SCOPING REVIEW

Occupations at risk of contracting zoonoses of public health significance in Québec

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Abstract

Introduction: Climate change plays an important role in the geographic spread of zoonotic diseases. Knowing which populations are at risk of contracting these diseases is critical to informing public health policies and practices. In Québec, 14 zoonoses have been identified as important for public health to guide the climate change adaptation efforts of decision-makers and researchers. A great deal has been learned about these diseases in recent years, but information on at-risk workplaces remains incomplete. The objective of this study is to paint a portrait of the occupations and sectors of economic activity at risk for the acquisition of these zoonoses.

Methods: A rapid review of the scientific literature was conducted. Databases on the Ovid and EBSCO research platforms were searched for articles published between 1995 and 2018, in English and French, on 14 zoonoses (campylobacteriosis, cryptosporidiosis, verocytotoxigenic *Escherichia coli*, giardiasis, listeriosis, salmonellosis, Eastern equine encephalitis, Lyme disease, West Nile virus, food botulism, Q fever, avian and swine influenza, rabies, hantavirus pulmonary syndrome) and occupational health. The literature search retrieved 12,558 articles and, after elimination of duplicates, 6,838 articles were evaluated based on the title and the abstract. Eligible articles had to address both concepts of the research issue (prioritized zoonoses and worker health). Of the 621 articles deemed eligible, 110 were selected following their full reading.

Results: Of the diseases under study, enteric zoonoses were the most frequently reported. Agriculture, including veterinary services, public administration services and medical and social services were the sectors most frequently identified in the literature.

Conclusion: The results of our study will support public health authorities and decision-makers in targeting those sectors and occupations that are particularly at risk for the acquisition of zoonoses. Doing so will ultimately optimize the public health practices of those responsible for the health of workers.

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Introduction

Climate change plays an important role in the geographic establishment and spread of zoonoses. Projected variations in temperature and precipitation will influence the survival and spread of zoonotic pathogens, as well as the distribution of their vectors, favouring the spread of these diseases over larger geographic areas and for longer periods (1).

In Québec, 14 zoonotic diseases were identified as important to public health. Of these, 12 were prioritized by the scientific experts and public policy decision-makers making up Québec's Multi-Party Observatory on Zoonoses and Adaptation to Climate Change. The other two zoonoses are listeriosis and hantavirus pulmonary syndrome (1–3). These 14 zoonoses are enteric (campylobacteriosis, cryptosporidiosis, Shiga toxi-producing

Escherichia coli, giardiasis, listeriosis, salmonellosis) and non-enteric (vector-borne: Eastern equine encephalitis, Lyme disease, West Nile virus; non-vector-borne: food botulism in Nunavik, Q fever, avian and swine influenza, rabies, hantavirus pulmonary syndrome). The Observatory has published information on populations vulnerable to these diseases, including sealers in Nunavik, who are at risk of acquiring foodborne botulism, and workers in the poultry industry, who are at risk for campylobacteriosis (2,3). However, information targeting workers remains incomplete or even non-existent for some zoonoses, indicating the need to develop this body of knowledge to inform public health policies and practices.

The objective of this study was to identify the occupations and sectors of economic activity most at risk for the acquisition of zoonoses important to public health in Québec in order to contribute to the decision-making process of public health authorities and to optimize the practices of those responsible for workers' health. This synthesis of knowledge from the scientific literature is presented by zoonosis category (enteric, vector-borne non-enteric and non-vector-borne non-enteric).

Methods

The research team conducted a rapid review of the literature using systematic review methodology. The Ovid and EBSCO platforms were used to search the Medline, Embase, Evidence-Based Medicine Reviews (EBMR), Global Health, Forfait Total Access Collection and Environment Complete databases. The searches of the databases were conducted using a series of keywords related to the zoonoses of interest and to workers' health. **Table 1** and **Table 2** show the queries developed using these keywords.

The research was restricted to original peer-reviewed studies published between 1995 and 2018, in English or French. Literature reviews, commentaries, editorials, news, letters of opinion and Q&A were excluded. No restrictions were applied in terms of geographical scope. First, the article was screened by title and abstract; eligible articles had to demonstrate a clear link to the research, i.e. address both concepts of the research issue (prioritized zoonoses and worker health) and minimally address a high-risk sector of economic activity or occupation. Next, a full

Table 1: Queries in Ovid databases

Search #	Requests
S1	botulism/ or "Clostridium botulinum"/ or "Clostridium botulinum type E"/ or campylobacter/ or "Campylobacter infections"/ or "Campylobacter jejuni"/ or Cryptosporidiosis/ or exp Cryptosporidium/ or "Encephalitis Virus, Eastern Equine"/ or "Encephalomyelitis, Eastern Equine"/ or "Shiga-Toxigenic Escherichia coli"/ or "Escherichia coli O157"/ or "Enterohemorrhagic Escherichia coli"/ or "Q fever"/ or Giardiasis/ or Giardia/ or "Giardia lamblia"/ or exp "Lyme disease"/ or Rabies/ or "Rabies virus"/ or "Salmonella Infections"/ or "Salmonella Food Poisoning"/ or "Salmonella Infections, Animal"/ or "Salmonella enterica"/ or "Salmonella enteritidis"/ or "Salmonella typhimurium"/ or "West Nile virus"/ or exp Listeriosis/ or exp Listeria/ or "Hantavirus Infections"/ or "Hantavirus Pulmonary Syndrome"/
S2	("Influenza A virus"/ or "Influenza A Virus, H1N1 Subtype"/ or "Influenza A Virus, H1N2 Subtype"/ or "Influenza A Virus, H3N2 Subtype"/ or "Influenza A Virus, H5N1 Subtype"/ or "Influenza A Virus, H7N9 Subtype"/ or "Influenza in Birds"/) and Zoonoses/
S3	1 or 2
S4	(Botulism* or "Clostridium botulinum" or Campylobacter* or (C adj jejuni) or Cryptosporidios* or Cryptosporidium or "eastern equine encephal*" or (EEE adj virus*) or VTEC or STEC or ((Verocytotox* or Verotox* or "Vero Cytotoxin-Producing" or (shiga adj tox*) or Shigatox*) adj15 ("Escherichia coli" or "E. coli")) or (("Escherichia coli" or "E. coli") adj10 "O157*") or "Q fever*" or "Query fever*" or Coxiellosis or "coxiella burnetii" or Giardia* or lamblias#s or (G adj intestinalis) or (G adj duodenalis) or lyme or ((B or borrelia) adj burgdorferi) or Rabies or Salmonellos#s or (("west nile" or "egypt 101" or kunjin) adj (fever* or virus)) or listerios#s or ((listeria or L) adj monocytoge*) or (hantavirus adj1 pulmonary adj1 syndrome*) or "Sin Nombre virus").ti,ab,kw.
S5	((((A or A-type or "Type A" or Avian or Bird or Swine or H1N1 or H1N2 or H3N2 or H5N1 or H7N9) adj2 (Influenza? or flu or orthomyxovirus)) or ("pestis galli" adj1 myxovirus*) or "fowl plague virus*") and (zoonos* or zoonotic or "emerg* diseas*" or (animal-transmitted adj (infection* or disease*)) or (human adj1 animal adj transmission*))).ti,ab,kw.
S6	4 or 5
S7	3 or 6
S8	*"occupational exposure"/ or *"occupational health"/ or exp *"occupational groups"/ or *"occupational diseases"/ or *"agricultural workers' diseases"/ or "meat-packing industry"/
S9	(occupation* or worker* or workplace* or professional* or employ* or job$1 or labo?r or labo?rs or labo?rer* or personnel or staff).ti,ab,kw.
S10	(farm* or agricultur* or hunter* or (outdoor adj occupation*) or veterinar* or (wildlife adj manag*) or abattoir* or slaughter*).ti,ab,kw.
S11	8 or 9 or 10
S12	7 and 11
S13	12 not (exp animals/ not humans/)
S14	13 and (english or french).lg.
S15	limit 14 to yr=1995-2018
S16	15 not (editorial or letter or comment or news).pt.

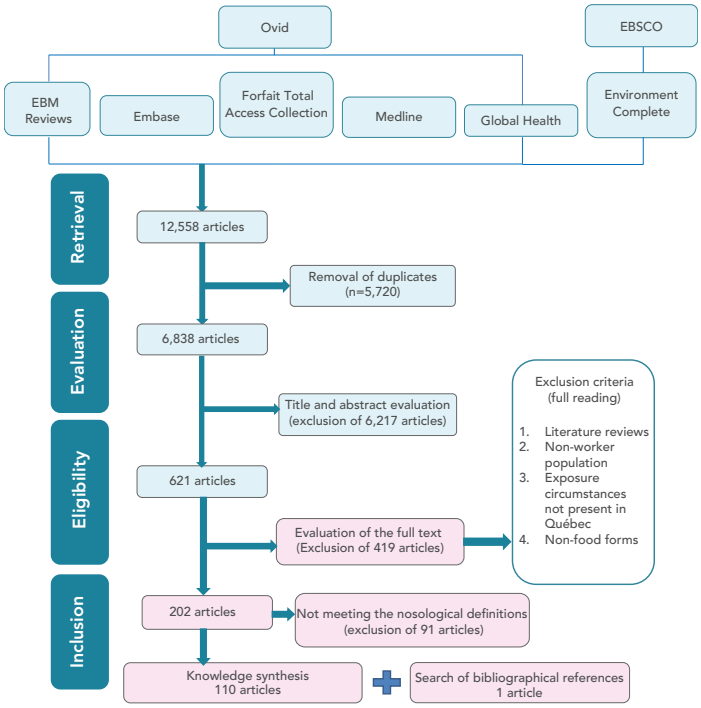
Table 2: Queries in EBSCO database

Search #	Requests
S1	TI (Botulism* OR "Clostridium botulinum" OR Campylobacter* OR (C W0 jejuni) OR Cryptosporidios* OR Cryptosporidium OR "eastern equine encephal*" OR (EEE W0 virus*) OR VTEC OR STEC OR ((Verocytotox* or Verotox* or "Vero Cytotoxin-Producing" or (shiga w0 tox*) OR Shigatox*) W15 ("Escherichia coli" or "E. coli")) OR (("Escherichia coli" or "E. coli") W10 "O157*") OR "Q fever*" OR "Query fever*" OR Coxiellosis OR "coxiella burnetii" OR Giardia* OR lamblias#s OR (G W0 intestinalis) OR (G W0 duodenalis) OR lyme or ((B or borrelia) W0 burgdorferi) OR Rabies OR Salmonellos#s OR (("west nile" OR "egypt 101" OR kunjin) W0 (fever* OR virus)) OR listerios#s OR ((listeria OR L) W0 monocytoge*) OR (hantavirus W1 pulmonary W1 syndrome*) OR "Sin Nombre virus") OR AB (Botulism* OR "Clostridium botulinum" OR Campylobacter* OR (C W0 jejuni) OR Cryptosporidios* OR Cryptosporidium OR "eastern equine encephal*" OR (EEE W0 virus*) OR VTEC OR STEC OR ((Verocytotox* or Verotox* or "Vero Cytotoxin-Producing" or (shiga W0 tox*) OR Shigatox*) W15 ("Escherichia coli" or "E. coli")) OR (("Escherichia coli" or "E. coli") W10 "O157*") OR "Q fever*" OR "Query fever*" OR Coxiellosis OR "coxiella burnetii" OR Giardia* OR lamblias#s OR (G W0 intestinalis) OR (G W0 duodenalis) OR lyme or ((B or borrelia) W0 burgdorferi) OR Rabies OR Salmonellos#s OR (("west nile" OR "egypt 101" OR kunjin) W0 (fever* OR virus)) OR listerios#s OR ((listeria OR L) W0 monocytoge*) OR (hantavirus W1 pulmonary W1 syndrome*) OR "Sin Nombre virus") OR KW (Botulism* OR "Clostridium botulinum" OR Campylobacter* OR (C W0 jejuni) OR Cryptosporidios* OR Cryptosporidium OR "eastern equine encephal*" OR (EEE W0 virus*) OR VTEC OR STEC OR ((Verocytotox* or Verotox* or "Vero Cytotoxin-Producing" or (shiga W0 tox*) OR Shigatox*) W15 ("Escherichia coli" or "E. coli")) OR (("Escherichia coli" or "E. coli") W10 "O157*") OR "Q fever*" OR "Query fever*" OR Coxiellosis OR "coxiella burnetii" OR Giardia* OR lamblias#s OR (G W0 intestinalis) OR (G W0 duodenalis) OR lyme or ((B or borrelia) W0 burgdorferi) OR Rabies OR Salmonellos#s OR (("west nile" OR "egypt 101" OR kunjin) W0 (fever* OR virus)) OR listerios#s OR ((listeria OR L) W0 monocytoge*) OR (hantavirus W1 pulmonary W1 syndrome*) OR "Sin Nombre virus")
S2	TI ((((A OR A-type OR "Type A" OR Avian OR Bird OR Swine OR H1N1 OR H1N2 OR H3N2 OR H5N1 OR H7N9) W2 (Influenza# OR flu OR orthomyxovirus)) OR ("pestis galli" W1 myxovirus*) OR "fowl plague virus*") AND (zoonos* OR zoonotic OR "emerg* diseas*" OR (animal-transmitted W0 (infection* OR disease*)) OR (human W1 animal W0 transmission*))) OR AB ((((A OR A-type OR "Type A" OR Avian OR Bird OR Swine OR H1N1 OR H1N2 OR H3N2 OR H5N1 OR H7N9) W2 (Influenza# OR flu OR orthomyxovirus)) OR ("pestis galli" W1 myxovirus*) OR "fowl plague virus*") AND (zoonos* OR zoonotic OR "emerg* diseas*" OR (animal-transmitted W0 (infection* OR disease*)) OR (human W1 animal W0 transmission*))) OR KW ((((A OR A-type OR "Type A" OR Avian OR Bird OR Swine OR H1N1 OR H1N2 OR H3N2 OR H5N1 OR H7N9) W2 (Influenza# OR flu OR orthomyxovirus)) OR ("pestis galli" W1 myxovirus*) OR "fowl plague virus*") AND (zoonos* OR zoonotic OR "emerg* diseas*" OR (animal-transmitted W0 (infection* OR disease*)) OR (human W1 animal W0 transmission*)))
S3	S1 OR S2
S4	TI (occupation* or worker* or workplace* or professional* or employee* or job or jobs or labo#r or labor#rs or labo#rer* or personnel or staff) OR AB (occupation* or worker* or workplace* or professional* or employee* or job or jobs or labo#r or labor#rs or labo#rer* or personnel or staff) OR KW (occupation* or worker* or workplace* or professional* or employee* or job or jobs or labo#r or labor#rs or labo#rer* or personnel or staff)
S5	TI (farmer* or hunter* or (outdoor W0 occupation*) or veterinar* or (wildlife W0 manager*) or slaughterer*) OR AB (farmer* or hunter* or (outdoor W0 occupation*) or veterinar* or (wildlife W0 manager*) or slaughterer*) OR KW (farmer* or hunter* or (outdoor W0 occupation*) or veterinar* or (wildlife W0 manager*) or slaughterer*)
S6	S4 OR S5
S7	S3 AND S6
S8	S7 and LA (english OR french)
S9	S8 and (DT 1995-2018)
S10	S9 NOT PT (editorial or letter or commentary)
S11	TI (((systematic OR state-of-the-art OR scoping OR literature) W0 (review OR reviews OR overview* OR assessment*)) OR "review* of reviews" OR meta-analy* OR metaanaly* OR ((systematic OR evidence) N1 assess*) OR "research evidence" OR synthes?s OR metasynthe* OR meta-synthe*) OR SU (((systematic OR state-of-the-art OR scoping OR literature) W0 (review OR reviews OR overview* OR assessment*)) OR "review* of reviews" OR meta-analy* OR metaanaly* OR ((systematic OR evidence) N1 assess*) OR "research evidence" OR synthes?s OR metasynthe* OR meta-synthe*)
S12	S10 AND S11
S13	S10 NOT S11

reading of the selected publications led to the selection of only those articles that dealt specifically with the zoonoses of interest and that referred to the workplace as a place of acquisition. Studies not involving a work environment (i.e. community acquisition) or that mentioned exposure circumstances that could not have occurred in Québec workplaces were excluded. Reviewing the references listed in the selected publications allowed for the identification of relevant elements in articles published prior to 1995. Finally, studies for which the descriptions of zoonotic cases did not meet the criteria of the provincial nosological definitions or the diagnostic criteria used in Québec were excluded. The data collected from the selected articles (sectors of economic activity, occupations at risk, risk factors) were recapped in summary analysis grids.

Figure 1 shows the process leading to the selection of information. The research team determined the occupations and sectors of economic activity most at risk for the acquisition of these zoonoses based on the number of articles documenting them.

Figure 1: Illustration of the process for documentation searches and selection of publications Database search algorithms



Note: Five databases were queried on the Ovid platform: Embase, Ovid MEDLINE, Evidence-Based Medicine Reviews (EBMR), Forfait Total Access Collection and Global Health; one database was queried on the EBSCO platform: Environment Complete (EC)
Restrictions applied: 1995–2018; English and French; commentaries, editorials, news, opinion letters and Q&A excluded. No restrictions in terms of geographic scope were applied to initiate the search

Results

A list of the occupations and sectors of economic activity most at risk for the acquisition of prioritized zoonotic diseases is presented in **Table 3**. These are classified according to the National Occupational Classification system version 2016 version 1.3 and the 1984 Québec Economic Activity Classification version 1990, respectively. The distribution of selected articles by prioritized zoonosis is available in **Table 4**

According to the scientific literature evaluated, the most commonly reported zoonoses in workplaces are enteric zoonoses, followed by non-vector-borne non-enteric zoonoses and vector-borne zoonoses. Salmonellosis and cryptosporidiosis are the enteric zoonoses most frequently identified in the literature evaluated. Of vector-borne zoonoses, Lyme disease is the most documented, while very few articles that deal with arboviruses in workers, such as West Nile virus and Eastern equine encephalitis, have been identified. Of non-vector-borne non-enteric zoonoses, most of the scientific articles selected were about Q fever.

Agriculture, including veterinary services, was the sector in which the most important zoonoses can be contracted. The public administration service sector, which includes national security and defence, was also specifically identified as at risk for the acquisition of the three categories of zoonoses, enteric, vector-borne non-enteric and non-vector-borne non-enteric. The third most frequently mentioned sector were medical and social services, which includes childcare staff, laboratory personnel,

Table 3: Categories of zoonoses, their main reservoir animals in Québec and main sectors of economic activity and occupations identified as at risk for the acquisition of these zoonoses in the scientific literature

Zoonoses	Main reservoir animals	Main sectors of economic activity	Occupations and references
Enteric zoonoses			
Campylobacteriosisx	Poultry	Agriculture	Farm workers, poultry industry workers (4–13)
		Public administration	Military personnel (14–19)
Cryptosporidiosis	Cattle and other ruminants	Agriculture	Veterinary medicine students (20–27), farm workers (28–33) and agricultural emergency responders (34,35)
		Other business and personal services	Field trip attendants and summer camp employees (36–38)
		Medical and social services	Childcare staff (39) and animal research laboratory personnel (40)
Verocytotoxigenic *Escherichia coli*	Cattle, other ruminant or herbivorous mammals	Agriculture	Agricultural workers (41–48)
		Medical and social services	Childcare staff (49,50), hospital staff (nurses) and nursing home staff (51,52)
		Teaching and related services	School-based employees (teachers and teaching assistants) (53)
		Public administration	Military personnel (54)
Giardiasis	Cattle, wildlife mammals	Medical and social services	Childcare staff (55–57)
Listeriosis	Cattle, sheep, pigs, goats	Agriculture	Veterinarians (58,59) and farm workers (60)

Table 3: Categories of zoonoses, their main reservoir animals in Québec and main sectors of economic activity and occupations identified as at risk for the acquisition of these zoonoses in the scientific literature (*continued*)

Zoonoses	Main reservoir animals	Main sectors of economic activity	Occupations and references
Enteric zoonoses			
Salmonellosis	Poultry, pigs, cattle	Agriculture	Technicians and veterinary medicine professionals (61–64), farm workers (65–67), snake farm employees (68)
		Medical and social services	Healthcare workers (69–71), nursing home staff (72) and childcare staff (73,74)
		Public administration	Military (75,76)
		Miscellaneous manufacturing industries	Pet industry staff (77)
		Food and beverage industry	Workers exposed to raw meat (78)
		Building and public works	Construction workers (79)
		Other business and personal services	Restaurant employees (80)
Vector-borne non-enteric zoonoses			
Eastern equine encephalitis	Wild birds (e.g. passerines)	Agriculture	Veterinary technicians (81)
Lyme disease	White-footed mouse (*Peromyscus leucopus*)	Agriculture	Farm workers (82–85)
		Forestry and sawmills	Forestry workers (85)
		Public administration	Military personnel (86–89)
West Nile virus	Avian (especially passerines)	Medical and social services	Laboratory personnel (90)
		Other business and personal services	Animal control officers (91)
		Agriculture	Veterinary medicine students (92)
Non-vector-borne non-enteric zoonoses			
Foodborne botulism in Nunavik	Seals	No information	No information
Q fever	Domestic ruminants	Public administration	Military personnel (93–97)
		Agriculture	Farm workers (98,99)
		Food and beverage industry	Slaughterhouse workers (100)
		Chemical industry	Cosmetics industry workers (101,102)
		Transportation and warehousing	Drivers (103)
Avian and swine influenza	Avian (wild birds), pigs	Agriculture	Commercial poultry farm workers (104)
Rabies	Arctic foxes, raccoons, bats	Public administration	Military personnel (105,106)
		Agriculture	Veterinary services (107)
		Other business and personal services	Employees in contact with bats (108)
Hantavirus pulmonary syndrome	Deer mouse (*Peromyscus maniculatus*)	Agriculture	Farm workers (109–111)
		Forestry and sawmills	Forest workers (109)
		Public administration	Military personnel (112)
		Other business and personal services	Trapping and handling of rodents for ecological studies (113) Communications, power transmission and other utilities (114)

Table 4: Number of articles retained by prioritized zoonosis

Prioritized zoonoses	Number of scientific publications for which case descriptions meet the criteria of the nosological definitions and diagnostic criteria
Foodborne botulism in Nunavik	0
Campylobacteriosis	16
Cryptosporidiosis	21
Eastern equine encephalitis	1
Verocytotoxigenic *Escherichia coli*	14
Q fever	11
Giardiasis	3
Hantavirus pulmonary syndrome	6
Avian and swine influenza	1
Listeriosis	3
Lyme disease	8
Rabies	4
Salmonellosis	20
West Nile virus	3
Two zoonoses or more	2[a]
Total	**111**

[a] These two articles are included in the number of articles selected for the review of knowledge of the zoonoses concerned, i.e. campylobacteriosis, cryptosporidiosis and salmonellosis, but are counted only once

hospital staff, long-term care centre staff and nursing home staff, among others. This sector was identified as at greater risk for contracting enteric zoonoses such as cryptosporidiosis, verocytotoxigenic E. coli, giardiasis and salmonellosis and one vector-borne zoonosis (accidental transmission of West Nile virus among laboratory personnel).

Discussion

The objective of this study was to describe the occupations and sectors at risk for the acquisition of zoonoses of public health importance in Québec. Different occupations are at varying risk of contracting one of the 14 zoonoses prioritized as important to public health by Québec's Multi-Party Observatory on Zoonoses and Adaptation to Climate. Farm workers and veterinarians, as well as military personnel and medical and social services personnel are among the workers most frequently documented as at risk.

There is shortage of literature documenting at-risk occupations that would guide preventive occupational health measures. Two published studies allowed us to compare certain observations.

A systematic review of the scientific literature (1999–2008, no geographic restriction) by Haagsma *et al.* (115) examined occupational injuries attributable to infectious diseases. The second study presented the extent of occupational injuries attributable to infectious diseases reported in the United States between 2006 and 2015 (116). Su *et al.* (116) conducted a review of 67 peer-reviewed scientific publications (published between 2006 and 2016) by following the methodology used by Haagsma *et al.* (115) and supplemented this research by evaluating 66 case reports of workplace-acquired infectious diseases from the Center for Disease of the National Institute for Occupational Safety and Health.

In this study, the military was identified as being at risk for the acquisition of three categories of zoonotic diseases (enteric and vector-borne non-enteric and non-vector-borne non-enteric), especially during missions abroad. The military was not widely discussed by Su *et al.* (116) or Haagsma *et al.* (115), with the exception of the risk for leishmaniasis, a parasitic infection that is not present in Canada. Several of the studies that focused on the military were published after 2008, i.e. after the time period covered by Haagsma *et al.* (115) and Su *et al.* (116), which explains some of the difference in observations between those studies and our research. This study identified several risk factors for the acquisition of zoonoses by military personnel: being based in endemic areas; participating in training camps in or near wooded areas (Lyme disease) (87,88); living in abandoned structures or barns in which animals have reproduced; and working in deployment sites where dust becomes air-borne because of air turbulence caused by helicopters (Q fever) (93,94,96,97).

Similar to Su *et al.*'s (116) observations, it was found that enteric zoonoses of bacterial etiology are the workplace zoonoses most frequently found from among the zoonoses of importance. This study also showed that three sectors are particularly affected by zoonoses of importance: agriculture, including veterinary services; public administration services including defence; and medical and social services. This was also observed by Haagsma *et al.* (115) and Su *et al.* (116), who reported that healthcare workers and those in contact with animals are most at risk of being infected by a variety of zoonotic pathogens. Healthcare workers are predominantly exposed to pathogens through human-to-human contact (115). Infection occurs accidentally through wounds or needlesticks, and also through direct skin contact or indirectly via oral–fecal contact, often related to hand hygiene. Su *et al.* (116) explain that workers in contact with animals, particularly livestock and/or poultry, are at risk of contracting zoonoses. Haagsma *et al.* (115) identified farmers, slaughterhouse workers, animal care workers, veterinarians, hunters and gardeners as those at risk for the acquisition of zoonoses following contact with animals. All of these occupations were identified in our study as being at risk.

Strengths and limitations

The main limitation of this study hinges on the inclusion and exclusion criteria used in the search strategy. Selecting only those published studies where the description of zoonotic cases meets the nosological definitions or diagnostic criteria may have resulted in the exclusion of studies presenting asymptomatic infection cases diagnosed in the laboratory. Despite this limitation, the conclusions of our review are similar to those reported in two other literature reviews (115,116). However, the results of this study reflect a publication bias. To illustrate, it is not surprising that more articles on Lyme disease were retrieved than on the two other vector-borne zoonotic diseases under study given the amount of recent research on this disease. This therefore calls for a cautious interpretation of the importance of the documentation on each of the zoonoses.

Conclusion

This study has painted a portrait of the occupations and sectors most at risk for the acquisition of prioritized zoonoses in Québec. Agriculture (including veterinary workers), public administration personnel (in particular the military) and medical and social services were identified as the sectors most affected by the prioritized zoonoses. Military personnel have also been identified as at risk of contracting the three categories of zoonoses, with several risk factors were identified for the acquisition of zoonoses in the military.

Overall, risks of acquiring zoonotic diseases in the workplace have not been widely studied. Future studies would include consulting representatives at various workplaces and zoonosis experts to build on observations. It would also be valuable to identify the measures put in place to protect the workforce from zoonoses. This would ultimately help to identify any gaps and better guide public health adaptation efforts in the context of climate change.

Authors' statement

AAP — Concept, writing-original draft, revising the writing, critical review
LMD — Concept, writing-original draft, revising the writing, critical review
SB — Revising the writing and critical review
GG — Revising the writing and critical review
AIC — Revising the writing and critical review
MPS — Revising the writing and critical review
AS — Revising the writing and critical review
JS — Revising the writing and critical review
KT — Revising the writing and critical review
FT — Revising the writing and critical review

Competing interests

None to declare.

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