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Review

A climate health policy: Will it be a better approach to overcome the greatest global challenge of the 21st century? A review to explore public and public health officials' perceptions towards policy development

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ABSTRACT

Background: Climate change is predicted to be one of the most substantial influences on future global public health. Addressing this urgent problem requires substantive public and professional engagement in developing public health policy and ensuring its implementation and adherence. This paper explores the current perceptions of the public and officers of public health and their willingness to engage in a climate health policy.
Methods: A systematic integrative review was conducted, drawing on an established framework. This incorporated systematic literature searching, quality appraisal, data extraction and synthesis of findings from qualitative and quantitative studies.
Results: Only 13 studies were included in the review, indicating a paucity of knowledge. However, a growth in the number of studies during the recent decade was observed. Significant concerns identified were belief that public health wasn't sufficiently engaged in the climate debate or associated policies, a felt lack of expertise among public health experts regarding their ability to influence policy in this area (knowledge, resources and influence), and a small but significant proportion of professionals and the public denying the reality of climate change. The findings demonstrate public understanding and support for policy when climate change is seen within a health frame. Further, the study shows gaps in the required knowledge, attitudes, resources, and political and administrative support in effective public health engagement.
Conclusion: These findings point to the need for both strategic involvement and empowerment of public health officials at national and local levels, and development of a robust evidence base to support resultant policies.

Introduction

Throughout history, public health has faced substantial periodic challenges, from the plague to the Spanish flu through the recent pandemic of COVID 19. None of these were specifically anticipated, nor was there time to plan for substantive prevention and mitigation. Consequently, such global health challenges have led to both significant health consequences and economic instability.

In contrast, climate change's likely impacts are now universally known and anticipated, with significant potential time for planning to reduce the likely health consequences. According to the World Health Organization (WHO), climate change affects multiple social determinants of health and will have much greater consequences on human health in the future than today [1]. Climate change therefore is recognized as a significant public health challenge, with academics and professionals increasingly exploring strategies to reduce its impact.

Many public health entities have shown interest in the nexus of climate change and public health. In 2015, the Lancet Commission was formed to identify and explore necessary climate change policy responses to achieve population health, advise governments to adopt mechanisms to ensure collaboration between health ministries and other departments, and to empower health professionals to protect human health [2]. The Centers for Disease Control (CDC) in the United States (US) developed an assessment framework for building resilience against climate change (BRACE) to help local governments adapt to the health effects of climate change [3]. Furthermore, the WHO encourages and supports public health policy to mitigate the effects of climate change [4].

However, despite the importance of climate change in public health, the public, policy and press narratives surrounding its impact

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remain primarily environmental with relatively little reporting in terms of health consequences and measures to minimize them. As a result, public involvement and engagement are predominantly concerned with reducing carbon footprints, and less importance is given to protective strategies to ensure health. Watts et al. have argued that bringing a health voice and perspective to the climate change debate would ensure that the public would better understand the implications for health[2]. They also suggested that "fostering such public resonance can act as a powerful policy driver." Pillay and Vanden Bergh further strengthen this argument in their review of behavioral studies, emphasizing that using health frames increases public engagement in climate policy [5]. The WHO has identified four important stakeholder groups in the priority setting for national health policies [6]. Policymakers and administrators are two groups responsible for developing policy. However, the remaining two groups, health professionals and the community, are important stakeholders who will engage in implementing the developed policy.

Research across the broader area of implementation science now recognizses that failure to consider implementation at the design stage is a significant cause of policy failure [7,8,9]. Public and professional involvement in policy development and implementation is vital for success. The community's perception of this mounting threat to health therefore is important in formulating policies that will be accepted and implemented by the public. Hence, it is important to understand how these two groups feel about such a policy.

Despite the importance of both health professional and public views and involvement in this area, research to date has suggested that barriers to engagement may exist. For example, in a review of studies in Canada, the US and Malta on public beliefs, attitudes and behavior regarding climate change, it was noted that climate change was not identified as a salient health issue by the public in any of the three countries [10]. Alternatively, a systematic review on the role of medicine in responding to climate change in the US highlighted medical professionals' overwhelming support for addressing climate change [11]. The article also concluded that existing studies tend to point to the potential partnership between the health sector and the public sector to address climate change, while 32% of the 75 articles included from medical, business and policy databases suggested healthcare should take a lead role in addressing climate change.

Since the participation and engagement of the public and health profession is needed for successful policy implementation, their views are important in the policy development process [6]. However, no study has attempted to draw conclusions regarding how the public and health professionals would support health policies to address the implications of climate change. Therefore, this study aimed to focus on the perceptions of the Officers in Public Health (OPH) and members of the public on climate change, health, and policy. For purposes of this study the OPH include public health officers, academics in public health, and administrators in public health. Their perceptions were explored through a diverse range of variables such as knowledge, engagement, mitigatory efforts, and barriers to mitigation. Further, this study exploresdnew knowledge in order to inform policy to reduce the health effects of climate change.

Methods

This study assessed the views of a particular study group on a relatively novel topic in research. Consequently, it was important to draw on quantitative and qualitative studies and be open to a broad range of research questions in the area.

Integrative review

Climate change and its impacts on health have been explored through various studies. However, limited knowledge is available on the nexus on climate change, health and policy. An integrative review is a broad research review method which allows the inclusion of varied methodologies simultaneously, which allows for a comprehensive range of outcomes [12]. It includes a systematic approach and a detailed literature search strategy [13]. Hence, an integrative review was conducted to summarize the available knowledge to inform policy development and to highlight the role and remit of public health and general public responses.

Search strategy

The SPIDER tool was used to formulate the research questions for the literature search strategy. The EBSCO search platform and natural sciences database were selected to include a wide range of multidisciplinary inputs. The EBSCO search platform includes 'Medline' medical database, 'CINAHL' nursing database, 'CAB abstract' environment, and 'Greenfile' environmental database. The search included the following key words: "climate change" or "climatic change" and "public health" or "human health" and "view*" or "attitude" or "perception" or "opinion" or "thought" or "feeling" or "belief" or "survey" or "questionnaire" or "interview" or "observe*" (see supplementary Table 2 for search strategy).

The time frame selected was from January 1990 to January 2021. Only peer-reviewed English-language articles were selected. Literature reviews and reports were excluded. In addition, studies were sought from the citations of relevant studies as an additional search which resulted in further 6 studies.

The literature derived using the search strategy was filtered using the PRISMA 2009 flow diagram. The criteria for funneling down to the final 13 articles are as shown in Fig. 1. Two reviewers were involved in the screening process (LB and NW). The articles were first screened for topics and duplicates. Next, the study abstracts were screened, and 28 studies were selected for full-text review. Among them, 13 were selected to proceed within the review. Four of these were qualitative studies, 7 were quantitative studies and 2 were mixed studies.

The articles were selected based on their contribution to climate change policy in a public health context. Studies on climate change and health risk were excluded. Such studies were included if the themes implied framing climate change as a health issue, thereby implying a potential need for a health sector solution. No studies precisely addressed the exact topic, but the selected studies had components that could strongly relate to and contribute to the desired new knowledge.

Critical appraisal

The CASP quality appraisal tool was used for qualitative, randomized control, and mixed-method studies. The British Medical Journal quality appraisal checklist for questionnaire studies was used for surveys. Two authors (LB and BW) were involved in assessing the quality of the studies. Studies were given a score according to their relevance to the study and study quality, from 1 to 5. Better quality and relevance corresponded with the numerical value of the given score.

Data analysis

Thematic data analysis was carried out following a systematic data extraction as in supplementary Tables 3 to 8. Study findings were compared both across and within studies to identify key concepts relevant to the review aims. These were then used to generate emerging themes that might shed light on the public and OPH views on climate change and health, communicating climate change and the public health engagement and barriers in climate change. The themes ranged from the knowledge on climate change, its health effects, to engagement and barriers to engagement.

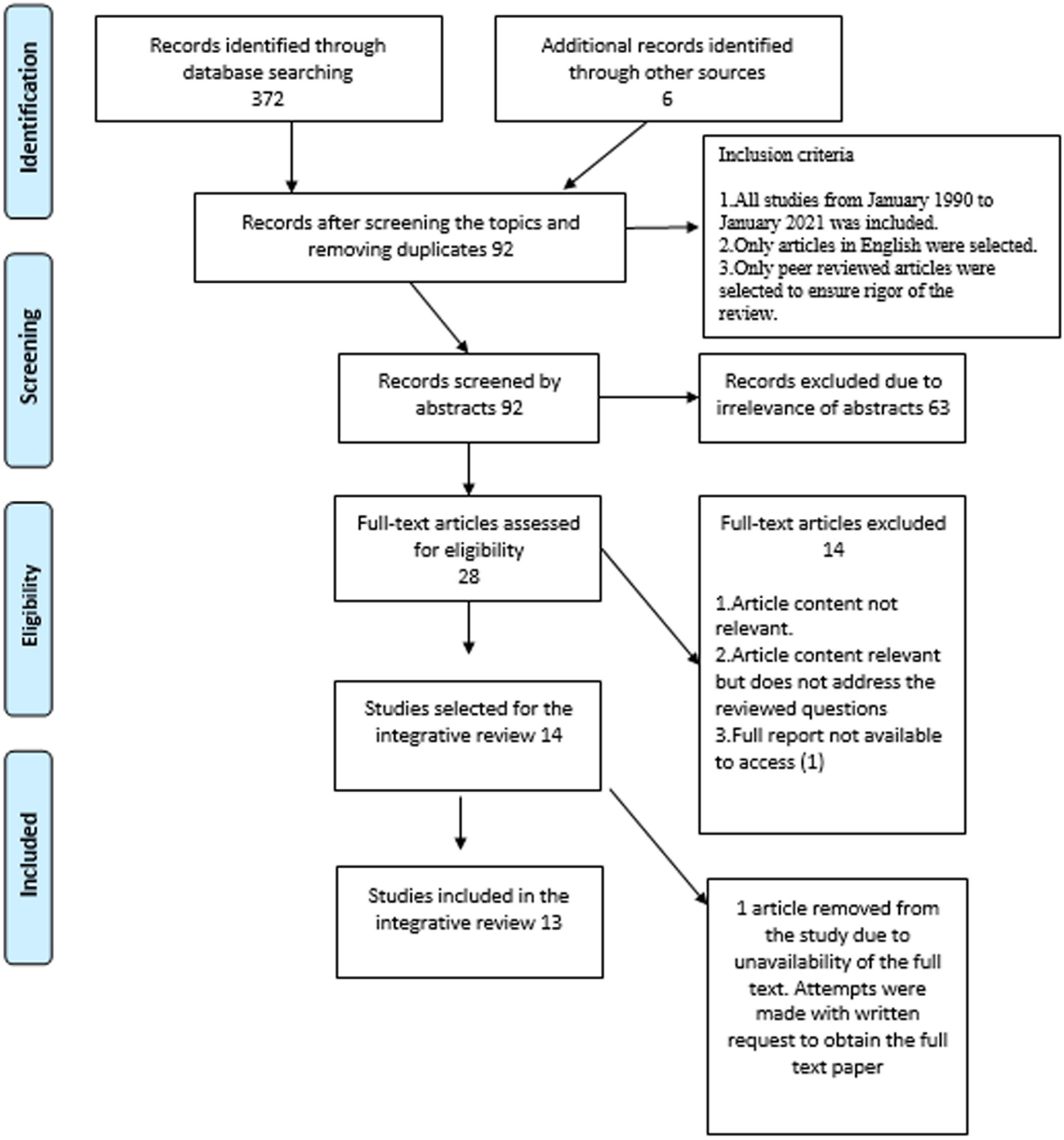

Fig. 1. Prisma Flow Diagram.

Results

Articles researching the topic of the study directly were not found. Hence, key findings were divided into broad themes to link and relate them to perceptions of the OPH and the public, and to give meaningful insights of their perceptions on the different topics that have been studied.

Only 14 studies were identified among which 13 were included, demonstrating a paucity of knowledge. However, during the past 12 years there has been growth in the number of studies including 10 of the 13 studies in this review. Significant concerns can be raised by these studies including a belief that public health has not been sufficiently engaged in the climate debate or associated policies; a felt lack of expertise among public health experts as to their ability to influence policy in this area (knowledge, resources and influence); and a small but significant proportion of OPH and the public who deny the reality of climate change.

More detailed findings categorized by themes and sub-themes are detailed in supplementary Table 9. Table 1 and 2 below depict the perceptions among the OPH and the public. The study from which the theme has been extracted has been numbered and can be referred at the end of each table.

Table 1
Perceptions among the OPH.

Themes exploring perceptions of the OPH	Study
Perceptions of OPH on climate change	
The majority perceived climate change to be a problem.	E5
Perceptions of OPH on climate change and its health impacts	
Most public health offices feel that climate change is a threat to public health	N11
Health officials are concerned on how climate change will affect existing health and new health concerns	E3
Climate change poses a threat to public health	E5
Perceptions of OPH on public health involvement in climate change	
Only a minority think it is a top priority in their department	E5
Engagement and partnerships on climate change policies occurred within and across public health and non-public health organizations in Ontario	N3
Engagements in climate change impacted public health's roles, decisions, mandate, and capacities beyond the climate change discourse	N3
Engagements in climate change enabled access to funds, expertise, and new stakeholders	N3
Engagements in climate change build relationships for future engagements	N3
Engagements in climate change supported knowledge sharing, generation, and creation	N3
Engagements in climate change advanced public health interests in political platforms and decision making	N3
Public health consultants did not have an explicit remit for climate change adaptation	E15
Perceptions of OPH on self-knowledge	
Public health officers do not feel they are well equipped with information to cope up with the threat	N11
Majority of the public health officials felt they were knowledgeable on health impacts of climate change	E5
Perceptions of OPH on the knowledge among other officials	
Most felt that health department personnel and other key stakeholders had lack of knowledge	E5
Perceptions of OPH on the adequacy of technical support	
Few felt that the health authorities had the necessary expertise to help them in adaptation and mitigation	E5
Perceptions of OPH on the adequacy of resources	
Most felt their health department need more funding	E5
Most felt that the staff needs training to effectively respond to climate change	E5
Public health officers do not feel they are well equipped with resources to cope with the threat	N11
Perceptions of OPH on mitigation and adaptation practices	
Several programs are already in place	N11
Adaptation is in place by mainstreaming climate change into public health activities	E3
Adaptive progression relies on leadership, federal support, political will and inter-agency efforts	E3
Related action is often aligned with public health's emergency planning functions	E3
Adaptation strategies/plans varied in existence and scope	E15
Perceptions of OPH on barriers to public health involvement	
Public health engagements were constrained by a fragmented sectoral approach	N3
Public health engagements were constrained by a lack of holistic inter-organizational structures and process	N3
Public health engagements were constrained by political and bureaucratic influences	N3
Public health engagements were constrained by irregular and unestablished communication channels for public health integration	N3
Public health engagements were constrained by identities and culture focused on functions, mandates, biased ideologies	N3
Public health engagements were constrained by lack of clear commitment to engage public health	N3
Resource constraints	N3
Individual perceptions that climate change is not urgent or solvable is a barrier to public health engagement in climate change	N7
Insufficient understanding of climate change's health impact and programmatic connections is a barrier to public health engagement in climate change	N7
Lack of public health capacity, authority, and leadership is an institutional barrier	N7
A narrow framework for public health practice that limits work on the root causes of climate change and health	N7
Compartmentalization within and across sectors	N7
Acquisition of necessary data is necessary to support effective policy	E3
Lack of resources constraints the sustainability of long term adaptation programs	E3
Perceived lack of urgency	E3
Communication barriers	E3
Financial constraints, lack of leadership are barriers to health-related adaptation	E15
Limited public and professional awareness about health impacts are barriers to health-related adaptation	E15
Perceptions of OPH on the opportunities/efforts to engage public health in climate change	
Integrating climate change into current public health practice	N7
Providing inter-sectoral support for climate solutions with health co-benefits	N7
Using a health frame to engage and mobilize communities	N7
Education and communications	N7
Building leadership and funding	N7
Increasing work on the shared root causes of climate change and health inequities	N7

E3 -Paterson, J. A., Ford, J. D., Ford, L. B., Lesnikowski, A., Berry, P., Henderson, J., & Heymann, J. (2012). Adaptation to climate change in the Ontario public health sector.
E5 - Maibach, E. W., Chadwick, A., McBride, D., Chuk, M., Ebi, K. L., & Balbus, J. (2008). Climate change and local public health in the United States: preparedness, programs and perceptions of local public health department directors. PloS One, 3(7), e2838 –e2838.
E15 - Woodhall, S. C., Landeg, O., & Kovats, S. (2019). Public health and climate change: How are local authorities preparing for the health impacts of our changing climate? Journal of Public Health (Oxford, England).
N3 – Awuor, L., Meldrum, R., & Liberda, E. N. (2020). Institutional Engagement Practices as Barriers to Public Health Capacity in Climate Change Policy Discourse: Lessons from the Canadian Province of Ontario. International Journal of Environmental Research and Public Health, 17(17), 6338.
N7 – Gould, Solange, & Rudolph, Linda. (2015). Challenges and Opportunities for Advancing Work on Climate Change and Public Health. International Journal of Environmental Research and Public Health, 12(12).
N 11 - Bedsworth, L. (2009). Preparing for Climate Change: A Perspective from Local Public Health Officers in California. Environmental Health Perspectives, 117(4), 617 –623.

Perceptions of the OPH

The different perceptions identified by the studies were categorized into ten themes. The findings of each theme are detailed below.

Only one study among those reviewed explored OPH perceptions towards climate change [14]. This study from 2008 revealed that 30% of a representable sample of public health directors does not agree to climate change happening during the past 20 years and 22% do not believe there is a possibility of experiencing it the next 20 years.

OPH perceptions on climate change and its health impacts were explored by Paterson et al.. [15], Maibach et al. [14] and Bedsworth [16]. All three studies indicate that a majority of OPH believe that climate change has an impact on health.

OPH perceptions on the involvement of public health in climate change has been explored in three studies. One US survey in 2008 found that even if climate change was identified as a threat to public health, only 19% of 217 health officials from the national association of county and city officials indicated that climate change was among the top 10 priorities of their department [14]. A study conducted 11 years later in South-West England showed that public health

Table 2
Perceptions among the public.

Themes exploring the perception of the public	Study
Perceptions of the public on climate change	
Majority were aware of the terms climate change and global warming	E19
Risk perception index does not correlate with knowledge about contributors to climate change index	E19
Albertans are only moderately informed about a variety of environmental issues	N14
The study showed a majority of participants had some knowledge about climate change	E11
A majority who had some knowledge on climate change felt excessive temperature was the main effect	E11
Age, education, monthly income and occupation were associated with knowledge about climate change	E11
Majority of the respondents reported that the heat during the summers had increased	E9
Majority reported winters were warmer than in previous years, but they still experienced very erratic and severe cold during the winter	E9
Majority reported that rainfall had decreased, compared to their previous experiences	E9
Significant association with the perception of climate change and impacts with gender and education	E13
No association between the perception of impact of climate change and socioeconomic status	E13
Perceptions of the public on climate change and its health impacts	
Risk perception index very strongly correlates with people dying, people becoming ill	E19
Risk perception index very strongly correlates knowledge of health effects of climate change	E19
Knowledge of health effects of climate change index most strongly correlates with people dying and people becoming ill	E19
Albertans are highly concerned about health problems related to environment and air pollution	N14
Majority of people think that health expenditure increased after extreme weather events	E11
People with a higher educational level or who lived near a school were more knowledgeable about climate change and its impact on health	E11
Majority responded that cold related diseases have increased compared to five to ten years ago	E9
Majority responded that heat related diseases have increased compared to five to ten years ago	E9
Majority of the respondents had heard about climate change and its impact on human health	E13
One third responded that their family has experienced more illnesses during the winter and summer as opposed to five years ago	E13
The most common symptoms reported during hot weather were headaches, fatigue, and dizziness	E13
During the hot weather, hypertension and other cardiovascular diseases were also reported	E13
During cold weather, people reported experiencing cough, fever, and influenza	E13
In cold weather they also experienced pneumonia and emerging infectious diseases such as dengue and Japanese encephalitis	E13
Majority responded that water related diseases have increased compared to five to ten years ago	E9
Perceptions of the public on communicating climate change in a health frame	
Clear evidence shows that the alarmed and the concerned responded positively to the health message on climate change	E18
Mixed evidence that cautious and the disengaged responded positively to the health message on climate change	E18
There was no evidence that doubtful responded positively to the health message on climate change	E18
Health frame messages generate hope and security frame messages generate anger	N9
Public willingness to act on climate change	
Risk perception index very strongly correlates with willingness to act	E19
Knowledge of health effects of climate change index significantly correlates with willingness to act index	E19
Willingness to act correlates to a lesser extent with people dying and people becoming ill	E19
Majority of Albertans appear to be engaged in environmental behavior at home	N14
Fewer Albertans consider energy efficiency when purchasing consumer goods	N14
Even smaller percentage of Albertans consider environmentally conscious transportation choices	N14
Public willingness to support policy	
Risk perception index very strongly correlates with support for policy	E19
Willingness to act index very strongly correlates with support for policy index	E19
Support for policy correlates to a lesser extent with people dying and people becoming ill	E19
Responses suggest that the association between environmental issues and health may be an effective strategy	N14

E9 – Haque, M. A., Yamamoto, S. S., Malik, A. A., & Sauerborn, R. (2012). Households' perception of climate change and human health risks: a community perspective. Environmental Health, 11(1), 1–1.
E 11 – Kabir, M. I., Rahman, M. B., Smith, W., Lusha, M. A. F., Azim, S., & Milton, A. H. (2016). Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. BMC Public Health, 16(1), 266–266.
E 13 – Toan, D. T. T., Kien, V. D., Giang, K. B., Minh, H. V., & Wright, P. (2014). Perceptions of climate change and its impact on human health: an integrated quantitative and qualitative approach. Global Health Action, 7(1), 23,025–23,025.
E 18 – Maibach, E. W., Nisbet, M., Baldwin, P., Akerlof, K., & Diao, G. (2010). Reframing climate change as a public health issue: an exploratory study of public reactions. BMC Public Health, 10(1), 299–299.
E 19 – DeBono, R., Vincenti, K., & Calleja, N. (2012). Risk communication: climate change as a human-health threat, a survey of public perceptions in Malta. European Journal of Public Health, 22(1), 144–149.
N 9 – Myers, T. A., Nisbet, M. C., Maibach, E. W., & Leiserowitz, A. A. (2012). A public health frame arouses hopeful emotions about climate change: A Letter. Climatic Change, 113(3), 1105–1112.
N 14 – Plotnikoff, R. C., Wright, M.-F., & Karunamuni, N. (2004). Knowledge, attitudes and behaviours related to climate change in Alberta, Canada: implications for public health policy and practice. International Journal of Environmental Health Research, 14(3), 223–229.

consultants still did not have an explicit charge for climate change adaptation [17]. Another study in Ontario explored public health involvement in more detail [18], and depicted the nuanced approaches and opportunities of public health engagement in climate change.

Bedsworth in his study among 61 OPH in California found that OPH did not feel that they were sufficiently well equipped with information to cope with the threat [16]. However, Maibach et al. in their study of 217 officials identified that a majority of the OPH felt they were knowledgeable on health impacts of climate change [14]. However, most of the 217 officers from the study by Maibach et al. felt that health department personnel and other key stakeholders had lack of knowledge. In the same study only few felt that the health authorities had the necessary expertise to help them in adaptation and mitigation [14]. Most felt their health department needed more funding and that the staff needed training to respond to climate change effectively. The study by Bedsworth similarly found that the OPH felt they needed to be better equipped with resources to cope with the threat [16].

Three studies noted that there are some measures in place and adaptation measures have been mainstreamed into programs [16–18]. The studies suggest that the progress of such measures relies on leadership, federal support, political will and inter-agency efforts, while the related action often is aligned with public health's emergency planning functions.

Barriers to public health involvement in climate change were explored in four studies [15,17–19]. OPH described barriers within the public health sector in the context of knowledge on the subject, public health capacity, and perceptions of climate change either needing to be more urgent or solvable. The studies have identified many constraints for public health engagement. In their study, Gould

et al. [19] mention that the OPH perceived the importance of integrating climate change into public health, intersectoral approaches with climate health co-benefits, and using the health frame to engage communities.

Perceptions of the public

Five themes were identified regarding the public's perceptions. Among the papers identified, seven studies explored public perceptions. They were conducted in the US, Canada, Malta and Bangladesh from 2004 to 2014. Five papers reported on quantitative studies [14,21–24] while two were mixed studies [25,26]. Qualitative research is limited to some of the components in the mixed studies.

Several studies over the past 20 years have focused on public knowledge. An early study (2004) in Alberta showed that Albertans were only moderately aware about several environmental issues [23]. Studies in Malta and Gozo (Bangladesh) showed that a majority were aware of climate change and global warming [22,24].

The same studies that explored perceptions on climate change also explored perceptions on climate change and its health impacts. A study in Hanoi shows that most participants were aware of climate change and its health impacts [26]. In addition, Albertans were highly concerned about health problems related to environment and air pollution [23]. These studies elaborate the perception of disease burden and the cost of health to be high in comparison with that of the past in relation to the changing weather. A comprehensive mixed method study in Bangladesh noted that among the 450 households, a majority responded that cold related, heat related, and water related diseases have increased compared to five to ten years ago [25].

Two studies carried out in the US depicted the potential value of framing climate change as a health issue [14,21]. The study by Maibach et al. [14] explored the reactions to a climate change message in a health frame among six American groups described as the alarmed, concerned, cautious, disengaged, doubtful and dismissive. This study concluded that there is clear evidence that the alarmed and the concerned responded positively to the health message on climate change. In the study by Myers et al. [21], the participants were given climate change messages in a heath frame, security frame and an environment frame. The study findings show that the health frame messages generate hope.

A DeBono et al. study with 543 participants found that risk perception and knowledge were associated with the willingness to act and to support policy. However, the same study found willingness to act and to support policy correlated to a lesser extent with the perception of risk that people would become ill or die from climate change [24].

Discussion

Perceptions of the OPH

OPH are among one of the four main stakeholders in health policy development [6]. Nonetheless, only one study explored OPH perceptions towards climate change [14]. According to this study, most perceive climate change as a problem. However, only a few believe it to be a top priority in their department. However, since this study was done in 2008, the current situation might be different and findings might need to be validated with more current research.

A majority of OPH agree that climate change poses a risk to health [14–16]. This supports a climate health policy to address climate-specific public health impacts. Among the above-mentioned studies, heat-related illnesses have been identified as a threat by all studies. This understanding could be an entry point in communication and public health commitment. A study by Hathaway and Maibach on how public and health officials perceive the health implications of climate change found that the OPH perception that climate change harms health is high, although their knowledge is low, and the perception of the need to learn is high [27].

OPH perceptions on the involvement of public health in climate change has been explored in the US, Southwest England and Ontario [14,17,18]. The situation of minimal engagement identified in the US in 2008 is shown to still exist in South-West England 11 years later [14,17]. Even though the Ontario study mentioned practices in place on public health engagement and its impacts, how much public health engagement was not clearly identified [18]. Hence, more studies are needed to explore public health involvement as well as how it will affect the health of the communities. Furthermore, the OPH perception of lack of a specific charge for increased involvement in climate change is a finding that can inform climate change policy development. The OPH understanding and acceptance of climate change as their jurisdiction is important for successfully implementing such a policy. Hence, measures such as education and training might be among the possible priorities for policy development.

Barriers to public health involvement in climate change were explored in four studies [15,17,18,19]. Barriers within the public health sector were described in the context of knowledge on the subject, public health capacity, and perceptions of climate change as either not urgent or unsolvable. Social determinants constraining public health engagement in climate change include politics, finance, communication, culture and institutional considerations. Hence, the barriers to public health engagement have been studied more than any other theme discussed so far in recent years from 2012 to 2020 and show constraints within and outside of the public health sector. Further, if public health is to be engaged effectively in climate change-related health impacts, these constraints must be addressed to provide a favorable environment during policy implementation.

Perceptions of the public

Public engagement is vital in health policy development [20]. Members of the public are the final decision makers and without them policy implementation cannot occur. Hence, exploring public perceptions is of great importance in any health policy. The selected studies were conducted in the US, Canada, Malta and Bangladesh from 2004 to 2014.

These studies show that the public is aware of climate change [22,23,24]. However, the study in Bangladesh [22] had a significant gender bias since 92.9% of the participants were male; hence, the applicability of this finding to the female population is uncertain in light of other studies that have highlighted gender differences. For example, in a 2014 study, men were 1.6 times more likely to have heard of the impacts of climate change than women, while respondents who had completed high school or university were respectively 5.8 times and 12.9 times more likely to have heard of climate change and its health impacts [26]. An association between knowledge of climate change and age and education was seen in the Bangladesh study [22]. The study done in Hanoi showed no association with socioeconomic status [26], while the Bangladesh study showed that monthly income and occupation were associated with knowledge of climate change [22]. The same studies that explored perceptions about climate change also explored perceptions about climate change-associated health impacts. Knowledge of the health impacts of climate change and perception of risk correlated with many factors such as respondant's education level, and perception of risk that morbidity and mortality would from climate change [22,24].

Hence, these findings support the intersectionality and the impact of wider social determinants on public awareness, and on perceptions about climate change and its impact on health. This is an important finding that needs to be considered in policy development.

Further, the review findings elaborate on the perception of an increased disease burden and the cost of health in relation to the changing weather. Economic evaluation and education, and out-of-

Table 3
Summary of study findings.

Perceptions of the public	Perceptions of the public health officials
• The public perceived climate change to be an increase in heat. • Studies depicted that knowledge on climate change was greater among males and with those having a higher education. • The relationship between socioeconomic factors and knowledge on climate change varied. • Perception of resulting morbidity and mortality, risk perception and education strongly correlated with knowledge on climate change. • The public perceived that the health costs and burden due to climate change events have increased in comparison to what the were five to ten years ago. • Studies showed that there was a positive impact in communicating climate change within a health frame. • Risk perception and knowledge have shown a significant correlation to public willingness to act. • Risk perception and willingness to act very strongly correlated with support for policy.	• A significant proportion of public health officials believed that they had not in the recent past and will not in the next 20 years experience climate change. • Among the majority who believed climate change poses impacts on health, it is perceived to be related to heat related condition. • As perceived by public health officials, the engagement of public health in climate change was found to be limited. • In exploring self-knowledge on climate change, differences were identified in self-perception on adequacy of knowledge. • Public health officials perceived that there was a significant gap in knowledge among other officials in their department as well as other relevant stakeholders on climate change and health. • Public health officers perceived that their department lacked the expertise and resources to support effective mitigation and adaptation. • Knowledge, capacity, perceptions on climate change, politics, culture, finance, communication and institutions were some of the barriers to public health engagement in climate change that were discussed by the participants. • Public health officials perceived that there are opportunities to engage public health in climate change.

pocket expenses of disease burden due to the health impacts of climate change, are topics that need to be explored since there is limited evidence and this can provide valuable inputs to policy development.

Two studies in the US support the value of framing climate change as a health issue [14,21]. The study findings show that the health frame messages give a positive response and generate hope. Further, the public health-framed message was the most likely to generate emotional reactions to support climate change mitigation and adaptation across all six of America's political segments [14]. Hence, the acceptance of a health frame in climate change messages is a good indicator of possible public acceptance of a climate change policy within a public health frame.

Study limitations

Public and OPH involvement in public health-related aspects of climate change policy is relatively new as a topic. Consequently, it was unsurprising to find few papers focused specifically and solely on this issue. However, the relevant sections from studies have been congregated to get a collective understanding. This might pose a bias on the outcome which is skewed to the scope that has been studied most (Table 3). In addition, even though this study included articles from all countries, among the selected studies, 8 out of 13 are from North America. Hence, the study participants' perceptions reflect cultural and economic influences with limited studies published in other regions. Further, there might be limitations in the scope of literature as this study covers publications from a relevant subject scope of peer-reviewed journals, potentitally missing policy appraisals and national assessments.

Nevertheless, the mentioned limitations do not limit the value of the important lessons learned in this study and their applicability in policy development.

Conclusion

Climate change is a global dilemma which has been framed within various disciplines by academics, experts, and governments. The response by countries and disciplines has framed climate change within many scopes such as environment, national security and health.

This study's findings suggest that public understanding and support for policy is facilitated when climate change is seen within a health frame. The public's perceptions relate positivity towards climate change messages in a health frame and respond well when climate change is perceived as a threat to health, indicating public support towards effective mitigatory and adaptive practices. These perceptions of accepting climate change as a health threat can positively facilitate policy-making and adherence to those policies.

Furthermore, with their apparent willingness to engage, it is time the public health community takes the lead and is provided with the needed support to overcome the challenge of climate change with the engagement of multidisciplinary stakeholders. However, the findings of this study show gaps in the required knowledge, attitudes, resources, and political and administrative support within effective public health engagement. Even though the findings range over a decade, the fact that there were only a few studies on the topic reflects the lack of an evidence-based approach to studying the engagement of the public and OPH. Hence, more studies are needed to assess the latest situation. Nevertheless, if used well, these findings could be a turning point in public health to minimize the effects of the greatest global challenge of the 21st century.

Declaration of Competing Interest

No conflicts of interest

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.joclim.2023.100257.

References

[1] World Health Organization (WHO). Climate Change and Health. https://www.who.int/news-room/fact-sheets/detail/climate-change-andhealth, accessed 20 A (2018)
[2] Watts N, MA, Adger WN, Agnolucci P, Blackstock J, Byass P, Cai W, et al. Health and climate change: policy responses to protect public health. The Lancet (British edition) 2015;386(10006):1861–914.
[3] Centers for Disease Control. CDC's Building Resilience Against Climate Effects (BRACE) framework. National Center for Environment Health; 2019 https://www.cdc.gov/climateandhealth/BRACE.htm.
[4] World Health Organization. WHO workplan on climate change and health aims and objectives: 2014 –2019. https://www.who.int/globalchange/health_policy/climate-change-and-health-workplan-2014-2019.pdf?ua=1(2015)

[5] Pillay C, van den Bergh J. Human health impacts of climate change as a catalyst for public engagement: combining medical, economic and behavioural insights. Int J Clim Change Strat Manage 2016;8(5):578–96. doi: 10.1108/IJCCSM-06-2015-0084.
[6] World Health Organization. Strategising national health in the 21st century: a handbook. World Health Organization; 2016 https://apps.who.int/iris/handle/10665/25022.
[7] Hansen DE, Kristensen FB. Exploring qualitative research wynthesis: the role of patients' perspectives in health policy eesign and decision making. Patient Patient-Center Outcom Res 2012;4(3):143–52. doi: 10.2165/11539880-000000000-00000.
[8] Judge K. Politics and health: policy design and implementation are even more neglected than political values? Eur J Public Health 2008;18(4):355–6. doi: 10.1093/eurpub/ckn043.
[9] Kickbusch I. Policy innovation for health. New York: Springer; 2009. p. 1–21. doi: 10.1007/978-0-387-79876-9.
[10] Akerlof K, Debono R, Berry P, Leiserowitz A, Roser-Renouf C, Clarke K, et al. Public perceptions of climate change as a human health risk: surveys of the United States, Canada and Malta. Int J Environ Res Public Health 2010;7(6):2559–606.
[11] Graham R, Compton J, Meador K. A systematic review of peer-reviewed literature authored by medical professionals regarding US biomedicine's role in responding to climate change. Prev Med Rep 2018;13:132–8. doi: 10.1016/j.pmedr.2018.11.014.
[12] Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs 2005;52(5):546–53. doi: 10.1111/j.1365-2648.2005.03621.x.
[13] Noble H, Smith J. Reviewing the literature: choosing a review design. Evid Based Nurs 2018;21(2):39–41. doi: 10.1136/eb-2018-102895.
[14] Maibach EW, Chadwick A, McBride D, Chuk M, Ebi KL, Balbus J. Climate change and local public health in the United States: preparedness, programs and perceptions of local public health department directors. PluS One 2008;3(7) e2838 −e2838. doi: 10.1371/journal.pone.0002838.
[15] Paterson JA, Ford JD, Ford LB, Lesnikowski A, Berry P, Henderson J, et al. Adaptation to climate change in the Ontario public health sector. BMC Public Health 2012;12(1) 452-452.
[16] Bedsworth L. Preparing for climate change: a perspective from local public health officers in California. Environ Health Perspect 2009;117(4):617–23. doi: 10.1289/ehp.0800114.
[17] Woodhall SC, Landeg O, Kovats S. Public health and climate change: how are local authorities preparing for the health impacts of our changing climate? J Public Health (Oxf) 2019. doi: 10.1093/pubmed/fdz098.
[18] Awuor L, Meldrum R, Liberda EN. Institutional engagement practices as barriers to public health capacity in climate change policy discourse: lessons from the Canadian Province of Ontario. Int J Environ Res Public Health 2020;17(17):6338. −. doi: 10.3390/ijerph17176338.
[19] Gould S, Rudolph L. Challenges and opportunities for advancing work on climate change and public health. Int J Environ Res Public Health 2015;12(12):15649–72.
[20] World Health Organization. National health policies,strategies and plans. World Health Organization. https://www.who.int/nationalpolicies/processes/stakeholders/en/.
[21] Myers TA, Nisbet MC, Maibach EW, Leiserowitz AA. A public health frame arouses hopeful emotions about climate change: a Letter. Climatic Change 2012;113 (3):1105–12. doi: 10.1007/s10584-012-0513-6.
[22] Kabir MI, Rahman MB, Smith W, Lusha MAF, Azim S, Milton AH. Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. BMC Public Health 2016;16 (1) 266−266. doi: 10.1186/s12889-016-2930-3.
[23] Plotnikoff RC, Wright MF, Karunamuni N. Knowledge, attitudes and behaviours related to climate change in Alberta, Canada: implications for public health policy and practice. Int J Environ Health Res 2004;14(3):223–9. doi: 10.1080/0960312042000218633.
[24] DeBono R, Vincenti K, Calleja N. Risk communication: climate change as a human-health threat, a survey of public perceptions in Malta. Eur J Public Health 2012;22 (1):144–9. doi: 10.1093/eurpub/ckq181.
[25] Haque MA, Yamamoto SS, Malik AA, Sauerborn R. Households' perception of climate change and human health risks: a community perspective. Environ Health 2012;11(1) 1−1. doi: 10.1186/1476-069X-11-1.
[26] Toan DTT, Kien VD, Giang KB, Minh HV, Wright P. Perceptions of climate change and its impact on human health: an integrated quantitative and qualitative approach. Glob Health Action 2014;7(1) 23025−23025. doi: 10.3402/gha.v7.23025.
[27] Hathaway J, Maibach EW. Health implications of climate change: a review of the literature about the perception of the public and health professionals. Curr Environ Health Rep 2018;5(1):197–204.