



Zoonoses and social determinants of health: A consultation of Canadian experts

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ABSTRACT

This study aimed to identify priorities for transdisciplinary research on zoonotic diseases (ZDs) using a One Health perspective. In 2017, 69 Canadian experts from various disciplines participated in a three-round Delphi prioritization exercise. Round 1 started with three ZD-related research axes: the convergence between zoonoses and chronic diseases, social determinants of zoonoses, and health system effectiveness in zoonosis prevention and control. Each included a list of potential research questions, and respondents were invited to propose additional topics for each axis. The next two rounds reduced the number of topics. Three priority research questions were ultimately selected: 1) What is the evidence that zoonoses contribute to the burden of chronic disease? 2) What do we know about the populations most vulnerable to zoonoses? 3) What do we know about the effectiveness of zoonosis prevention and control strategies? The results provide a unique view of important research needs in three ZD-related areas.

1. Introduction

Zoonotic diseases (ZDs) are a growing cause of morbidity and mortality worldwide. Their emergence is linked to multiple factors, including climate change, which is associated with increased risk of transmission of several zoonoses due to the impact of rising temperatures and extreme precipitation events on vectors and animal reservoirs [1,2]. Other factors include changing land use patterns, intensive agricultural practices, human behavioral changes, globalization, and conflicts that provoke increased movement of people, animals, and goods [3,4].

Given the diversity of risk factors and the complexity of their epidemiology, preventing and controlling ZDs require a comprehensive approach that considers the close linkages between humans and animals and their shared environment. For nearly 20 years, One Health has built upon a systems approach and inspired research and action on zoonoses [5]. Yet, while One Health has generated much enthusiasm, researchers and practitioners have encountered multiple barriers to its implementation [6]. In fact, the research and intervention approaches for zoonoses remain oriented within the perspective of infectious disease

control and prevention, focusing on pathogen transmission between animals and humans, with little attention to the broader vision of health determinants [7–9]. However, when addressing ZDs, a One Health approach should also consider social determinants of health.

The past 30 years have seen a flourishing movement in public health and health promotion towards investigating and acting on the social determinants of health [10]. A major turning point was the work of the World Health Organization's Commission on Social Determinants of Health [11]. That Commission put forward an all-encompassing definition of the determinants of health that includes daily living conditions and the underlying structural drivers that shape them. That definition has been highly influential, inspiring debates and reflection on research and policies in public health. However, the One Health community has yet to fully embrace the social determinants discourse. Wider inclusion would provide new impetus for studying key social determinants of ZDs such as socio-economics or the built environment.

The present study was part of a broader initiative aimed at building a transdisciplinary research agenda on zoonoses based on a One Health vision. Its overall objective was to identify priorities for ZD research from a determinants-of-health perspective using a systematic process

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based on expert consultations. For this exercise, zoonoses were defined as “diseases or infections caused by viruses, bacteria, parasites, fungi and prions that are naturally transmitted between animals and humans” [12]. Chronic diseases were defined as long-term conditions that typically evolve slowly over time [13].

2. Materials and methods

In the autumn of 2017, we invited 69 Canadian researchers, health professionals, and decision-makers with expertise in the field of zoonoses to participate in a Delphi prioritization survey. We used purposive sampling to recruit participants. To compile a preliminary list of experts, we initially relied on professional networking and consulted organizational directories, then pursued a snowball approach with recruited participants. Participants were involved in relevant organizations in six of Canada’s 10 provinces: Quebec (39), Ontario (7), Saskatchewan (3), Alberta (3), British Columbia (2), and Prince Edward Island (2), as well as at the federal level (13). They came from universities and government agencies (federal, provincial, and local) in almost equal proportions. Their profiles varied, with a large majority active either in veterinary or human public health or, to a lesser extent, in environmental sciences. To ensure anonymity, participants were assigned an ID number.

Three rounds of consultation were conducted. In Round 1, the objective was to identify a comprehensive list of questions for consideration in relation to three research axes: the interface between zoonoses and chronic diseases; social determinants of zoonoses; and health system effectiveness in zoonosis prevention and control. Members of the research team had identified these three axes as key areas with significant knowledge gaps. Respondents were invited to propose topics for each axis. To guide the exercise and to stimulate their reflection, examples of potential research questions were provided (Table 1). The topics proposed by the respondents were then sorted and grouped thematically. We excluded 11, because they either strayed from the objective or were too restrictive.

In Round 2, participants were invited to rate the research questions

that had emerged from the first round by assigning each a score from 1 (to be eliminated) to 5 (essential). We retained the most favoured, i.e., those rated 4 or 5 by at least 60% of respondents. In Round 3, we presented the resulting set of research questions to the participants and invited them to select three priority questions, one per research axis. To inform their selections, the results of the previous rounds were included with the questionnaires in Rounds 2 and 3. We invited all 69 participants to respond in each round, regardless of whether they had participated in the previous round(s). For each round, participants were given 10 days to respond. The survey was available in French and English, and two reminders were sent for each round. The consultation process lasted two months, from October 24 to December 31, 2017. The Health Sciences Human Research Ethics Committee of the Université de Montréal approved the project (certificate #17-136-CERES-D). The datasets generated during the current study are available from the corresponding author upon request. Fig. 1 shows a schematic representation of the Delphi process.

3. Results

Response rates were 36% ($n = 25$), 46% ($n = 27$), and 36% ($n = 21$) for the three rounds of consultation, respectively. Respondents suggested 137 research topics or questions at Round 1. Table 2 presents the response distributions for each of the 15 research questions resulting from the analysis of all initial suggestions. For the chronic disease theme, respondents clearly expressed an interest in advancing knowledge on the relationship between zoonoses and chronic diseases. Particularly, understanding how zoonoses impact or modify the burden of chronic diseases was more important to respondents than topics related to mechanisms of pathogenicity or to public health interventions. Respondents also prioritized expanding knowledge on the social determinants of zoonoses and on vulnerable populations. With respect to the health systems theme, issues relating to surveillance effectiveness and to prevention and control strategies were identified as priority areas. Seven questions emerged as the most preferred at the

Table 1

List of potential research questions provided in round 1

Based on your expertise, can you complete the preliminary list of research questions to consider for a scoping review for axis 1- Interface between zoonoses and chronic diseases?
<ol style="list-style-type: none"> 1. How do chronic diseases contribute to increasing the impact of zoonoses on populations? 2. How do zoonoses contribute to increasing the impact of chronic diseases on populations? 3. Are links and associations between zoonoses and chronic diseases essentially the same worldwide, or are there specificities between populations? 4. What are the factors contributing to increasing the joint impact of zoonoses and chronic diseases? 5. In the current context of global changes (climatic, geographic, migrations, demographic explosion, agriculture), can we anticipate changes in the joint impact of zoonoses and chronic diseases?
axis 2- Zoonoses and social determinants?
<ol style="list-style-type: none"> 1. What are the most important social determinants of health in the emergence of zoonoses and in their care (or not) and what are the most important links/associations regarding these determinants? 2. What are the characteristics of vulnerable populations for zoonoses in the context of Québec and Canada? In the world? 3. Regarding the impact of zoonoses on populations, are there any differences between autochthonous populations and the general population? If yes, what are these differences and how to explain them? 4. Are there any common elements in the links and associations between social determinants of health and zoonoses when we consider major zoonotic diseases such as vector-borne diseases (VNO, Lyme, Zyka), water-borne and food-borne diseases (Salmonellosis, listeriosis, Q fever), and zoonoses transmitted by direct or indirect contact with animals (influenza, rabies, hantavirus)?
axis 3- Effectiveness of health systems in prevention and control of emergent zoonoses?
<ol style="list-style-type: none"> 1. What do we know about the effectiveness (and its determinants) of front-line interventions for detection, diagnosis, care of zoonoses (Québec, Canada, specific context of autochthonous communities, and abroad)? 2. What do we know about the effectiveness of integrated surveillance of zoonoses? 3. What do we know about the effectiveness of prevention and control interventions for zoonoses (including risk communications)? 4. Are there any preventive programs taking into account the complexity of the links between zoonoses, chronic diseases and social determinants of health? If yes, what do we know of their effectiveness? 5. How to improve integration of social determinants of health in preventive programs for zoonoses? 6. How to improve effectiveness of integrated approaches such as “One Health” regarding zoonoses?

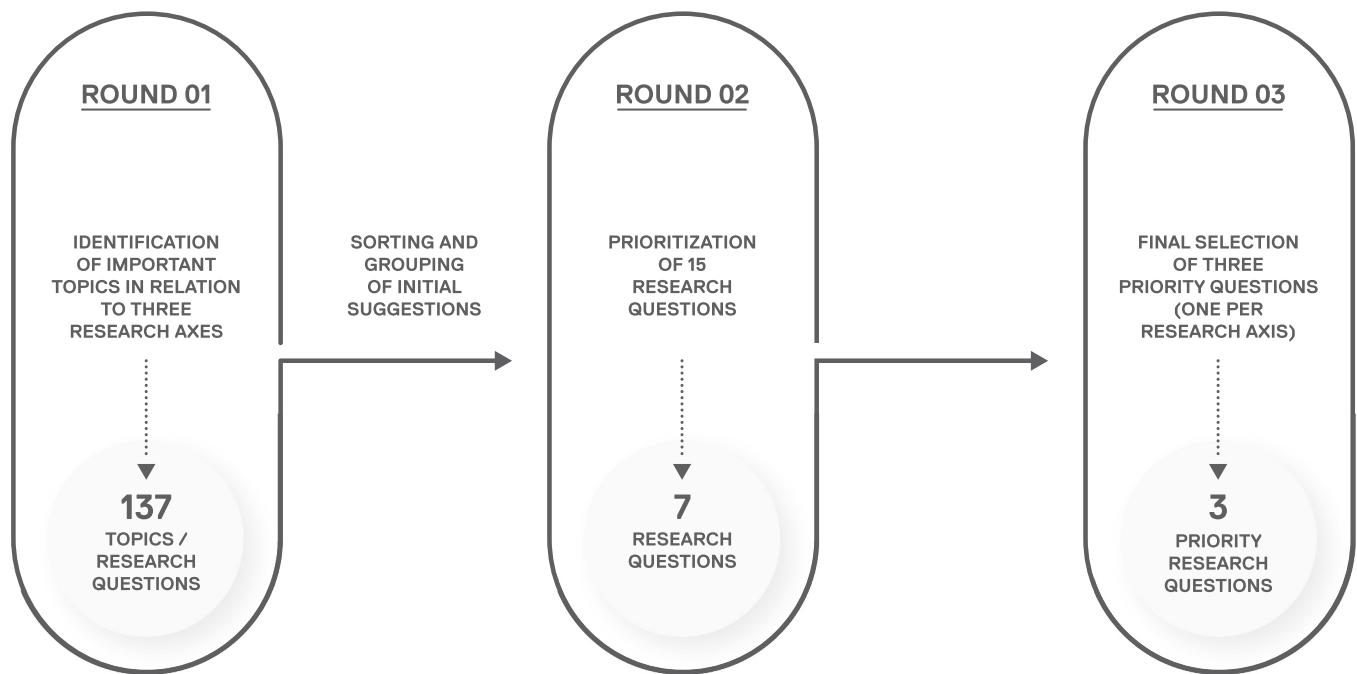


Fig. 1. Schematic representation of the Delphi process.

Table 2

Response distribution for research questions proposed at Round 2.

Item	Essential n (%)	Desirable n (%)	Possible n (%)	Negligible n (%)	To be eliminated n (%)	Total
Chronic diseases						
What is the evidence that zoonoses are causes that contribute to the burden of chronic diseases?	11 (45.8)	6 (25.0)	7 (29.2)	0 (0.0)	0 (0.0)	24
What is the evidence that chronic diseases increase the impact of zoonoses on the health of populations?	5 (20.0)	7 (28.0)	10 (40.0)	1 (4.0)	2 (8.0)	25
What do we know about the overall impact of zoonoses on the burden of chronic diseases?	8 (32.0)	6 (24.0)	8 (32.0)	1 (4.0)	2 (8.0)	25
How/by what mechanisms of pathogenicity do zoonotic diseases contribute to increasing the impact and burden of chronic diseases?	2 (8.0)	11 (44.0)	9 (36.0)	1 (4.0)	2 (8.0)	25
What are the factors (e.g. environmental, geographical, socioeconomic, behavioral) that modify the impact of zoonoses on chronic diseases?	4 (16.7)	11 (45.8)	6 (25.0)	2 (8.3)	1 (4.2)	24
What is known about the integration of the link between zoonoses and chronic diseases in prevention or control interventions?	0 (0.0)	8 (32.0)	10 (40.0)	5 (20.0)	2 (8.0)	25
Social determinants						
What do we know about the social determinants of zoonoses?	10 (38.5)	9 (34.6)	5 (19.2)	2 (7.7)	0 (0.0)	26
What do we know about the most vulnerable populations to zoonoses?	9 (34.6)	8 (30.8)	8 (30.8)	1 (3.8)	0 (0.0)	26
What is known about the integration of the social determinants of zoonoses in the surveillance, prevention and control of zoonoses?	6 (23.1)	7 (26.9)	10 (38.5)	1 (3.8)	2 (7.7)	26
Health system						
What do we know about the knowledge, perceptions and behaviours of the population in relation to zoonoses?	5 (20.0)	10 (40.0)	7 (28.0)	2 (8.0)	1 (4.00)	25
What do we know about the effectiveness of zoonose prevention and control strategies?	13 (52.0)	8 (32.0)	4 (16.0)	0 (0.0)	0 (0.0)	25
What do we know about integrating the One Health concept/approach into zoonotic disease surveillance, prevention and control?	7 (28.0)	7 (28.0)	7 (28.0)	4 (16.0)	0 (0.0)	25
What do we know about the effectiveness (and its determinants) of front-line interventions for the detection, diagnosis, treatment of zoonoses?	5 (20.0)	8 (32.0)	8 (32.0)	2 (8.0)	2 (8.0)	25
What do we know about the effectiveness of zoonose surveillance?	7 (29.2)	9 (37.5)	5 (20.8)	3 (12.5)	0 (0.0)	24
What do we know about the expertise of front-line workers on zoonoses and their determinants?	2 (8.0)	5 (20.0)	12 (48.0)	5 (20.0)	1 (4.0)	25

Note. The listed items are the 15 research questions resulting from the analysis of topics collected at Round 1. The most favoured items, i.e., those rated 4 (desirable) or 5 (essential) by more than 60% of respondents, are in bold type.

conclusion of Round 2 and were retained in Round 3. Ultimately, the three priority research questions selected in Round 3 were: 1) What is the evidence that zoonoses contribute to the burden of chronic disease? 2) What do we know about the populations most vulnerable to

zoonoses? and 3) What do we know about the effectiveness of zoonosis prevention and control strategies?

4. Discussion

This study identified three key research questions to be addressed by a One Health research agenda: the chronic disease burden of zoonoses, the most vulnerable populations, and the effectiveness of prevention and control strategies.

Chronic manifestations and sequelae of several ZDs in humans have been documented [14], but the overall contribution of ZDs to the increasing burden of chronic diseases is yet to be understood. In a recent paper, Badawi et al. [15] highlighted the need to investigate the convergence between chronic and infectious diseases. Advancing knowledge in this key area will require institutional structures and multidisciplinary approaches to ensure greater collaboration between infectious and chronic disease experts, practitioners, and institutions.

Vulnerable populations are “groups and communities at a higher risk for poor health as a result of the barriers they experience to social, economic, political and environmental resources, as well as limitations due to illness or disability” [16]. While socio-economic vulnerability is a major risk factor for most zoonoses [3,17], socio-economic barriers are rarely included in zoonosis research and practice agendas. According to Waltner-Toews [6], “the accelerated outbreaks of EIDs [emerging infectious diseases] comprise a pandemic of epidemics, emerging from deeper, systemic problems” (p. 1). Several complex factors, such as poverty, land use, agricultural practices, dietary preferences, and human mobility, are key determinants that should be addressed in One Health research [3,8]. As an approach that promotes transdisciplinary and systems thinking, One Health is well positioned to support the integrated research and policy innovations needed to address the social determinants of health related to ZDs and to better protect vulnerable communities and individuals.

Lastly, respondents echoed recent calls to prioritize research on the effectiveness of interventions to prevent and control human ZDs. For example, in a systematic review covering the period 1995–2015, Beaujean et al. [18] highlighted the paucity of studies on educational and communicational interventions to prevent tick-borne diseases. This is in line with two recent reviews concluding on the need for stronger evidence on the effectiveness of personal and environmental interventions to reduce human tick-borne diseases [19,20]. Intervention approaches developed from a One Health perspective that would combine diverse interventions and involve multisectoral collaborations (e.g. nature conservation, urban design) offer a promising avenue for action [20].

This study has limitations. First, our data collection strategy that initially guided participants to consider three pre-identified themes may have limited the emergence of other themes. Second, while the response rates for this study compare favourably with those obtained in other consultations of this type, the snowball approach used and the overrepresentation of Quebec among the participants may have limited the diversity of opinions. Future consultations should aim at a more balanced representation of regions. In addition, including participants from low- and middle-income countries would enrich and broaden perspectives.

Identifying research priority areas is essential to advance the application of One Health in ZD research and practice. By dynamically integrating the perspectives of Canadian researchers and practitioners, this study identified shared research priorities to inform the development of an innovative One Health research agenda.

Declaration of competing interests

None.

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