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Obstacles in Public Health Professionals' Information Practice: Introducing a Conceptual Model of Working Professionals' Information Seeking Process

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Abstract

Introduction. This paper reports a mixed method study involving public health professionals concerning obstacles they encounter as they seek information for work tasks.

Method. This study included Phase I qualitative interviews with 12 public health professionals and a Phase II survey to 579 public health professionals in the US.

Analysis. Qualitative analysis of Phase I data focused on types of obstacles that public health professionals faced. Statistical analyses of Phase II survey data identified significant differences among work settings.

Results. Respondents' confidence with their information searching skills varied among work settings and educational backgrounds. Their satisfaction with their institutional support for information services also differed among work settings and demographic groups. Work settings correlated to causes behind the obstacles. We present a conceptual model of the information seeking process for working professionals by incorporating the steps of encountering obstacles, and further steps when obstacles are overcome or not overcome.

Conclusion. As a large-scale study on public health professionals' information practice, this study revealed insights into the impact of work settings on the obstacles they encountered. The conceptual model we introduce here helps advance the scholarship and holds theoretical value.

Introduction

Public health remains critically important in today's world, especially in light of the lasting impacts of the COVID-19 pandemic and the ongoing need for preparedness and resilience. Public health professionals observe and diagnose the health issues of entire communities and promote healthy lifestyles and behaviours to general populations (American Public Health Association website https://www.apha.org/what-is-public-health/generation-public-health, n.d.). There are three primary functions that the public health profession performs: (1) assessment, such as investigating health problems and infectious disease outbreaks; (2) policy development, including educating the public and supporting their health with regulations; and (3) assurance, by enforcing regulations and providing personal health care services (Turner, et al., 2008). Public health professionals face obstacles in their information seeking process, and these obstacles might be attributed to either the information services/resources available to them or to their own information skills. Library and information science professionals may play a vital role in upskilling public health professionals' information literacy competencies to overcome obstacles and perform their work tasks effectively and efficiently.

This research study focuses on the information seeking behaviour of public health professionals who work in a broad range of settings. Even though existing studies have investigated health information seeking behaviour, few have examined the differences in information seeking behaviour and obstacles confronted between those who work in academic settings and those who work in practice-based settings. The focus of this study was on examining the differences in public health professionals' confidence with their information searching skills and satisfaction with the institutional support for information services provision among participants of various work settings, educational backgrounds, and demographic makeups. Furthermore, we attempted to identify obstacles that public health professionals experience when they search for work-related information, and their causes. We also examined the gaps in information services provided in different settings and developed recommendations to improve information services to enable professionals to overcome their obstacles and complete their tasks. Finally, we developed a conceptual model of the information seeking process used by working professionals that accentuates the role of obstacles throughout the process by illustrating that task completion depends largely on the failure or ability to overcome the obstacles. This model may be extendable to all working professionals seeking information for work tasks.

Background

Public health professionals are responsible for acquiring accurate, up-to-date, and evidence-based information to ensure effective decision making. It is crucial for these professionals to have a current awareness of public health research and constantly update their knowledge and skills to provide high-quality health services to their communities. Despite the growth of electronic resources and increased technological capability, challenges remain for users to identify, evaluate, and select relevant publications. As indicated by Groote et al. (2014), more expert-level search skills and advanced information management competencies are needed. Furthermore, with the multitude of biomedical databases, public health-related databases, and general science-oriented databases, public health researchers and practitioners have to develop an effective strategy for streamlining their information seeking process.

Existing research has revealed that scientists' search habits include *power browsing*, *squirreling*, and *bouncing* (e.g., Nicholas et al., 2008; Nicholas, 2010; Gradinaru, 2013). Power browsing involves 'a very rapid navigation through the overwhelming quantity of information for picking up some small pieces' (Gradinaru, 2013, p. 94). Squirreling is 'an energetic search for treasures that are downloaded for later consumption' (Hillesund, 2010, p. 4). The habit of bouncing describes the way scientists view a limited number of pages without going through in-depth reading. These discussions provide useful insight into public health professionals' information habits.

Furthermore, a number of studies reported the patterns of users' searching behaviour (e.g., Navarro-Prieto et al., 1999; Nicholas et al., 2004). Navarro-Prieto et al. (1999) identified three searching approaches: (1) a top-down strategy, (2) a bottom-up strategy, and (3) a mixed strategy. The top-down strategy begins the search in a general area and then narrows down until users find what they are looking for. The bottom-up strategy is commonly used by experienced users for 'fact-finding' tasks starting with specific keywords and opening the results until they find 'the desired information'. The mixed strategy involves users employing both top-down and bottom-up strategies and searching while having multiple windows open simultaneously (Nicholas et al., 2004).

In summary, public health professionals face a number of challenges as they navigate through a wealth of electronic resources to find information pertinent to their everyday work practices. The challenges and handling processes may vary depending on their needs and their work contexts.

Related Research

Information needs and seeking

Empirical studies of public health professionals' information need and seeking processes have mostly focused on academic faculty, with only a few targeting practising professionals. Shpilko (2011) found three major factors affecting faculty's use of electronic resources: accessibility, up-to-date content, and usefulness. An academic public health researcher routinely consulted scholarly journals, conference proceedings, government sources, and nutrition information published on the web by professional organisations. The most frequently used databases were PubMed, ScienceDirect, and Academic Search Primer.

Among the primary databases, Medline was found as a key database used by faculty members of health science colleges, including public health and nursing at the University of Illinois at Chicago (Groote et al., 2014). The authors reported that 78.5% of participants used Medline at least weekly, and used Google on a daily basis. Only a small percentage of faculty (less than 5%) used other databases, such as CINAHL and UpToDate. Meanwhile, in their investigation into health professionals working in public hospitals in Ethiopia, Andualem, et al. (2013) found that 42% of the participants had access to electronic sources, and the majority of respondents expressed their need to access more resources. Ultimately, the results of these studies emphasised the need to provide more health information literacy training, increase the awareness of e-resources, acquire pertinent digital products, and offer information services to support evidence-based practice. In a survey study focusing on comparing the information sources used by healthcare workers (HCW) and the general public in Israel, Gesser-Edelsburg, et al. (2019) found that the most frequently mentioned sources for health information for HCWs were health organisations (44.08%), academic articles (24.24%), and social networks (18.18%). However, in terms of credibility, they rated health organisations the highest, academic articles second, and social networks among the lowest. The collective findings on the most frequently used resources by public health and health care professionals, faculty members, nurse practitioners, and physicians are listed in Table 1 below.

Author (Year)	Focus/Setting	Most frequently used resource
Gesser-Edelsburg, A. et al. (2019)	Health care workers (HCW)	Health organisation sites (44.08%) Academic articles (24.24%) Social networks (18.18%)
Andualem et al. (2013)	Various public health practitioners: nurses, laboratory, and pharmacy personnel.	Textbooks and senior staff (58%)
Weng et al. (2013)	Various main and allied health practitioners: nurses, physicians, pharmacists, physical therapists, and technicians.	All Groups: most used resource was web portal (95%) Nurses: colleagues (70%) Technicians: colleagues (65%) Physical therapists: textbook (80%) Physicians: Databases (Medline 95%) Pharmacists: Databases (Micromedex 90%)
Shpilko (2011)	Various public health faculty members: nutrition, food science, and dietetics faculty.	Scholarly journals (100%) Conference and seminar proceedings (78.9%) Web search engines (73.6%)
Groote et al. (2014)	Various health faculty members: public health, nursing, applied health sciences, medicine, and pharmacy.	Overall: Medline (47.7%) once a week and Google (50.8%) on a daily basis.
Kumaran and Chipanshi (2015)	Nurse practitioners	Phase I: Google and health websites Phase II: Colleagues, senior staff, books and guidelines
Turner et al. (2008)	Nurse practitioners	Colleagues
Marshall et al. (2011)	Nurse practitioners	Colleagues
Davies (2011)	Hospital-based and primary care Physicians	Hospital-based physicians: full-text electronic journals Primary care physicians: Colleagues
Kosteniuk et al. (2013)	Physicians	Medical journals (93%)
Bennett et al. (2004)	Physicians	Internet sources (73.9%)
Kostagiolas et al. (2014)	Physicians	Internet used daily (41.6%) Search engines

Table 1. Findings on Most Frequently Used Resources in Various Public Health Settings.

Impact of demographic background and work settings

Existing studies comparing demographic attributes, educational background, and work settings of health care professionals (e.g., Weng et al., 2013; Kumaran and Chipanshi, 2015; Marshall et al., 2011; Rutland and Smith, 2010; Turner et al., 2008) confirmed the impact of these factors on information seeking behaviour. In a nationwide survey of health professionals in Taiwan, Weng et al. (2013) found significant differences among age, degree, and professional positions. Nurse practitioners '*with younger age, higher academic degree, faculty position or director's position more often accessed the online databases*' (p. 906) than those who are older, hold lower levels of degrees and have lower-ranking positions. Previous studies also discovered that nurses relied extensively on colleagues as their main resources, and they cared more about relevance, speed, and ease of access than the credibility of resources (Kumaran and Chipanshi, 2015; Marshall et al., 2011; Rutland and Smith, 2010; Turner et al., 2008). Other public health professionals used different types of sources in addition to health databases (Groote et al., 2014; Shpilko, 2011; Weng et al., 2013). In contrast, physicians used electronic resources more than physical resources and valued the quality of

information more than convenience and accessibility (Bennett et al., 2004; Davies, 2011; Kosteniuk et al., 2013; Kostagiolas et al., 2014). Weng et al. (2013) indicated that '*Our study identified associations between demographic backgrounds and usage of online databases…Faculty tended to select online databases as their information resource among physicians, nurses, pharmacists and other allied professionals*' (p. 906). In a study on newly qualified nurses in Norway, Nordsteien and Bystrom (2018) found information skill differences between newcomers and experienced practitioners, and '*the newcomers describe the workplace culture as characterised by continuous and mutual information sharing between newcomers and experienced colleagues*' (p.837).

Models of information seeking of professionals

Among impactful models of information seeking (e.g., Kuhlthau, 2004; Wilson, 1996; Ellis, 1993, 1997), a number of studies focused specifically on modelling the information behaviour of working professionals (e.g., Bystrom & Jarvelin, 1995; Leckie, et al., 1996). In 1995, noting that working professionals' information seeking is initiated and driven by the need to carry out and complete their work tasks, Bystrom and Jarvelin (1995) developed an information-seeking model that incorporates both situational factors (e.g. availability of time) and organisational factors. The model claims that when working professionals are challenged with various tasks in their contexts, they frequently experience a lack of knowledge and thus their information needs increase. A complex task may require multiple rounds of information seeking processes. In addition to the multiple factors impacting working professionals' information seeking, actions taken by working professionals could also be affected by the accessibility of information channels and sources as well as their personal information seeking style.

Meanwhile, Leckie et al. (1996) found that highly specialised professionals often assumed work roles requiring complex and varied tasks that created different information needs and ways of seeking. Once the information seeking process starts, other factors become important for the final success or failure of the result, including all possible information sources available and whether the working professional had some knowledge of those sources. The outcome of the information seeking process is either moving forward with the work tasks or further information seeking. Leckie et al.'s (1996) model outlines the steps that a working professional goes through to seek information. Note that the model does not include the obstacles that professionals would encounter in this process.

Overall, both models by Leckie et al. (1996) and Bystrom and Jarvelin (1995) focus on information seeking behaviour of professionals seeking information for their work tasks. Both models articulate factors that could shape the professional's information needs. Nevertheless, the factors that the two models focus on are different. The model by Leckie et al. (1996) includes individuals' demographic information such as age and specialisation as factors impacting the information needs. During the information seeking process, Leckie et al. (1996) note other factors such as the importance of the *awareness of information* and *source of information*. In comparison, Bystrom and Jarvelin (1995) zoom in to situational factors, organisational factors, as well as personal factors (e.g. attitude and mood) that could shape a working professional's information needs and actions that they take to satisfy the information needs.

Public health professionals' information use

Existing research has explored the information use patterns of public health professionals in different academic or practice-based settings. Most of this work has focused on one setting, rather than comparing across various work settings. For instance, in studying the information seeking behaviour of academic faculty in a school of public health, Wallis (2006) reported that faculty conducted web searches on a daily basis (56.8%), and they also frequently searched article databases (17.8%). Nevertheless, most faculty did not use the library's services. Faculty ranked article databases as the most useful resource, followed by journal subscriptions and Web search engines. Interestingly, Wallis also found that 'Librarians and online catalogs at non-UIC libraries

were rated among the least useful resources' (p. 444). With regard to barriers to their information seeking tasks, the most commonly encountered difficulty (n = 37, 82.2%) was 'a lack of knowledge about what resources were available to them' (p. 444). Another common barrier was the lack of time, with many respondents (n = 35, 77.8%) indicating the lack of time for searching or for learning to use an information resource. The infrequent use of libraries was also observed in a study by Lee et al. (2003). In their study of 775 Tennessee public health workers, Lee et al. (2003) concluded that there is an *information crisis* in public health: 'Few resources or categories of information exceeded 50% of respondents' frequency of use or need' (p. 333). The data showed that 'More than 58% (58.4%) of urban and 70.9% of rural respondents never or seldom use libraries to find information' (p. 331). In addition to the underuse of libraries, Lee et al. (2003) revealed that, for public health practitioners, there was also an underutilization of e-resources or Medline with 'only 18.7% of urban and 19% of rural respondents needing or using medical information either daily or weekly… Only 4.3% of urban and less than 3% of rural region respondents reported daily or weekly use. Over 60% of urban and rural respondents never use or need MEDLINE' (p. 332).

Obstacles for healthcare professionals

Previous studies reported a range of obstacles that working professionals face, which include technical difficulties (Alpi, 2005; Rutland and Smith, 2010), lack of computer skills (Ford and Korjonen, 2012), lack of support (Andualem et al., 2013; Barr-Walker, J., 2017), lack of information literacy skills (Kumaran and Chipanshi, 2015), and information overload (LaPelle et al., 2006; Kumaran and Chipanshi, 2015). Ford and Korjonen (2012) note that health professionals have limited time to learn to use electronic resources, leading to gaps in their search skills. Limited resources or barriers to accessing computers and the internet contributed to the overall lack of use of electronic health resources in rural communities and less developed countries. Alpi (2005) indicated that restrictions such as firewalls or location specific log-ins might also limit access to electronic databases.

The second obstacle is related to the workplace environment. Both Alpi (2005) and Kostagiolas et al. (2014) reported that many healthcare workers experienced a lack of institutional support due to limited budgets that excluded database subscriptions in their collection. Meanwhile, Andualem et al. (2013) found that only 33% of their respondents were computer literate and 54% lacked access to health electronic resources. Geographical, organisational, economic, and educational status were the main barriers to accessing digital information. Furthermore, lack of organisational support, poor infrastructure, and a deficit in internet access, library services, and in-house service training were seen as major problems by all participants. As discovered by Naeem and Bhatti (2016), 'primary care physicians encounter multiple barriers that obstruct their health-related information seeking behaviour system, which compromises patient care' (p. 1014).

Through interviewing employees from the Massachusetts Department of Public Health, LaPelle et al. (2006) found participants needed breaking news about urgent-care diseases or information about health promotion related to chronic disease, and they faced similar barriers accessing e-resources as reported in other studies. The overwhelming volume of electronic resources leads to information overload, which makes public health professionals unable to access databases regularly. Furthermore, LaPelle et al. (2006) found that it was difficult for users to keep track of publications already found for future use. The lack of skills or tools to archive found information was a major problem for information use. Information overload and unwieldy websites were also found to be a major challenge in Weng et al.'s study. Weng et al. (2013) revealed that nurses in Taiwan more often accessed Chinese online resources than English databases, suggesting that language was an obstacle. The collective findings on the frequently encountered obstacles by public health professionals, nurse practitioners, and physicians are listed in Table 2 below.

Although there is extensive coverage on public health professionals' information behaviour, the impact of their work setting and demographic attributes, the types of obstacles that they

experience in using electronic resources, and information behaviour models of working professionals, there is a gap in the empirical investigation into the connection between demographic attributes and work settings with public health professionals' confidence level in their information skills, satisfaction with institutional support, and the particular types of obstacles they encounter. The present study addresses such a gap through a two-phased investigation, with the focus on the obstacles that public health professionals experience during their work-task information seeking process.

Author (Year)	Method	Setting	Obstacles
Ford & Korjonen (2012)	Literature review	Public health	Lack of access to the internet; Lack of computer skills
Alpi (2005)	Literature review	Public health	Restrictions in web browsers' firewalls on sites limit access to resources
Andualem et al. (2013)	Questionnaire	Public health	Lack of organisational support and infrastructure; Lack of access to the internet; Lack of library services
LaPelle et al. (2006)	Interviews	Public health	Information overload in electronic resources
Barr-Walker J. (2017)	Literature review	Public health	Lack of institutional support; Lack of time
Rutland and Smith (2010)	Interviews	Public health	Lack of IT equipment and training; Lack of time; Lack of funding; Lack of communication from higher level
Intas et al. (2013)	Literature review	Nursing	Lack of information literacy skills
Gilmour et al. (2014)	Questionnaire	Nursing	Lack of time; Lack of access to electronic resources
Marshall et al. (2011)	Case study	Nursing	Lack of time
Kumaran and Chipanshi (2015)	Questionnaire and interviews	Nursing	*Phase 1*:Lack of time; Lack of information skill; Lack of knowledge *Phase 2*: Lack of time; Information overload
Davies (2011)	Questionnaire	Physicians	Lack of time; Too much information; Lack of access to electronic resources
Kostagiolas et al. (2014, 2016)	Questionnaire	Physicians	Financial problems; Unfamiliar with methods of information seeking;Unfamiliar with the use of computer; Lack of trust in digital information; Overload of medical/health information
Naeem & Bhatti (2016)	Questionnaire	Physicians	No onsite library; No health science librarian; Lack of health information resources; Inaccessibility of health information systems; Lack of technological infrastructure

Table 2. Summary of publications on obstacles that public health professionals experience.

Methods

In this study, we employed a multi-phased mixed methods design, featuring Phase I interviews with public health professionals in academic and practical settings, followed by a Phase II online survey of working public health professionals across the country.

Research questions and hypotheses

The research questions (RQs) for the study are:

> RQ1. To what extent do participants of different demographic attributes, educational backgrounds, and work settings differ in their confidence rating of their information skills?
>
> RQ2. To what extent do participants of different demographic attributes, educational backgrounds, and work settings differ in their satisfaction rating with institutional support in providing information services?
>
> RQ3. What obstacles do public health professionals face when they search for work-related information, and what are the sources of these obstacles? Do demographic attributes, educational backgrounds, and work settings have an impact on the sources for these obstacles?

Tied with the quantitative-based RQs, there are three research hypotheses:

> H1. There are statistically significant demographic differences among participants with varying educational backgrounds and work settings in their confidence with their information skills.
>
> H2. There are statistically significant differences in participants' satisfaction with their institutional support for information service provision among participants with varying educational backgrounds, and work settings.
>
> H3. There is a significant impact of demographic attributes on the causes behind the obstacles that public health professionals experience.

Research variables

The independent variables of the study included demographic attributes like age groups, highest academic degree attained, and work setting. The dependent variables were: confidence with information searching skills, satisfaction with institutional support in information services, and obstacles that occur during the searching process and the causes behind the obstacles. For confidence-related measures, participants were asked to rate their proficiency levels on six different types of information skills on a seven-point scale, from '1-not proficient at all' to '7-very proficient'. In terms of satisfaction, a seven-point scale ranging from '1-strongly disagree' to '7-strongly agree' was used for participants to express their agreement levels with several satisfaction-related statements. Table 3 outlines the details of the variables used in this study.

Independent Variables	Dependent Variables and Corresponding Example Survey Statements
Age group, Educational background, Work setting	**1- Confidence with information searching skills** - I know when to use Google or a website and when to use specialised sources (databases, digital repositories, etc.). - I confidently select the right health information from relevant sources and convey it to the public. **2-Satisfaction with institutional support in providing information services** - My institution provided financial support to access authoritative resources that impose subscription fees as well as to recent references in public health areas. - Information services that are provided by my institution always meet my information needs. **3- Causes behind obstacles occurring during information searching** - Information overload. - Lack of information literacy skills. - Lack of institutional support to access information resources and implement information systems. - Lack of time to properly assess retrieved information items.

Table 3. Research variables.

Research design

In this study, a two-phased mixed methods design was employed involving Phase I in-person interviews and a Phase II online survey. Phase I was qualitative and exploratory investigation into participants' thoughts regarding the day-to-day obstacles they encounter in accessing information. Interviewees were first asked about the types of information needs that typically prompted them to seek information. Then they reported any information literacy training that they received at their workplace. After discussing the obstacles in their information seeking process, causes behind them, and recommended solutions, participants were asked to describe a scenario where they encountered an obstacle in their information seeking process. Twelve interview sessions were conducted generating 281 minutes of interview recording.

Analysis of the Phase I data helped the researchers finalise the Phase II questionnaire. An online questionnaire was distributed to public health professionals in the United States. The questionnaire asked respondents to provide demographic information, searching behaviour in using electronic resources, their satisfaction with information resources provided by their institution, their confidence in their information searching skills, and their view of the obstacles they face in seeking information and their perception of the causes for these obstacles. More than 500 public health professionals working in practical and academic settings responded to the survey from September to October 2017.

Recruitment and sample procedure

The study population was public health professionals working in the United States in different work settings. Phase I involved a convenience sampling method where participants were invited through email or phone contacts. Participants from academic settings were affiliated with included public health schools in Boston, such as Harvard's T.H. Chan School of Public Health. Participants working in a practice-based setting came from the Brookline Department of Public Health, the Greater Boston Food Bank, and more.

A cluster random sampling method was used where the questionnaire was distributed based on geographic division within the U.S. Fifty-two American Public Health Association (APHA) affiliates were contacted, and these represented 50 states plus Puerto Rico and the District of Columbia. These were grouped into ten regions across the country (https://apha.org/APHA-

Communities/Affiliates/State-and-Regional-Public-Health-Associations). Recruitment emails were sent to the presidents of each APHA affiliate and the chairs of the 31 main interest sections of APHA to invite their members to participate. Presidents of other associations such as the Association of Public Health Nurses were also contacted to ask their members to participate. Responses were from 579 public health professionals, representing 46 states and two districts (District of Columbia and Puerto Rico) across the USA. The four states that were not represented included Montana, Rhode Island, West Virginia, and Wyoming. The top five represented states were New York (n = 48, 8.29%), Georgia (n = 46, 7.94%), Missouri (n = 37, 6.39%), Florida (n = 33, 5.70%), and California (n = 30, 5.18%). There were also 13 respondents who responded to the survey from out of state. Judging from the respondents' locations, we believe that our study sample is robust and representative of public health professionals in the U.S.

Data collection and data analysis

Phase I interviews were conducted from May 22 through June 21, 2017, with sessions lasting 20-45 minutes. Interviews took place in participants' workplaces and were audio recorded. Phase II data collection was conducted from September 5 through October 4, 2017. The highest number of responses was 579, while the average number of responses per question was 540. With the exception of the last open-ended question receiving 126 responses, all questions had more than 500 responses.

Phase I data analysis focused on responses regarding obstacles and causes for obstacles, which helped develop and update the Phase II questionnaire. Statistical analysis for Phase II data included descriptive and non-parametric statistics. Respondents' work settings were grouped based on their indication of the percentage of time they spent in academic and practice-based settings.

Results

Participants

Six participants in Phase I worked in an academic setting, and six in higher education. For Phase II participants, there was a good variety of people working in different settings, in various age groups, and with a variety of degrees and work experiences. The areas of specialisation were reported by 571 participants with 87 different categories. Among them, public health education (n = 44; 8%), epidemiology (n = 43; 8%), maternal and children's health (n = 41, 7%), and nutrition/food (n = 36, 6%) were most frequently reported. Table 4 contains the demographic background breakdown of Phase II participants.

Phase II Participants	Counts (Proportion)
Work Setting (n = 546)	
Academic	247 (43%)
Practice	252 (44%)
Both	71 (12%)
Age Group (n = 576)	
30 years old or younger	182 (32%)
31-40	178 (31%)
41-50	69 (12%)
51 years old or older	147 (26%)
Educational Background (n = 578)	
Bachelor's degree	98 (17%)
Master's degree	298 (52%)
Ph.D.	107 (19%)
M.D. (Medical Doctor)	31 (5%)
Other degrees (e.g., Ed.D., Dr. PH, DPM, LPN, Doctor of Health Science (DHsc), PharmD, MPH)	44 (8%)
Work Experience (n = 578)	
5 years or less	195 (34%)
6-10	101 (17%)
11-15	79 (14%)
16 or above	203 (35%)
Top Areas of Specializations (n = 571)	
Health/Public Health education	44 (8%)
Epidemiology	43 (8%)
Maternal and Children's Health	41 (7%)
Nutrition/Food	36 (6%)
HIV	31 (5%)
Community health	29 (5%)

Table 4. Breakdown of Phase II participants by demographics.

Phase I results

Information seeking obstacles

Different types of obstacles were identified by Phase I participants when they accessed and searched for information. The most common obstacle was the lack of access to the right resources and full-text. As stated by PI_P08, 'I don't have access to journals. I need to go to like PubMed, but they can only really read, you know, abstracts on that'. The lack of access to databases in the field of public health was mentioned by PI_P09, 'I can only access the abstracts because I'm not a member of the journal or not paying for the article'. Out of date information presented another challenge to participants. Three interviewees mentioned encountering problems with finding the literature that was out of date. Two interviewees pointed out that there were no tools or sources they could use to find, collect, and share up-to-date information items.

Participants also mentioned other obstacles they experienced related to technology, such as a lack of computer skills. As stated by PI_P01, 'I'm not computer literate. So that's the barrier'. PI_P11 also commented, 'overall gaps in information skills...how I search for information?' In addition, there were concerns about the credibility of the available information, lack of tools to assess the quality of information, and lack of time to drill down through the general information to get to what they need. As indicated by PI_P11, 'when it's going to be something we really need to find, go deep into I won't have the time to do it. Having the time is a big thing'.

Participants also discussed a variety of possible causes behind the obstacles in accessing and finding work-related information. Three participants indicated that the lack of institutional support for accessing information resources was the main cause for their obstacles. Two participants suggested that the causes were related to institutional financial issues. Information overload and unintuitive search interfaces were also identified as a reason for obstacles. As commented by PI_P03, 'I would say lack of proper tools to facilitate, lack of institutional support to implement the systems, and lack of time to properly measure, retrieve and look up information'.

Gaps in information skills

Five interviewees indicated that they received one-time training on searching and managing information, often years ago. More than half did not receive any training on access, search, and use of electronic resources. Participants specifically indicated that they were unsure whether they used correct terms for their search and would like to improve their search strategies. Responses also pointed out a variety of gaps: (1) lack of awareness of recent applications and databases in the field of public health, (2) lack of information management skills, and (3) lack of proficiency in effectively searching electronic resources. Additionally, gaps were mentioned specific to using social media tools to conveniently access, share, and record timely information items.

Overcoming obstacles and bridging the gaps

Phase I interviewees suggested different solutions to overcoming the obstacles. These solutions included: (1) increasing financial support from institutions, (2) providing one-on-one tutoring and creating more online tutorials, (3) increasing institution-wide awareness of what is up-to-date, and (4) providing tools that are useful for public health professionals. Additionally, institutions could prioritise subscribing to more resources in public health. Institutions may implement a system to collect and share data, and provide more training about specific tools in public health. Providing a web-based source that regularly recommends the top three sources for a specialised topic was also mentioned. As stated by PI_P08, 'We need a subscription … A food bank subscription so anybody here can access journals'.

Differences in work settings

Notable differences were observed based on comments from Phase I participants working in academic versus practice-based settings. These differences were in areas of information searching skills, institutional support, and reasons for obstacles that exist in their work environment. While three participants working in a practice-based setting indicated the need to improve their information skills, only one participant working in academia spoke of such a need. Three participants from academia stated that they received training from work, whereas two in practice-based settings received training. When commenting on the provision of the training, PI_P08 said: "No, not all. They expect us to know how to do that."

The differences between work settings were also reflected through participants' ratings of their satisfaction with the information services provided. A majority of participants (4 out 6) working in a practice-based setting were more satisfied with their online services than those working in an academic setting. Differences were also observed when discussing the causes behind obstacles participants experienced during their information seeking. While half of the participants in academic settings indicated that the primary reason for their obstacles was the lack of institutional support for accessing information resources, only one who worked in a practice-based setting mentioned that as the reason for their obstacles. Additionally, while a minority of the participants (2 out of 6) working in academic settings believed that institutional financial problems were the reason for obstacles in accessing e-resources, only one participant working in a practice-based setting discussed institutional financial problems.

Moreover, the lack of information searching skills was mentioned by half of the participants working in practice-based settings as main reasons for the obstacles, while only one participant

from academia mentioned it. Half of the participants in practice-based settings indicated that information overload, lack of proper tools to facilitate information searching, and systems not being user focused were the causes for the obstacles they encountered; none in academic settings discussed these obstacles. Two practice-based participants indicated lack of time as being a major obstacle, as opposed to none in academia. Overall, Phase I data identified specific obstacles and their causes, as well as the differences between work settings. As such, Phase I findings were useful for Phase II survey questions.

Phase II results

Information needs of public health professionals

Close to 60% (n = 346, 59.83%) of the survey respondents indicated that they had not received any training on information searching from their workplace, whereas 231 (40%) stated that they received such training. When answering the question of 'what are the primary information needs that prompt you to search in the electronic resources?', 88% of respondents (n = 505) selected the 'research/ literature search' option. The second most commonly selected option was 'keeping current and updated in the field' (n = 470, 81%). In terms of *other* types of needs, participants mentioned 'seeking government regulations'. 'seeking evidence-based public health practices', 'epidemiological data that predicts public health needs', 'public health nutrition', and 'health policy and global health issues'. Table 5 below includes the proportions of each type of information need.

Types of Information Needs	Frequency	Proportion
Research/literature search	505	87.52%
Keeping current and updated in my field	470	81.46%
The latest investigation on a specific topic	362	62.74%
Information related to a specific virus/problem/disease	322	55.81%
New therapy or product information	130	22.53%
Drug information	116	20.10%
Other (please specify)	47	8.15%

Table 5. Information needs that prompted the searching of E-resources (n = 577).

Using e-resources as the starting point.

Respondents (n = 579) provided their answer to the question of the frequency of using e-resources as a starting place to locate information (see Table 4). A majority identified Google as their starting point for daily searches. For weekly usage, about half of the participants used public health websites such as the World Health Organization (WHO) or Centers for Disease Control and Prevention (CDC). For monthly usage, the most common response was the electronic journals. For a yearly use, 'Digital libraries (e.g., National Library of Medicine)' was selected by the highest proportion of the respondents. In terms of the e-resources that were never used, 39% of the participants had never used portals. Other starting places (n = 23) included electronic newsletters, Wikipedia, military databases, blogs and company libraries, or state and federal sites that publish data (e.g., Census).

Resources	Daily	Weekly	Monthly	Yearly	Never	NA
Google (*n* = 549)	**412 (75%)**	95 (17%)	31 (6%)			
Google Scholar (*n* = 555)	95 (17%)	171 (31%)	144 (26%)	41 (7%)	85 (15%)	
Public health websites (*n* = 576)	73 (13%)	**265 (46%)**	200 (35%)	28 (5%)		
Digital libraries (*n* = 566)	56 (19%)	142 (25%)	149 (26%)	**101 (18%)**	97(17%)	21 (4%)
Portals (*n* = 557)	22 (4%)	64 (11%)	117 (21%)	72 (13%)	**215 (39%)**	67 (12%)
Electronic databases (*n* = 568)	53 (9%)	156 (27%)	162 (29%)	94 (17%)	79 (14%)	
E-journals(*n* = 573)	57 (10%)	185 (32%)	**220 (38%)**	72 (13%)	29 (5%)	

Table 6. E-resources as a starting point for participants (n = 579).

The use of bibliographic databases.

In listing databases used to search work-related information, the databases listed by 577 participants included Medline (n = 452, 79%), Cochrane Library (n = 298, 52%), CINAHL (n = 169, 30%), SCOPUS (n = 152, 27%), Global Health (n = 104, 18%), and Embase (n = 79, 14%). Medline was the most frequently identified database.

Trusted sources. Respondents rated how much they trusted various information sources on a seven-point scale. The top three most trusted sources were: electronic journal, health databases, and academics in the field. Thirty-one participants listed 'other trusted sources', which included government sources such as information from the Centers for Disease Control and Prevention (CDC) or other national health agencies and organisations, while others mentioned health statistics web sources, membership organisations, Wikipedia, Listserv newsletters, portals, and e-books. Table 7 provides information on trusted sources.

Types of information searching skills	M	SD	*mdn*	rank	*n*
Electronic journals	6.00	1.260	6.00	1	562
Health databases	5.91	1.185	6.00	2	558
Academics in your field	5.81	1.231	6.00	3	565
Colleagues at work	5.21	2.840	5.00	4	564
Health web sources (Websites)	4.34	1.466	4.00	5	562
Other sources	2.14	4.079	2.00	6	567

Table 7. Participants' ratings for the most trusted information sources

Note. *n* = number of participants. M = mean. SD = standard deviation. *mdn* = median.

Confidence and satisfaction

The survey participants rated their levels of confidence in their information searching skills, as well as their satisfaction with their institutions' support for their information needs. There were multiple statements concerning confidence and satisfaction that participants were asked to rate. The internal reliability for both measures was very strong: the confidence subscale consisted of five items and the value for Cronbach's Alpha was α = .909, whereas the satisfaction scale also consisted of five items and the value for Cronbach's Alpha was α = .924. Out of 567 participants who rated their confidence levels on a seven-point scale, half (*n* = 289, 50%) indicated a high confidence in using Google or specialised sources. Less than half of the participants found their confidence to be very high when integrating and synthesising information from various sources (*n* = 205; 36%), using health databases (*n* = 201; 35%), assessing the quality of information (*n* = 203; 35%), or selecting the right health information from sources and conveying it to the public (*n* = 187; 33%).

Among 560 participants who rated their satisfaction with their institutional support, 185 (34%) were very satisfied with their institution's financial support to access authoritative sources and

publications in public health areas. Participants (n = 79; 14%) were very satisfied with the provision of information management systems within their institutions. Seventy-eight (14%) respondents were very satisfied with online tutorials on digital resources and search strategies. Note that the average satisfaction ratings were lower than the confidence ratings (all above 5.5), with all items averaged below 5. The lowest average was 3.79, which rated their agreement with the statement 'My institution regularly evaluates its information services to assure that the services reflect the users' requests'. Table 8 provides the ratings of confidence and satisfaction.

Confidence (in Information Searching Skills)	**Number of Respondents, Average and Standard Deviation of Agreement Rating**
I know when to use Google or websites and when to use specialised sources (databases, digital repositories, etc.)	N = 567, M = 6.17, SD = 1.095
I can integrate and synthesize information from various sources to create new knowledge for the public.	N = 563, M = 5.82, SD = 1.270
I can assess the quality of information reasonably well (I can distinguish between credible and non-credible sources).	N = 566, M = 5.97, SD = 1.079
I am comfortable using databases that are created for the public health field.	N = 567, M = 5.80, SD = 1.255
I am confident I can select the right health information from sources and convey it to the public.	N = 563, M = 5.87, SD = 1.133
Satisfaction (with Institutional Support)	**Number of Respondents, Average and Standard Deviation of Agreement Rating**
My institution provided financial support to access authoritative resources that impose subscription fees as well as to recent references in public health areas.	N = 560, M = 4.70, SD = 2.237
Training and online tutorials on using resources and conducting an efficient search are provided in my institution.	N = 555, M = 3.91, SD = 2.070
My institution implemented appropriate information management systems to ease information accessibility for future use.	N = 553, M = 4.12, SD = 1.998
My institution regularly evaluates its information services to assure that the services reflect the users' requests.	N = 555, M = 3.79, SD = 1.969
Information services that are provided by my institution always meet my information needs.	N = 558, M = 4.13, SD = 1.932

Table 8. Participants' ratings for confidence with information searching skills and satisfaction with their institutional support.

Obstacles and their causes

More than half of the 528 participants who answered the question about their obstacles selected 'cost issues' (n = 268; 51%). Half selected 'limited access to electronic resources' (n = 266; 50%). Twelve participants indicated the lack of time as their obstacle whereas five frequently felt overwhelmed from overloaded information. Remaining obstacles included technology issues, organisational policies, lack of relevant publications, and difficulty in evaluating online resources. Figure 1 illustrates various obstacles listed by participants.

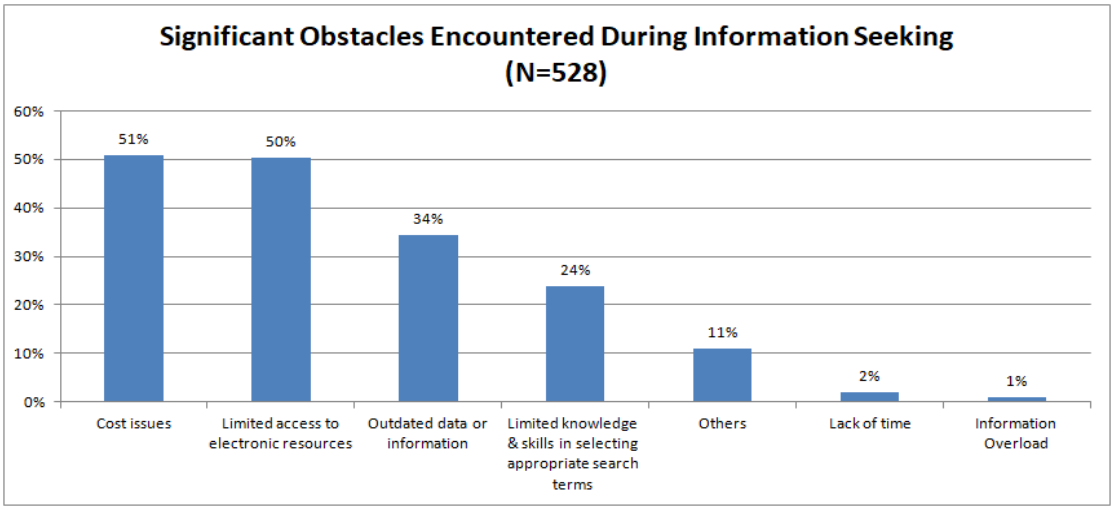

Figure 1. Obstacles encountered during information seeking.

The most common cause for obstacles identified by 530 respondents was institutional financial issues (n = 223; 42%), followed by information overload (n = 212; 40%), and lack of institutional support (n = 197; 37%). Additionally, 25 participants (5%) listed their own lack of computer or technology skills as a reason for obstacles. Figure 2 displays the list of causes identified by survey respondents.

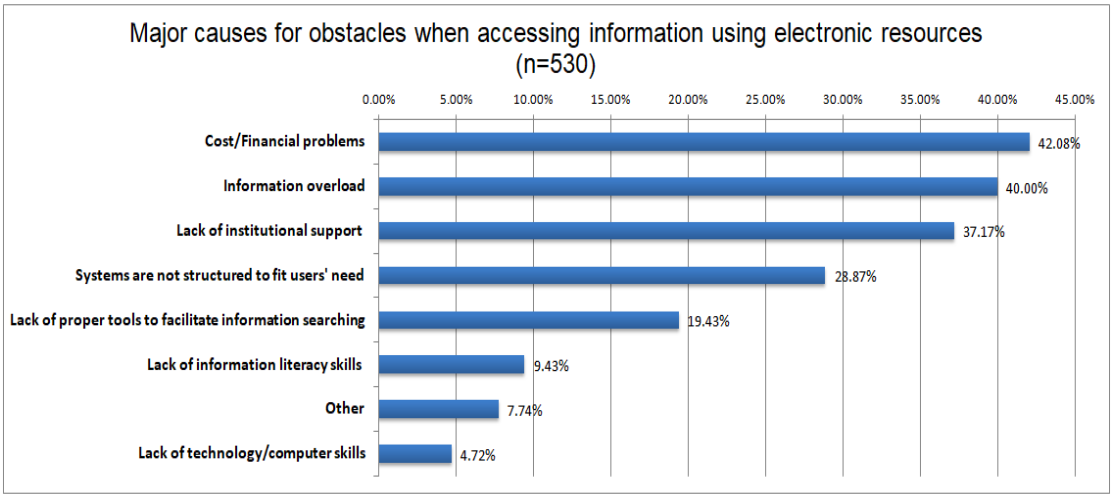

Figure 2. Causes behind the obstacles.

Demographic attributes and causes for obstacles.

Significant differences were found between age groups, educational backgrounds, work settings and the causes for obstacles selected by respondents. Specifically, significant differences were found among various age groups in identifying the lack of technology skills as a reason for obstacles ($\chi^2(3, n = 527) = 16.38$, $p = .001$, $d = .18$). In addition, significant differences were found among participants with different levels of education in identifying the lack of technology skills ($\chi^2(4, n = 529) = 32.18$, $p = .000$, $d = .25$), as well as the selection of the lack of proper tools to facilitate searching ($\chi^2 (4, n = 529) = 11.43$, $p = .022$, $d = .17$) as causes for obstacles.

The work setting was a strong indicator for the differences in the selection of causes for institutional obstacles. Significant differences were found among people in various work settings in their selection of the lack of technology ($\chi^2 (2, n = 524) = 7.54$, $p = .023$, $d = .12$), lack of proper

tools to facilitate searching (χ^2 (2, n = 524) = 6.04, p = .049, d = .11), lack of institutional support to access electronic resources (χ^2 (4, n = 524) = 17.83, p = .001, d = .18), and institutional financial problems (χ^2 (2, n = 524) = 36.27, p = .000, d = .26). In most cases, participants working in an academic setting had the lowest percentage selecting various causes for obstacles. Specifically, a significantly higher proportion of participants who worked in both academic and practice settings (10.1%) selected the lack of technology as a cause for obstacles than participants working in a practice-based setting (5.5%) and participants working in an academic setting (2.3%). A significantly higher proportion of participants in both settings (24.4%) selected a lack of proper tools to facilitate searching as a cause for obstacles than participants working in a practice-based setting (18.8%) or participants working in an academic setting (15.2%). A significantly higher proportion of participants in the practice setting (43.7%) selected a lack of institutional support to access electronic resources as a cause than participants working in both settings (36.8%) or participants working in the academic setting (28.6%). A significantly higher proportion of participants in the practice setting (53.4%) than participants in both settings (52.2%) or participants in the academic setting (26.7%) selected institutional financial constraints as the cause for their information seeking obstacles.

Impact of demographics, education, and work settings on confidence and satisfaction

Confidence ratings with educational background and work settings.

Kruskal Wallis H tests revealed significant differences among people with different education backgrounds in their confidence with their information searching skills in terms of: awareness of when to use Google or use databases (h = 10.12, df = 4, p = .038, d = .02); ability to integrate and synthesise information (h = 29.26, df = 4, p = .000, d = .05); ability to assess the quality of information (h = 35.63, df = 4, p = .000, d = .06); comfort level in using health databases (h = 23.45, df = 4, p = .000, d = .04) and confidence to select the right information and convey it to the public (h = 32.05, df = 4, p = .000, d = .06). Post hoc tests showed significant differences among educational backgrounds on several statements. Table 9 includes significant pairwise differences among educational backgrounds.

Dependent Variable	Educational Backgrounds (Sample1-Sample2)
Awareness of when to use Google or use databases (n = 573)	Ph.D. > Bachelor (p = .034)
Ability to integrate and synthesise information (n = 569)	Ph.D.> Bachelor (p = .000) Ph.D. > Master's (p = .031) Master's > Bachelor (p = .003)
Ability to assess the quality of information (n = 572)	Ph.D. > Bachelor (p = .000) Ph.D. > Master's (p = .005) Other > Bachelor (p = .041) Master's > Bachelor (p = .002)
Comfort level in using health databases (n = 573)	Ph.D. > Bachelor (p = .000) Ph.D. > Master's (p = 008)
Confidence to select the right information and convey it to the public (n = 569)	Ph.D. > Bachelor (p = .000) Ph.D. > Master's (p = .004) Master's > Bachelor (p = .008)

Table 9. Significant differences in confidence among respondents' educational backgrounds.

Kruskal Wallis tests revealed significant differences in respondents' confidence with their information searching skills in terms of: Awareness of when to use Google and when to use specialised databases (h = 19.97, df = 2, p = .000, d = .04); ability to integrate and synthesise information (h = 21.49, df = 2, p = .000, d = .04); ability to assess the quality of information (h = 19.42, df = 2, p = .000, d = .03); comfort level in using health databases (h = 16.92, df = 2, p = .000, d = .03); and confidence to select the right information and convey it to the public (h = 12.55, df = 2, p = .002,

d = .02). Post hoc tests revealed significant differences in respondents' confidence with their information searching skills. In all areas, participants who worked in the academic setting gave significantly higher ratings than those who worked in other settings. Participants working in practice-based settings had the lowest mean ranks. Table 10 includes all the post hoc pairwise significant differences among work settings.

Dependent Variable	Work Settings (Sample1-Sample2)
Awareness of when to use Google or use databases (n = 567)	Academic > Practice based (p = .000) Practice based > Combined settings (p = .022)
Ability to integrate and synthesise information (n = 563)	Academic > Practice (p = .000) Combined > Practice (p = .042)
Ability to assess the quality of information (n = 566)	Academic > Practice (p = .000) Combined > Practice (p = .042)
Comfort level in using health databases (n = 567)	Academic > Practice (p = .000)
Confidence to select the right information and convey it to the public (n = 563)	Academic > Practice (p = .002)

Table 10. Significant differences in confidence among respondents' work settings.

Satisfaction ratings and demographics, education, and work settings

Statistically significant differences were found in respondents' satisfaction with their institutions' support for information services provision among participants of different age groups. Kruskal Wallis H tests revealed significant differences in respondents' satisfaction with their institutional support in terms of: supporting access to subscription resources (h = 8.818, df = 3, p = .032, d = .016) and providing information services that meet users' needs (h = 8.707, df = 3, p = .033, d = .015). Post hoc Dunn's tests revealed significant differences in respondents' satisfaction with their institutions' support for information services provision. Specifically, in terms of satisfaction with institutional support in providing access to subscription resources, there are significant differences in respondents' satisfaction between those 30 or younger and those 51 or older (p = .029).

Meanwhile, statistically significant differences were found in respondents' satisfaction with their institutions' support for information services provision among participants of different educational backgrounds. Kruskal Wallis H tests revealed that participants with Ph.D.s gave significantly higher ratings than participants with Master's or Bachelor degrees. Table 11 provides significant pairwise differences among participants with varying educational backgrounds.

Dependent Variable	Educational Backgrounds (Sample1-Sample2)
Institution provides access to subscription resources (n = 568)	Ph.D. > Bachelor (p = .001) Ph.D. > Master's (p = .000)
Institution implements information management systems (n = 561)	Ph.D. > Master's (p = .011)
Institution evaluates information services (n = 563)	Ph.D. > Master's (p = .001) Ph.D. > Bachelor (p = .048)
Institution provides information services that meet users' needs (n = 566)	Ph.D. > Master's (p = .007)

Table 11. Significant differences in satisfaction among respondents' educational backgrounds.

Statistically significant differences were found in respondents' satisfaction with their institutional support for information services provision among participants in different work settings. Kruskal Wallis H tests revealed significant differences in terms of: supporting access to subscription resources (h = 109.83, df = 1, p = .000, d = .20); providing online tutorials (h = 77.31, df = 1, p = .000, d = .14); implementing information management systems (h = 64.10, df = 1, p = .000, d = .18); evaluating

information services (h = 70.44, df = 1, p = .000, d = .13) and ensuring that information services meet users' needs (h = 69.13, df = 1, p = .000, d = .12). The post hoc test revealed that, in all cases, participants who worked in academic settings had higher average satisfaction scores with their institutional support in providing information services than those who worked in other settings. Table 12 presents significant pairwise differences in participants' satisfaction ratings.

Dependent Variable	Work Settings (Sample1-Sample2)
Institution supports access to subscription resources (n = 560)	Combined settings > Practice (p = .001) Academic > Practice (p = .000) Academic > Combined settings (p = .003)
Institution provides online tutorials (n = 555)	Combined settings > Practice (p = .001) Academic > Practice (p = .000)
Institution implements information management systems (n = 553)	Combined settings > Practice (p = .031) Academic > Practice (p = .000) Academic > Combined settings (p=.021)
Institution evaluates information services (n = 555)	Combined settings > Practice (p = .002) Academic > Practice (p = .000)
Institution provides information services that meet users' needs (n = 558)	Combined settings > Practice (p = .026) Practice – Academic (p = .000) Combined Settings – Academic (p = .014)

Table 12. Significant differences in satisfaction among respondents' work settings.

Discussion

Key findings and existing research

Our key quantitative findings revealed statistically significant differences in participants' confidence ratings, satisfaction ratings and causes behind the obstacles. The analysis of the obstacles identified by the participants produced meaningful discoveries. Participants also commented on the impact of work settings. For instance, PII_P03 pointed out 'it really does depend, like let's say I'm in an academic teaching hospital for instance where the push is to be more research focused, being in an academic teaching hospital is going to be very different'.

The findings are mostly consistent with previous research. The most common obstacle identified in this study was cost, which confirms the results by Rutland and Smith (2010). Limited access to electronic resources was also a major obstacle previously identified by Alpi (2005), Gilmour et al. (2014), and Davies (2011). The most common reasons for obstacles were institutional financial issues, which is consistent with Kostagiolas et al.'s (2014) results. Information overload can also be found in results of multiple studies (e.g., Davies, 2011; Kumaran and Chopanshi, 2015; LaPelle et al., 2006).

Revised Information Behaviour Model of working professionals

Our findings suggest there are a few sub-processes in the public health professional's information seeking journey that are missing or lack visibility from existing models. For instance, the sub-process of encountering various types of obstacles and being able to or failing to overcome the obstacles has not been explicitly reflected in relevant models for working professionals. With the focus on the information seeking path of working professionals, we grounded the development of our model based specifically on Leckie et al. 's (1996) model (see Figure 3), as it provides the fundamental and distinctive steps/routes of working professionals' information seeking process. In fact, we labelled our model 'Revised Information Seeking Model of Working Professionals'. Nevertheless, Leckie et al.'s (1996) graphic model does not explicitly provide an entity regarding the obstacles that working professionals encounter. The model does not include the element of work settings, either. Our study intentionally involved participants from different settings, and as

such, we added *work setting* to the original element of *work roles*. In our model *work setting & work roles* are integrated into one element. We also believe that as the final step, the outcome could be task completion or redefining tasks. By incorporating factors related to obstacles and reconfiguring the processes, we expanded the information behaviour model of professionals as shown below in Figure 4.

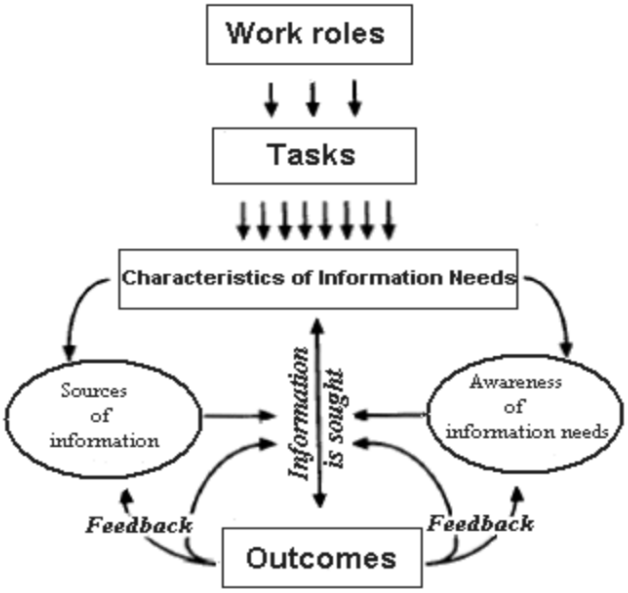

Figure 3. The Information Seeking of Professionals Model (Source: Leckie et al., 1996).

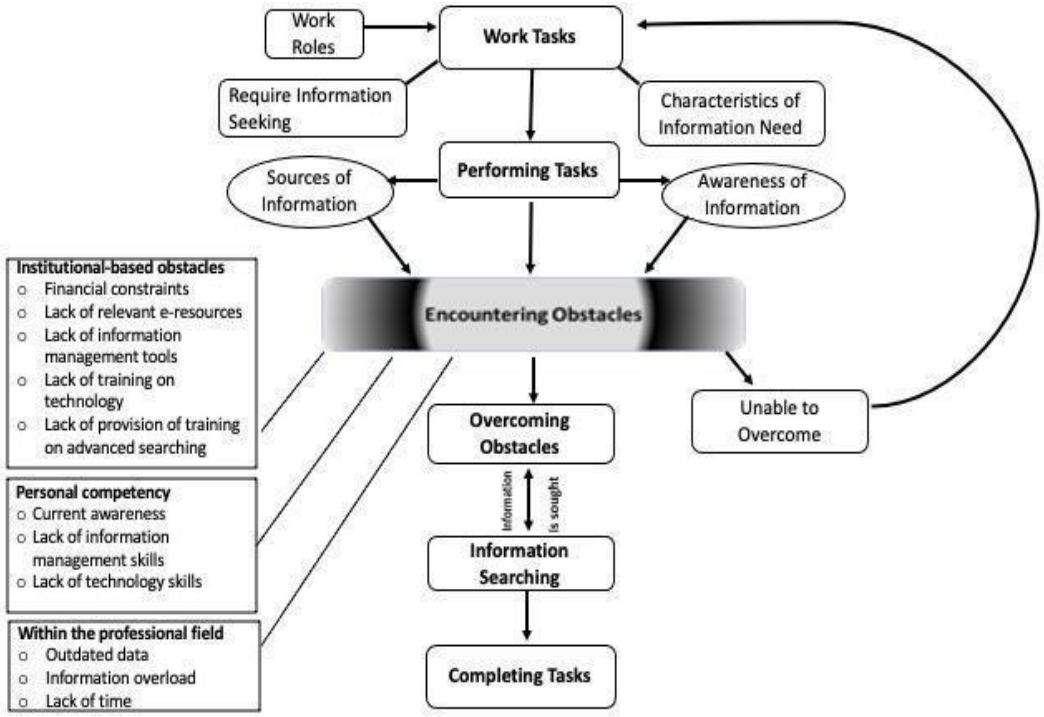

Figure 4. Revised information behaviour model of working professionals

In our model, the process of information seeking starts with *work tasks* emerging in different settings (i.e., academic or practice-based) which prompts users to seek information from the available resources. Work tasks vary depending on the professionals' roles, and they determine their information needs. As the working professionals start performing tasks, their performance is primarily dependent on their awareness of information and the sources of information available to them. They encounter various kinds of obstacles, listed in the three panels on the left of the 'encountering obstacles' step. These obstacles ranged from personal competencies to institutional issues, and even included issues within the broader professional field of practice. The institutional-based obstacles are all related to the capacity of an institution to support working professionals in their work tasks: lack of funds may limit access to relevant resources, information management tools, and training to improve searching skills. The obstacles related to institutional support, or lack thereof, also lead to the failure to develop personal competencies for working professionals. The obstacles pertaining to personal competencies include not having awareness of the advancement of the field, lack of technology skills and information management skills. The third set of obstacles originate from the professional field of practice where datasets are outdated, and there is an overabundance of information not yet being filtered, evaluated, and meaningfully selected. Moreover, a major obstacle that working public health professionals face is *lack of time*. Their workload tends to be overwhelmingly heavy, which frequently prevents them from having dedicated time to work on their information tasks; as such, their information seeking tends to be of short duration, and they often do not have sufficient time to complete the tasks at hand. This is the problem all practising professionals in the public health field experience: a constant battle for time between urgent health care matters and searching for information.

If professionals face a major obstacle that they are unable to overcome, the information searching process is either halted or requires further information searching or change of strategies to move forward with the task. Otherwise, if professionals are able to overcome obstacles, they move forward to the information searching stage, where they search through available sources and continue to other steps of the information seeking process including evaluating information from sources, selecting the most relevant information, organising the information found, and managing/archiving it for future use. The last stage of the process is to assess the status and the quality of information found. As the final outcome, if what they have found is sufficient, they reach the task completion step. If what they have found is insufficient, they redefine their tasks or go back to the original first step and start over.

Our model covers all essential steps that working professionals go through for work-related information seeking. It accentuates the obstacles people encounter in their information seeking process. By providing a detailed list of obstacles based on our data, and by including the steps of encountering and overcoming/failing to overcome obstacles in the information behaviour process, we made the model more realistic and comprehensive in capturing the information seeking experiences of working professionals. The model we present here is applicable to professionals of all fields. This model represents notable progress in the conceptualization of the information behaviour process for working professionals.

Research strengths and limitations

By using the mixed methods design, we achieved an empirical understanding of public health professionals' work task-based information behaviour at a level of depth and breadth that has never been achieved before. The qualitative interview study enabled us to obtain insights into the obstacles that public health professionals face in various settings. The robust sample size for the Phase II survey enabled us to examine the statistically significant differences among work settings and demographic attributes. Our Phase II participants had a rather even distributions of age, degree levels, work experiences, and areas of specialisation. Nevertheless, even though we collected information on areas of specialisation, we did not collect specific professional title

information, so we were unable to put participants into professional groups such as nurses, medical doctors, etc. Consequently, we were unable to compare various groups and see whether their responses differ in terms of obstacles, confidence, and more. The area of specialisation was so widely spread out with 87 different groups that we were also unable to compare different specialisations in our analysis.

Note that our study was conducted before the COVID-19 pandemic; consequently, it does not capture the shifts in working patterns and obstacles that public health professionals faced as they dealt with the global public health crisis. The COVID-19 pandemic underscored the tremendous challenges of uncertainty associated with lack of accurate information as well as the infodemic (e.g., The Lancet Infectious Diseases, 2020). Although the pandemic has subsided, the obstacles highlighted in our model remain relevant, and the urgency of accessing accurate and up-to-date public health data continues to be a priority for public health professionals. The pandemic intensified barriers such as 'lack of time', which is reflected in our model as a part of 'within the professional field', as professionals worked tirelessly to protect communities. Moving forward, further research is needed to explore how these obstacles evolve in routine public health practice and how new challenges may arise during future public health emergencies.

Conclusion

The present research provides insights about the information behaviour of public health professionals who work in academic and practice-based settings, especially with regard to the obstacles they face as they seek information for work-related tasks. Conceptually, our findings provided empirical evidence for the impact of textual factors such as demographic attributes, work settings, and educational background on public health professionals' information behaviour. Future research may expand the study population to include participants worldwide with great variation in work settings and demographic attributes. Additionally, conducting more in-depth examination into how obstacles hinder professionals' work-related information seeking would be fruitful.

Our model holds conceptual significance, as, for the first time, it brings obstacles into the forefront of the process. Our model not only acknowledges the existence and the role of obstacles, but also groups the obstacles into categories based on the sources/causes for these obstacles. We believe that this model advances the theories of information behaviour and is generalizable to all working professionals.

Furthermore, our study suggests that public health professionals need support with a wide array of information activities, including how to identify their work tasks (information needs), and how to look for information in the right place. They also need help processing, evaluating, synthesising, retrieving, and using the information for their own specific work tasks. As such, LIS professionals could support users in overcoming obstacles by facilitating access to reliable resources and up to date references, offering training and online tutorials on using and searching resources, and implementing appropriate information management systems to improve re-finding information for future use.

Nowadays in the wake of the COVID-19 pandemic, public health professionals continue to face evolving challenges that require them to be more self-sufficient and efficient when seeking information for their work tasks. Ongoing institutional support for accessing and sharing electronic resources remains crucial and critical for addressing both current public health priorities and future preparedness. LIS professionals play a vital role in supporting public health professionals by helping to navigate information obstacles, produce timely research, and enhance patient care. What we have discovered from this study continues to be valuable and applicable to today's public health landscape. It is essential to always providing ongoing support to the public

health workforce, equipping them with the resources and knowledge they need to address emerging health concerns and lead efforts to build resilient communities.

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References

Alpi, K.M. (2005). Expert searching in public health. *Journal of the Medical Library Association*, 93(1), 97. PMID: 15685281; PMCID: PMC545128.

Andualem, M., Kebede, G., & Kumie, A. (2013). Information needs and seeking behavior among health professionals working at public hospital and health centers in Bahir Dar, Ethiopia. *BMC Health Services Research*, 13(534). https://doi.org/10.1186/1472-6963-13-534

Academy of Nutrition and Dietetics Affiliates. (n.d.). *In Academy of Nutrition and Dietetics.* (http://www.eatrightpro.org/resource/membership/academy-groups/affiliates/state-affiliates#PR)

American Library Association. (1989). *Presidential Committee on Information Literacy Final Report*. Chicago. (www.ala.org/acrl/standards/informationliteracycompetency)

American Library Association. (2000). *Guidelines for Information Services, Approved by the RUSA Board of Directors.* Chicago. (http://www.ala.org/Template.cfm?Section=reference&template=/ContentManagement/ContentDisplay.cfm&ContentID=26884)

Association of College & Research Libraries Board. (2015). *Framework for Information Literacy for Higher Education.* Chicago. (http://www.ala.org/acrl/standards/ilframework)

Bystrom, K., & Jarvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing & Management.* 31(2), 191-213. https://doi.org/10.1016/0306-4573(95)80035-R

Barr-Walker, J. (2017). Evidence-based information needs of public health workers: a systematized review. *Journal of the Medical Library Association: JMLA*, 105(1), 69–79. https://doi.org/10.5195/jmla.2017.109

Bennett, N., Casebeer, L., Kristofco, R., & Strasser, S. (2004). Physicians' internet information-seeking behaviors. *Journal of Continuing Education in the Health Professions*, 24, 31-38. https://doi.org/10.1002/chp.1340240106

Case, D. (2012). *Looking for Information*. UK: Emerald Group Publishing Limited.

Creswell J. (2014). *Research Design, Qualitative, Quantitative and Mixed Methods Approaches.* Thousand Oaks, CA: SAGE Publications, Inc.

Davies, K. (2011). Information needs and barriers to accessing electronic information: Hospital-based physicians compared to primary care physicians. *Journal of Hospital Librarianship*, 11, 249-260. https://doi.org/10.1080/15323269.2011.587103

Ford, J., & Korjonen, H. (2012). Information needs of public health practitioners: a review of the literature. *Health Information & Libraries Journal*, 29(4), 260-273. https://doi.org/10.1111/hir.12001

Gesser-Edelsburg, A., Abed Elhadi Shahbari, N., Cohen, R., Mir Halavi, A., Hijazi, R., Paz-Yaakobovitch, G., & Birman, Y. (2019). Differences in Perceptions of Health Information Between the Public and Health Care Professionals: Nonprobability Sampling Questionnaire Survey. *Journal of medical Internet research*, 21(7), 1-11. https://doi.org/10.2196/14105

Gradinaru, C. (2013). Information searching behavior in the digital age. In Argumentum: *Journal of the Seminar of Discursive Logic, Argumentation Theory & Rhetoric*. 11(1), 90-101. https://doi.org/10.5860/crl-34r2

Groote, S., Shultz, M., & Blecic, D. (2014). Information-seeking behavior and the use of online resources: a snapshot of current health sciences faculty. *Journal of the Medical Library Association*, 102(3), 169-176. https:/doi.org/10.3163/1536-5050.102.3.006

Hertzum, M., & Simonsen, J. (2019). How is professionals' information seeking shaped by workplace procedures? A study of healthcare clinicians. *Information Processing & Management*, 56(3), 624-636. https:/doi.org/10.1016/j.ipm.2019.01.001

Ellis, D. (1993). Modeling the information seeking patterns of academic researchers: a grounded theory approach. *The Library Quarterly: Information, Community, Policy*, 63(4), 469-486. https://doi.org/10.1086/602622

Ellis, D. (1997). Modeling the information seeking patterns of Engineers and research scientists in an industrial environment. *Journal of Documentation*, 53(4), 384-400. https://doi.org/10.1108/EUM0000000007204

Johnson J.D. & Meischke, H. (1993). A comprehensive model of cancer-related information seeking applied to magazines. *Human Communication Research.* 19(3), 343-367. https://doi.org/10.1111/j.1468-2958.1993.tb00305.x

Kuhlthau, C. (2004). Seeking meaning: a process approach to library and information services. 2nd ed. Westport, CT: Libraries Unlimited.

Kostagiolas, P., Korfiatis, N., Kourouthanasis, P., & Alexias, G. (2014). Work-related factors influencing doctors' search behaviors and trust toward medical information resources. *International Journal of Information Management*, 34, 80-88. https://doi.org/10.1016/j.ijinfomgt.2013.11.009

Kostagiolas, P., Gorezis, P., Martzoukou, K., Deligeorgis, D., & Niakas, D. (2016). Linking physicians' medical practice information needs, resources and barriers to job satisfaction: A moderated mediation model. *Journal of Documentation*, 72(6), 1134-1153. https://doi.org/10.1108/JD-10-2015-0133

Kumaran, M., & Chipanshi, M. (2015). Exploring the information-seeking behavior of internationally educated nurses (IENs) in Saskatchewan. *Journal of the Canadian Health Libraries Association*, 36(2), 45-53. https://doi.org/10.5596/c15-013

Kosteniuk, J., Morgan, D., D'Arcy, C. (2013). Use and perceptions of information among family physicians: sources considered accessible, relevant, and reliable. *Journal of the Medical Library Association*, 101(1), 32. https://doi.org/10.3163/1536-5050.101.1.006

Leckie, G.J., Pettigrew, K.E., & Sylvain, C. (1996). Modeling the information seeking of professionals: A general model derived from research on engineers, health care professionals, and lawyers. *The Library Quarterly*, 161-193. https://doi.org/10.1086/602864

LaPelle, N.R., Luckmann, R., Simpson, E.H., & Martin, E.R. (2006). Identifying strategies to improve access to credible and relevant information for public health professionals: a qualitative study. *BMC Public Health*, 6(1), 1. https://doi.org/10.1186/1471-2458-6-89

Marshall, A., West, S., & Aitken, L. (2011). Preferred information sources for clinical decision making: Critical care nurses' perceptions of information accessibility and usefulness. *Worldviews on Evidence-Based Nursing*, 8(4), 224-235. https://doi.org/10.1111/j.1741-6787.2011.00221.x

Nordsteien, A., & Bystrom, K. (2018). Transitions in workplace information practices and culture. *Journals of Documentation*, 74(4), 827-843. https://doi.org/10.1108/JD-07-2017-0116

Nicholas, D., Huntington, P., Williams, P., & Dobrowolski, T. (2004). Re-appraising information seeking behavior in a digital environment: Bouncers, checkers, returnees and the like. *Journal of Documentation*, 60(1), 24-43. https://doi.org/10.1108/00220410410516635

Nicholl, H. (2010). Diaries as method of data collection in research. *Pediatric Nursing*, 22(6). https://doi.org/10.7748/paed2010.09.22.7.16.c7948

Naeem, S., & Bhatti, R. (2016). Barriers in seeking health information from primary healthcare facilities in Pakistan. *Information Development*, 32(4), 1014-1026. https://doi.org/10.1177/0266666915583919

Rutland, J.D., & Smith, A.M. (2010). Information needs of the 'frontline' public health workforce. *Public Health*, 124(11), 659-663. https://doi.org/10.1016/j.puhe.2010.06.002

State & Regional American Nursing Associations. (n.d.). *In American Nursing Associations*. (http://www.nursingworld.org/SNAS.aspx)

State & Regional Public Health Associations. (n.d.). *In American Public Health Association*. (https://www.apha.org/apha-communities/affiliates/state-and-regional-public-health-associations)

Shpilko, I. (2011). Assessing information-seeking patterns and needs of nutrition, food science and dietetics faculty. Library & Information Science Research, 33(2), 151-157 https://doi.org/10.1016/j.lisr.2010.07.018

Turner, A., Stavri, Z., Revere, D., & Altamore, R. (2008). From the ground up: information needs of nurses in a rural public health department in Oregon. *Journal of the Medical Library Association*, 96(4), 335-342. https://doi.org/10.3163/1536-5050.96.4.008

The Lancet Infectious Diseases (2020). The COVID-19 infodemic. *The Lancet. Infectious diseases*, 20(8), 875.

Weng, Y.H., Kuo, K.N., Yang, C.Y., Lo, H.L., Shih, Y.H., & Chiu, Y.W. (2013). Information-searching behaviors of main and allied health professionals: A nationwide survey in Taiwan. *Journal of Evaluation in Clinical Practice*, 19(5), 902-908. https://doi.org/10.1111/j.1365-2753.2012.01871.x

Wilson, T.D. (2000). Human information behavior. *Information Science Research*, 3(2), 49-56 https://doi.org/10.28945/576

Wilson, T.D. (1997). Information behavior: an interdisciplinary perspective. *Information Processing and Management*, 33(4), 551-572. https://doi.org/10.1016/S0306-4573(97)00028-9

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