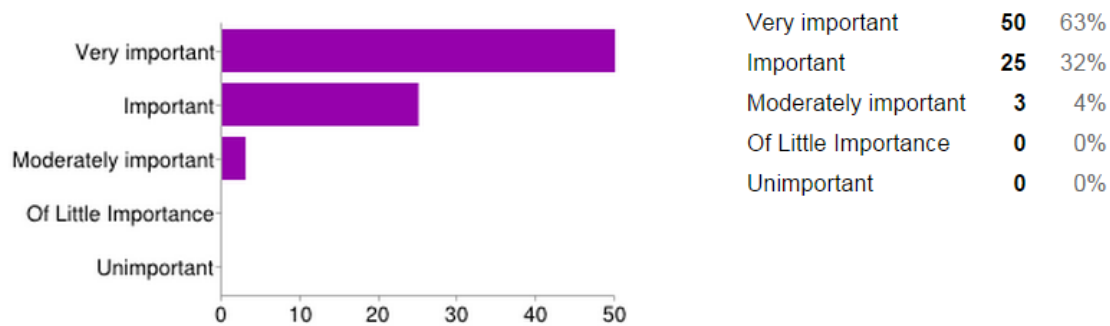


Very important	9	11%
Important	28	35%
Moderately important	37	47%
Of Little Importance	3	4%
Unimportant	1	1%

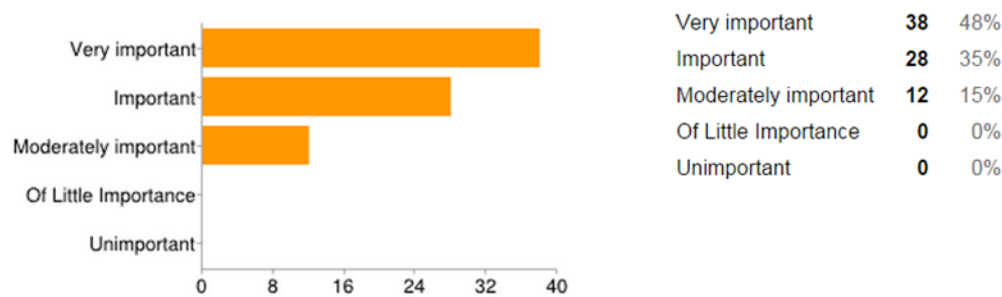
Professional literature (ex. trade publications, textbooks, manuals) [Rate the importance of the following factors influencing your practice:]



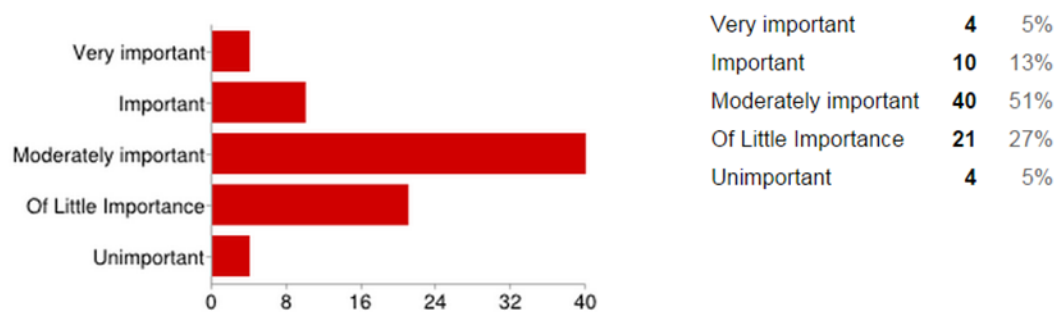
Experience [Rate the importance of the following factors influencing your practice:]



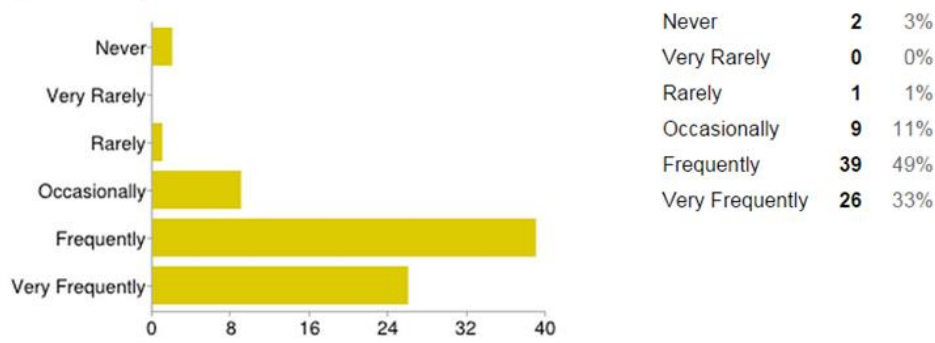
Continuing education (ex. webinars, conferences) [Rate the importance of the following factors influencing your practice:]



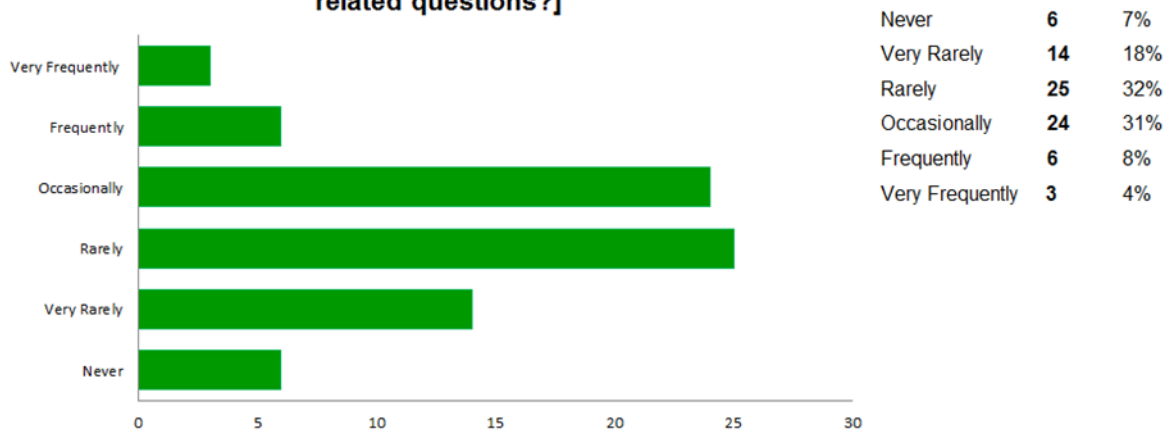
Mass media (ex. newspapers, TV, websites) [Rate the importance of the following factors influencing your practice:]



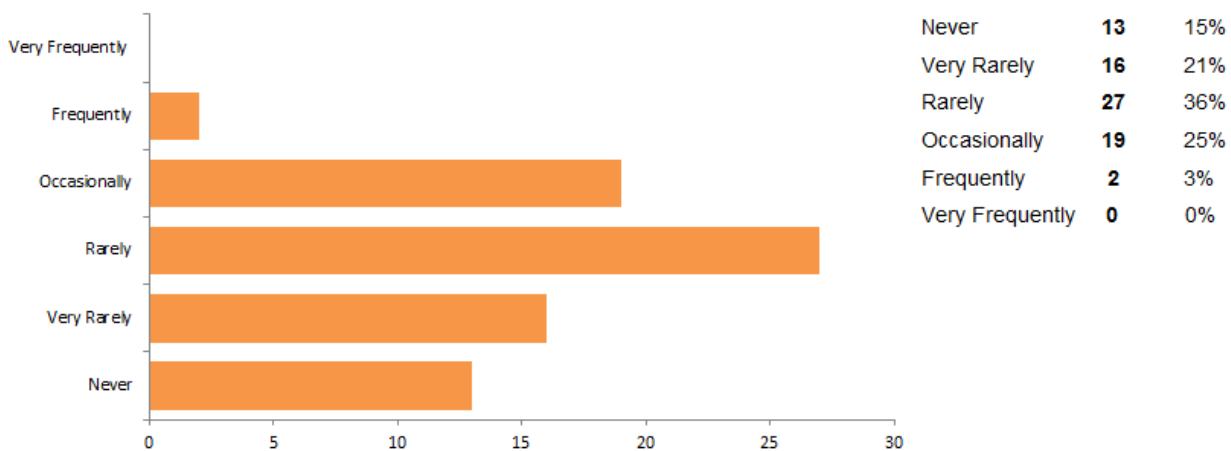
Colleagues [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



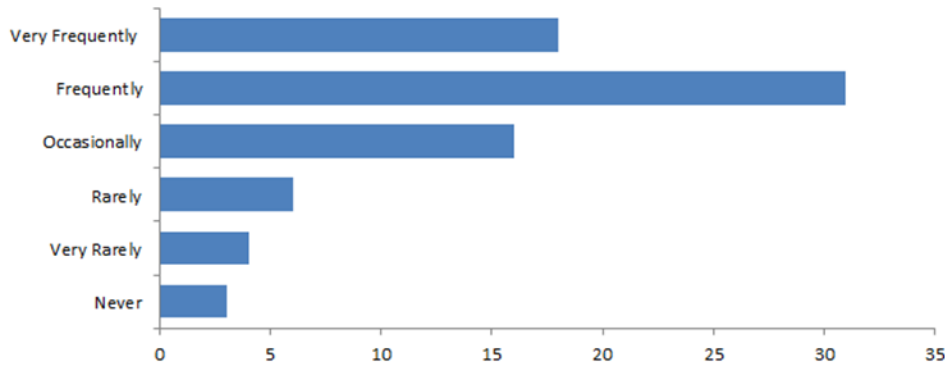
Print media (ex. newspapers, books, magazines) [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



Broadcast media (ex. TV, radio) [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]

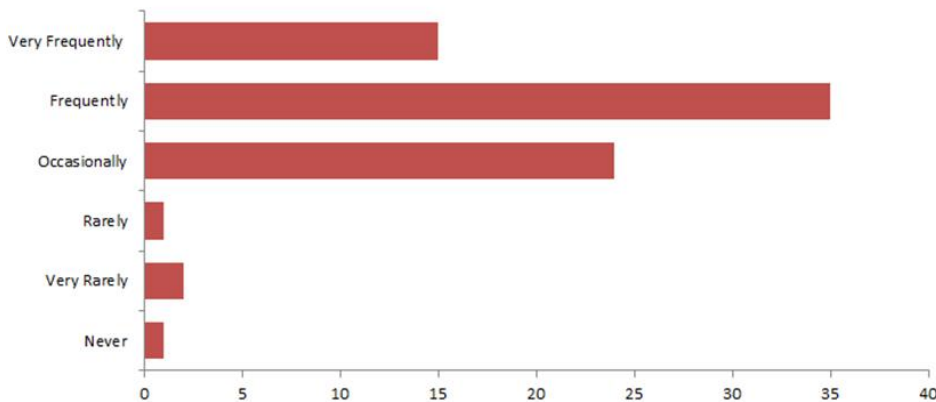


**Internet (ex. social media, search engines, websites)
[For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]**



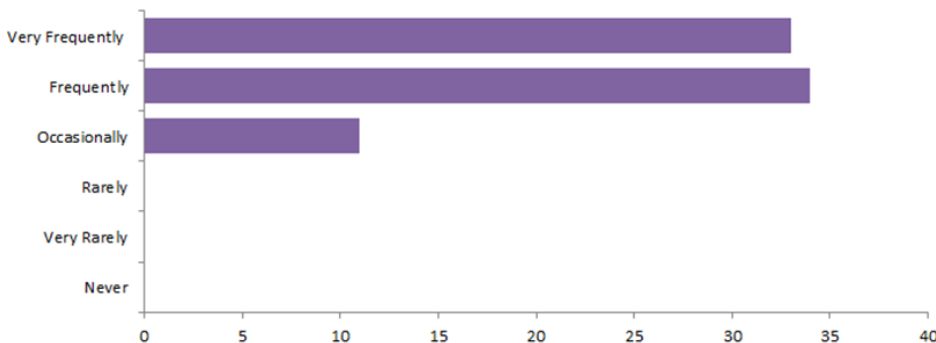
Never	3	4%
Very Rarely	4	5%
Rarely	6	8%
Occasionally	16	20%
Frequently	31	40%
Very Frequently	18	23%

Professional literature (ex. trade publications, textbooks, manuals) [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



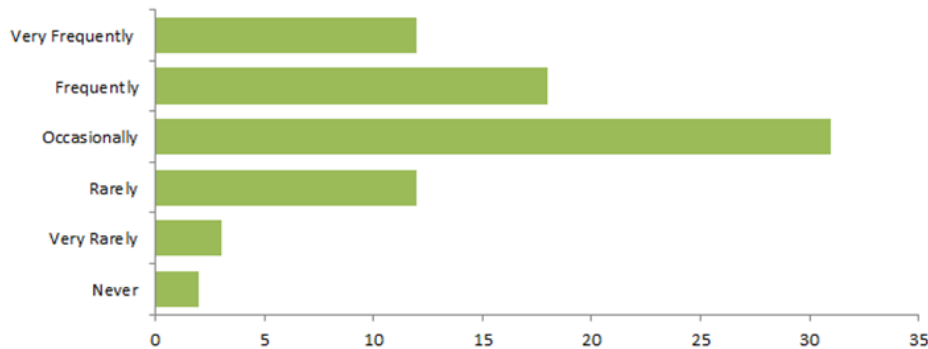
Never	1	1%
Very Rarely	2	2.5%
Rarely	1	1%
Occasionally	24	31%
Frequently	35	45%
Very Frequently	15	19.5%

Government agencies [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



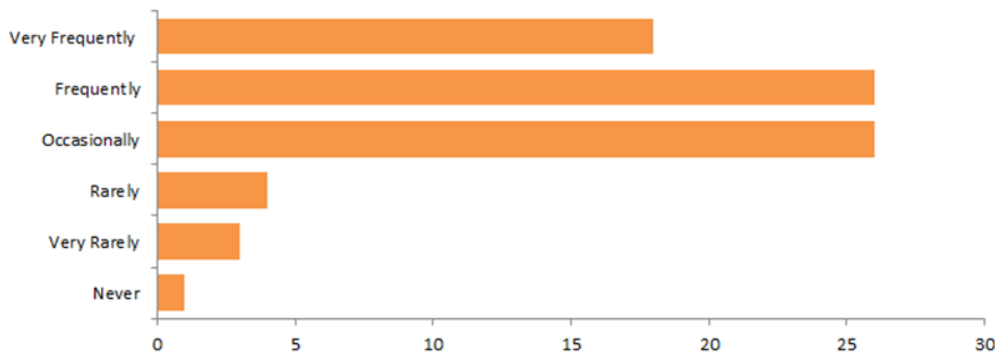
Never	0	0%
Very Rarely	0	0%
Rarely	0	0%
Occasionally	11	14%
Frequently	34	44%
Very Frequently	33	42%

Published scholarly journals [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



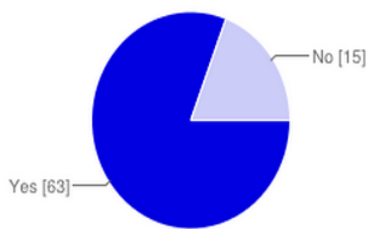
Never	2	3%
Very Rarely	3	4%
Rarely	12	15%
Occasionally	31	40%
Frequently	18	23%
Very Frequently	12	15%

Professional organizations [For situations you are unfamiliar with, how often do you use the following sources to advise public-health related questions?]



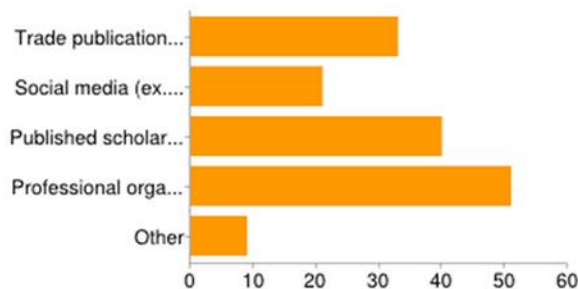
Never	1	1%
Very Rarely	3	4%
Rarely	4	5%
Occasionally	26	33.5%
Frequently	26	33.5%
Very Frequently	18	23%

Do you subscribe to any information sources on a regular basis that allows you to keep yourself current on environmental health topics?



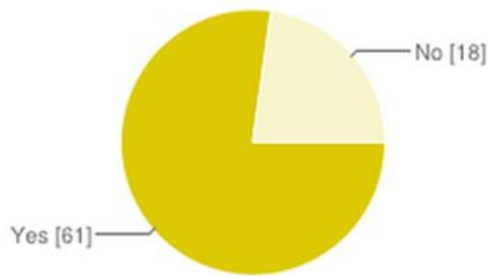
Yes	63	80%
No	15	19%

If YES, please select all that apply.



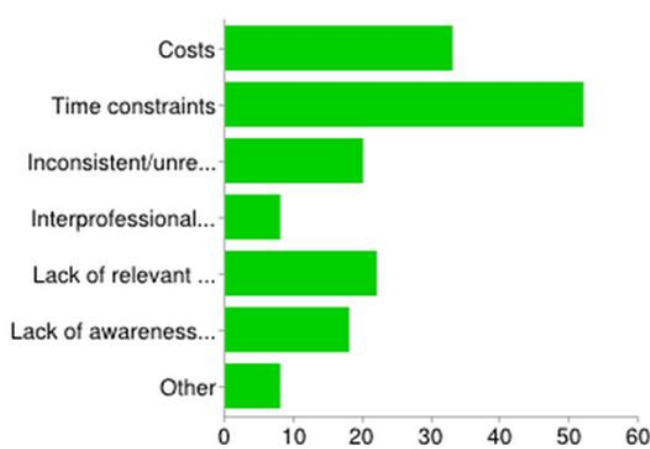
Trade publications/magazines (ex. Food Safety e-newsletter)	33	42%
Social media (ex. Twitter, RSS Feeds, blogs)	21	27%
Published scholarly journals (ex. Environmental Health Review)	40	51%
Professional organizations (ex. CIPHI webseries)	51	65%
Other	9	11%

In your practice, do barriers exist that impede your access to evidence-based information?



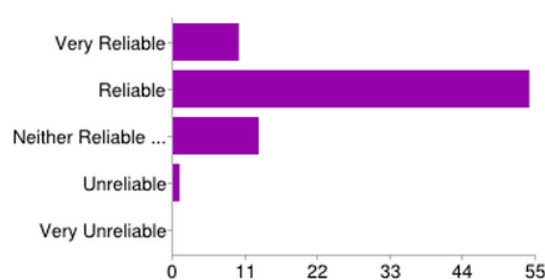
Yes	61	77%
No	18	23%

If YES, what barriers impede your access to evidence-based information? Select all that apply.



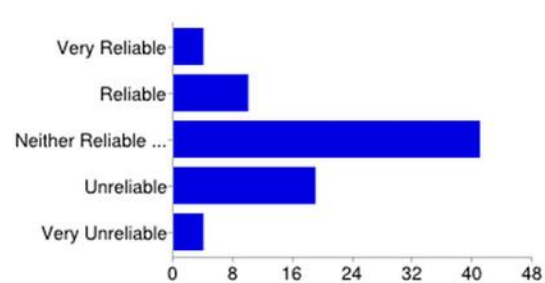
Costs	33	42%
Time constraints	52	66%
Inconsistent/unreliable information	20	25%
Interprofessional miscommunication	8	10%
Lack of relevant information	22	28%
Lack of awareness of available resources	18	23%
Other	8	10%

Colleagues [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



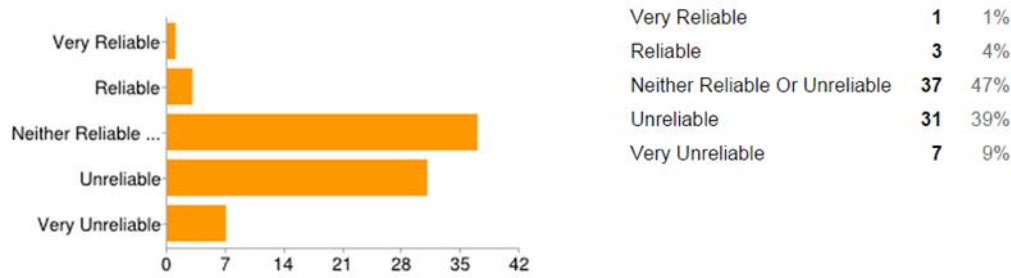
Very Reliable	10	13%
Reliable	54	68%
Neither Reliable Or Unreliable	13	16%
Unreliable	1	1%
Very Unreliable	0	0%

Print Media (ex. newspapers, books, magazines) [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]

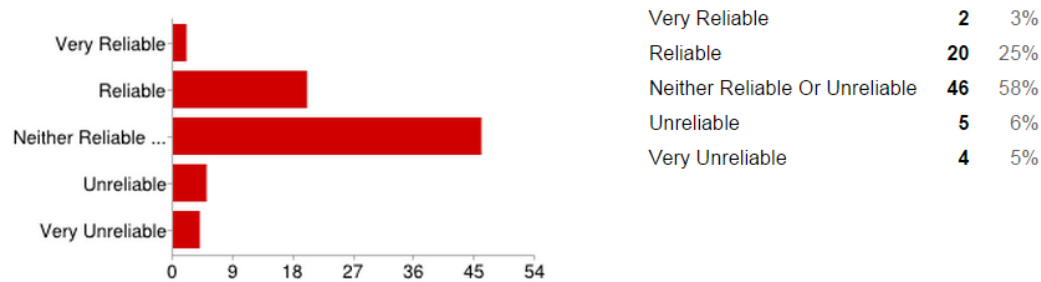


Very Reliable	4	5%
Reliable	10	13%
Neither Reliable Or Unreliable	41	52%
Unreliable	19	24%
Very Unreliable	4	5%

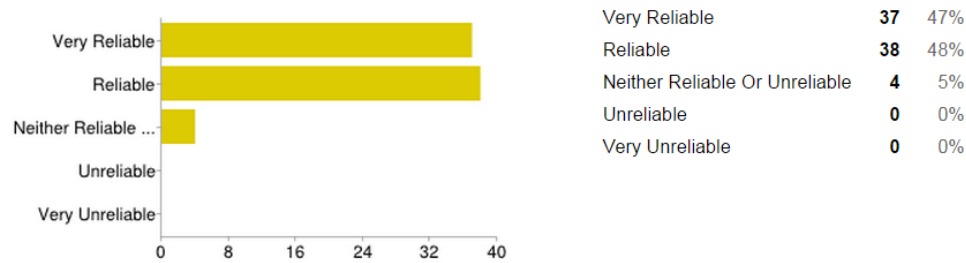
Broadcast media (ex. TV, radio) [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



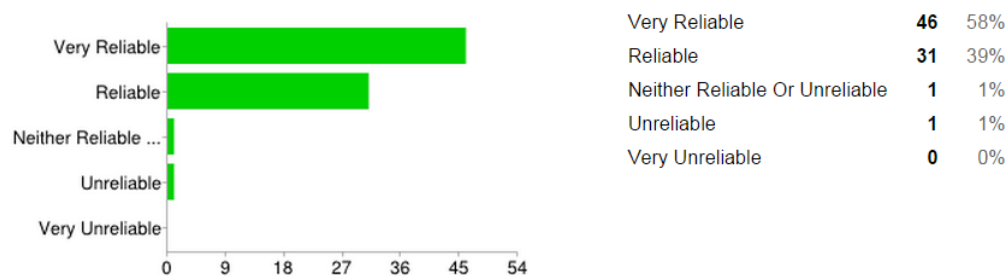
Internet (ex. social media, search engines, websites) [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



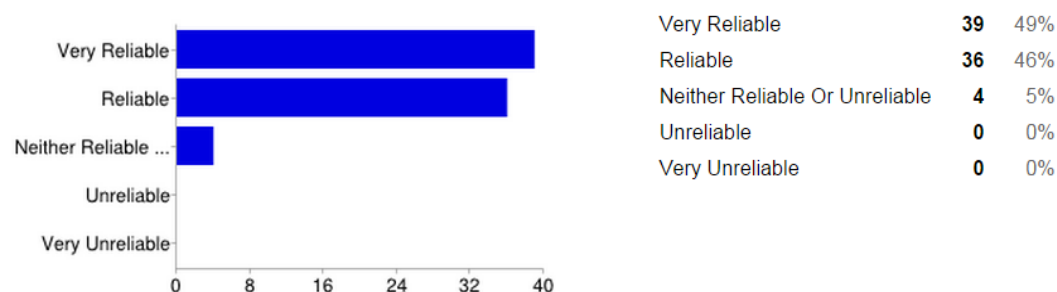
Professional literature (ex. trade publications, textbooks, manuals) [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



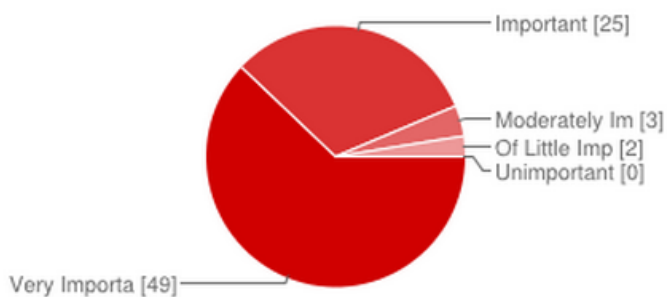
Government Agencies [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



Professional Organizations [In your opinion, how reliable is information from the sources listed below when making a public-health decision?]



How important is professional development to your practice?



Very Important	49	62%
Important	25	32%
Moderately Important	3	4%
Of Little Importance	2	3%
Unimportant	0	0%

Discussion

The objective of this study was to determine what and how often sources of environmental health information are used by PHIs, the level of trust invested into these resources, and perceived barriers to knowledge uptake. The study revealed that PHIs use evidence-based information to advise their decisions and actions always (43%) or often (46%) in daily practice. When faced with unfamiliar situations, the following sources were most frequently and very frequently used to advise public-health related questions: colleagues frequently (49%) or very frequently (33%), professional literature frequently (45%) or very frequently (19.5%), government agencies frequently (44%) or very frequently (42%), professional organizations frequently (33.5%) or very frequently (23%) and the internet frequently (40%) or very frequently (23%). With regards to reliability of sources used, the majority of participants deemed the aforementioned resources to be either very reliable or reliable, with the exception of the internet. Although frequently used, the internet was perceived as neither reliable nor unreliable by 58% of respondents.

PHIs access evidence-based information to guide their public health decisions on a daily basis. A common platform used to do so is the internet. As results show, the internet has become a daily resource for the majority of PHIs to access knowledge. With the rapid development of technology and the ever-changing nature of public health, online resources for health professionals are becoming increasingly central to healthcare delivery (Podichetty, Booher, Whitfield, & Biscup, 2006). This study found that only 9% of

PHIs turn to print media frequently or very frequently as opposed to 63% who look to internet-based resources. This is consistent with Koehler, Vujovic, & McMenamini's finding that health professionals are more frequently accessing information electronically over paper-based materials for ease and efficiency (2013). Koehler *et al.* further states that 67% of health professionals believe that healthcare related internet sites will replace non-electronic sources within 10 years (2013). The rise in internet usage may be attributable to its easy accessibility through computers and mobile devices as well as the influx of young, internet-savvy PHIs entering the public health field. Nonetheless, it is clear that the internet is a convenient and increasingly popular tool for PHIs to access information, but the information that is found is often questionable.

The knowledge sources that result from an internet search may vary greatly in quality and accuracy. PHIs in this study share this perspective as the majority perceived the internet to be "neither reliable nor unreliable" despite frequent use. Among the participants of this study, 28% list lack of relevant information and 25% cite lack of consistent/reliable information as barriers to KT. Jadad & Galiardi (1998) assert that information available on the internet lacks consistency due to the fact that it is produced and exchanged by many groups of people, presented using different formats, modified at an unregulated and unpredictable rate, and linked within an intricate network of internet websites. This means that it is left to the PHI to invest the time and mental resources to

determine what online knowledge is reliable enough to use in their practice. However, an interesting finding from this study shows that 80% of PHIs regularly subscribe to environmental health resources, 65% and 51% subscribe to publications from professional organizations and scholarly journals respectively, both of which are delivered online. As well, the perceived trustworthiness of these government agencies, professional organizations, and scholarly journals were high among PHIs. It follows that an increased presence of PHI-specific information from these respected resources may help to alleviate concerns regarding reliability.

Results from this study found that 66% of PHIs prefer to learn about environmental health topics from governmental agencies and professional organizations. However, common criticisms received in the open-ended questions referred to government organizations as being “difficult to navigate”, resources being “inconsistent”, or “scattered and unsearchable” and scholarly journals as presented in a format that requires excessive time and attention to fully comprehend. Participants (66%) indicated that the most prominent barrier to accessing evidence-based knowledge was time constraints. These results suggest that the availability of reliable knowledge is not enough to improve KT among PHIs. Information must be presented in a digested, concise manner for professionals to efficiently integrate into their practice. For example, 77% of PHIs indicated that they learn best from one page fact sheets while 51% prefer short 3-5 page reports. Previous studies are consistent with these findings as researchers acknowledge challenges associated with regulating information and emphasize the need for knowledge that is summarized accurately and effectively with linkages among multiple databases (Purcell & Wilson, 2002).

Lastly, 77% of respondents cited that barriers exist that impede their access to evidence-based information. It is possible that the perceived lack of relevant and reliable information may also be due to a PHI’s poor computer skills or unawareness of existing, readily available resources. However, a more compelling argument is posed by a study conducted by

LaPelle *et al.* (2006) suggesting that a major difficulty in resolving relevancy and reliability problems is simply the vast breadth of the public health discipline. Due to the multitude of topics and variance in PHI practices, it is difficult to identify and gather a body of evidence-based information to address the growing multitude of specified public health information needs (LaPelle *et al.*, 2006).

Recommendations

Based on the results of this study, the centralization of public health information specific to the PHI profession would help address issues regarding consistency and reliability of information. Although the researcher acknowledges that variations in practice exist with regards to location, legislation, and common practices---science-based evidence should remain consistent regardless. As resources continue to be computerized, measures need to be implemented to ensure that the information provided is kept updated and accurate. Increased communication of evidence, practices, and standards are required between health authorities, government agencies, and PHI professionals to improve consistency. Additionally, PHIs should be given continuous opportunities for professional development and training from reliable sources.

Limitations

Sample Population

The size and demographics of the sample population were major limitations in this study. The total number of PHIs that participated and met the inclusion data was 78. This represents a very small subset of PHIs across Canada. Some of the participants were recruited by other PHIs who had already completed the survey. This may have contributed to the demographics of the sample population lacking diversity. For example, 80% of participants have Bachelor degrees and 63% are between the ages of 20-39. In terms of workplace

location, 91% of the participants are from British Columbia, 4% from Saskatchewan, 3% from Alberta, 1% each from Manitoba and Newfoundland and Labrador, and 8 provinces were not represented at all. Furthermore, the PHIs employed at Fraser Health Authority and Vancouver Coastal Health represented 50% of the sample population. Access to evidence, PHI practice, viewpoints and exposure to KT concepts may differ significantly from province to province. Consequently, the generalizability of this study is low. The study may serve more as a representation of KT and PHI practice in BC, particularly Metro Vancouver, as opposed to across Canada.

Platform Used & Nature of the Survey

Use of the free service, Google Forms, posed several limitations. Problems with the program resulted in some participants being able to submit their survey without answering all the questions despite settings the researcher inputted. Consequently, the data collected for a few questions are missing one or two responses. Electronic distribution of the survey may have contributed to the high proportion of participants being under 39 years old because participation required computer skills, and in some cases, access to social media. Due to the low number of PHIs ages 40+ who participated, the study was unable to ascertain a full understanding of the older PHI faction's outlook with regards to KT.

The nature of the survey question options, which were primarily Likert scales, may have been interpreted differently by participants. For instance, "somewhat reliable" may represent different levels of trustworthiness to individual participants. Secondly, the last four questions of the survey were open-ended questions. The responses from participants vary greatly and are dependent on the researcher's interpretation. Lastly, it is possible that participants may have randomly assigned answers to questions without fully reading the questions.

Future Research

To obtain a better understanding of the KT needs

of PHIs across Canada, future studies could be conducted to determine:

- 1) Whether PHIs see the development of a profession-specific, single portal, web-based national database as a useful investment. Data could be gathered on specific topics and features that should be included such as discussion forums that encourage communication among professionals.
- 2) Whether PHIs perceive training and professional development delivered electronically as effective.
- 3) What specific actions government agencies and professional organizations can perform to facilitate the transfer of evidence to practice within the PHI profession.

Conclusions

PHIs access evidence-based information to advise their public health decisions on a daily basis. However, reliable and consistent information on the plethora of public health topics PHIs are responsible for knowing are not always available. The internet is a tool frequently used by PHIs, despite the fact that the level of trust is low. However, sources of reputable evidence accessed through the internet such as government agencies and professional organizations are frequently used and deemed as reliable. Still, the means by which information is presented can be made more concise, easily accessible and PHI-specific to address barriers to effective KT such as time constraints and access to relevant information.

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Competing Interest

The author declares that she has no competing interests.

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