



Public Health Messages About Face Masks Early in the COVID-19 Pandemic: Perceptions of and Impacts on Canadians

Ying Shan Doris Zhang¹ · Heather Young Leslie² · Yekta Sharafaddin-zadeh¹ · Kimberly Noels¹ · Nigel Mantou Lou³

Accepted: 5 February 2021 / Published online: 20 February 2021

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC part of Springer Nature 2021

Abstract

Early in the COVID-19 pandemic, Canadians faced much ambiguity in the public health messages around face mask use. As public health messaging plays a pivotal role in the provision of directives during a health crisis, this study examines Canadians' opinions on the early messaging they received regarding personal protection, especially around mask use, with the goal of identifying potential improvements to strengthen future health messaging. Nine online focus group interviews with 47 Canadians were conducted. These natural conversations focused on personal protective equipment (PPE) choices, mask-relevant public health information sources, and advice to Canadian authorities to improve public health messaging on mask use. Responses were imported into NVivo for thematic analysis. Four meta-themes of relevance were identified. Despite demonstrating trust in scientific evidence and public health authorities, the inconsistencies in public health messaging fostered confusion, and induced mistrust toward health professionals. Further, several information deficits were identified pertaining to the scientific efficacy, safe use, and disposal of masks. Rooted in loyalty to healthcare workers, these Canadians eschewed using medical grade masks during PPE shortages to ensure a sufficient supply for medical workers. The findings stress that consistency in public health messages should be prioritized, with necessary changes clearly justified and explained. More information should reach the public on the scientific benefits and proper use of masks. Public health recommendations should be evidence-based, simple, transparent, and realistic in the current circumstances to guide Canadians to make more informed personal protection choices in the rapidly evolving pandemic.

Keywords COVID-19 · Face masks · Public health messaging · Respiratory infections · Prevention

Introduction

The global outbreak of the novel coronavirus 2019 (COVID-19) caused significant disruption to society and strains on the public health system. In Canada, more than 520,000 confirmed cases of COVID-19 have been recorded, with a death toll exceeding 14,000 [1]. Since March 11, 2020, when the World Health Organization [2] officially declared COVID-19 a global pandemic, the primary aim of Canadian government

and health authorities has been to limit the spread of the SARS-CoV-2 virus among Canadians. Early public health messaging included firm instructions for hand washing, physical distancing, and self-isolation, and was intended to reduce the spread of this highly potent virus while the world awaited a viable vaccine [3]. The public health messaging about the use of face masks, however, was characterized by a lack of clarity in initial public health recommendations concerning the need for public mask use [4, 5]. Although by now mask use has been mandated in most of Canada, there remain those who are unconvinced by the benefits of mask-wearing to prevent the transmission of COVID-19 [6]. In facing a powerful second wave of the pandemic, public health messaging holds a pivotal role in providing direction to Canadians. This paper identifies several problems in the early health messaging on personal protective measures, and offers recommendations to strengthen future health messaging.

✉ Ying Shan Doris Zhang
yzd@ualberta.ca

¹ Department of Psychology, University of Alberta,
Edmonton, Canada

² Department of Anthropology, University of Alberta,
Edmonton, Canada

³ Research Institute of the McGill University Health Centre,
Montreal, Canada

Shifts in Public Health Messaging on Face Masks

Early in the outbreak, Canadian health authorities recommended against public use of face masks by healthy individuals, emphasizing a low need for masks in settings where exposure to COVID-19 remained minimal [7]. In line with this claim, the Canadian Chief Public Health Officer (CPHO) Dr. Theresa Tam stressed on March 30, 2020, that face masks ought to be reserved for healthcare workers, especially since these workers faced an initial shortage in personal protective equipment (PPE), and the preventative effect of face masks in public settings remained unclear [8]. Specifically, Dr. Tam cautioned against the use of face masks by untrained persons, on the grounds that incorrect use might increase the touching of one's face, which could heighten the possibility of self-contamination [9]. This recommendation aligned with the initial messaging of the WHO [5], which informed the public that the use of masks by healthy individuals could induce a false sense of security that might erode adherence to other more effective preventative measures (e.g., social distancing, hand hygiene, etc.).

However, in recognition of (1) the potential of transmission of COVID-19 by asymptomatic individuals, (2) other nations promoting the use of face coverings (e.g., Austria, China, Czechoslovakia, Jamaica; see Fig. 1), and (3) the climbing rate of community transmission in Canada, recommendations by Canadian health authorities on the public use of face masks changed. A key turning point was the CDC's recommendation on April 3, 2020, that cloth masks be used in public areas [10]. In consideration of the shortage in PPE faced by medical workers, the CDC [11] emphasized that “[c]loth face coverings are most likely to reduce the spread of COVID-19 when they are widely used by people in public settings” (para. 3), while surgical masks and respirators “should be reserved for healthcare workers and other first responders” (para. 4). This abrupt change in health recommendation was echoed by Canadian federal and provincial health authorities. On April 7, 2020, the Council of Chief Medical Officers of Health of Canada (CCMOH) began recommending the use of non-medical facial coverings in public areas [12]. The WHO also revised its recommendations to support the public use of face masks, on June 5, 2020 [13].

From early April 2020, mask-wearing was increasingly endorsed as a preventative health strategy across Canada, especially in contexts where physical distancing is not possible [14]. On April 17, the Federal Transport Minister, Marc Garneau, mandated masks on all public transit, and similar requirements began to spread across the provinces obliging Canadians to wear masks on public transportation and in all in-door public spaces ([15, 16]. By early June,

2020, concerned Canadians were promoting mask-wearing, sharing their messages on social media platforms. Sewing groups began to donate cloth masks. A new, non-profit organization, Masks4Canada, with members from health, law and other professions, released an open letter urging mask-wearing among Canadians via the message that “face coverings/masks are ESSENTIAL to fight the transmission of COVID-19” [17], para. 1). By early November, recognizing that COVID-19 was being transmitted by aerosols, Canada's CPHO advised using three-layer masks [18]. By this stage of the pandemic, unlike any other public health messages, those concerning mask use had undergone the most change. The mixed-messages about masks, including their necessity and efficacy, troubled Canada's pandemic response.

Inconclusive Findings in Face Mask Research

A contributing factor to the initial shift in public health recommendations was the paucity of evidence on the effectiveness of masks for preventing community-level transmission of respiratory infections. There was consensus that N95 respirators, followed by surgical masks, offered the greatest level of respiratory protection in clinical settings. Fabric masks were understood to provide the lowest level of airborne disease protection [19]. However, the efficacy of N95 respirators in community transmission prevention was considered uncertain, as they were primarily tested for healthcare usage [20]. Further, opinions regarding the efficacy of surgical and cloth masks were mixed. Despite some studies showing few additional benefits beyond other preventative health behaviours such as hand hygiene [21, 22], there was emerging evidence supporting the wide use of face masks for reducing respiratory infection transmission [23, 24].

Study Objectives

Possibly due to the supportive findings of recent research, public health officials turned to facial coverings in this time of urgency to flatten the curve in community transmission of COVID-19. While public health recommendations should be revised according to new scientific evidence, the dramatic and sometimes contradictory shifts may have induced confusion, or worse, mistrust in the messaging or the authorities providing the messages. Coupled with inconclusive scientific evidence supporting the recommended measures, these messages could leave Canadians confused as to what to do during a public health crisis, leading to serious public health consequences. To identify potential improvements that can be made to enhance the clarity, credibility, and effectiveness of future health messaging, the present study takes an inductive approach and utilizes focus group interviews to inquire

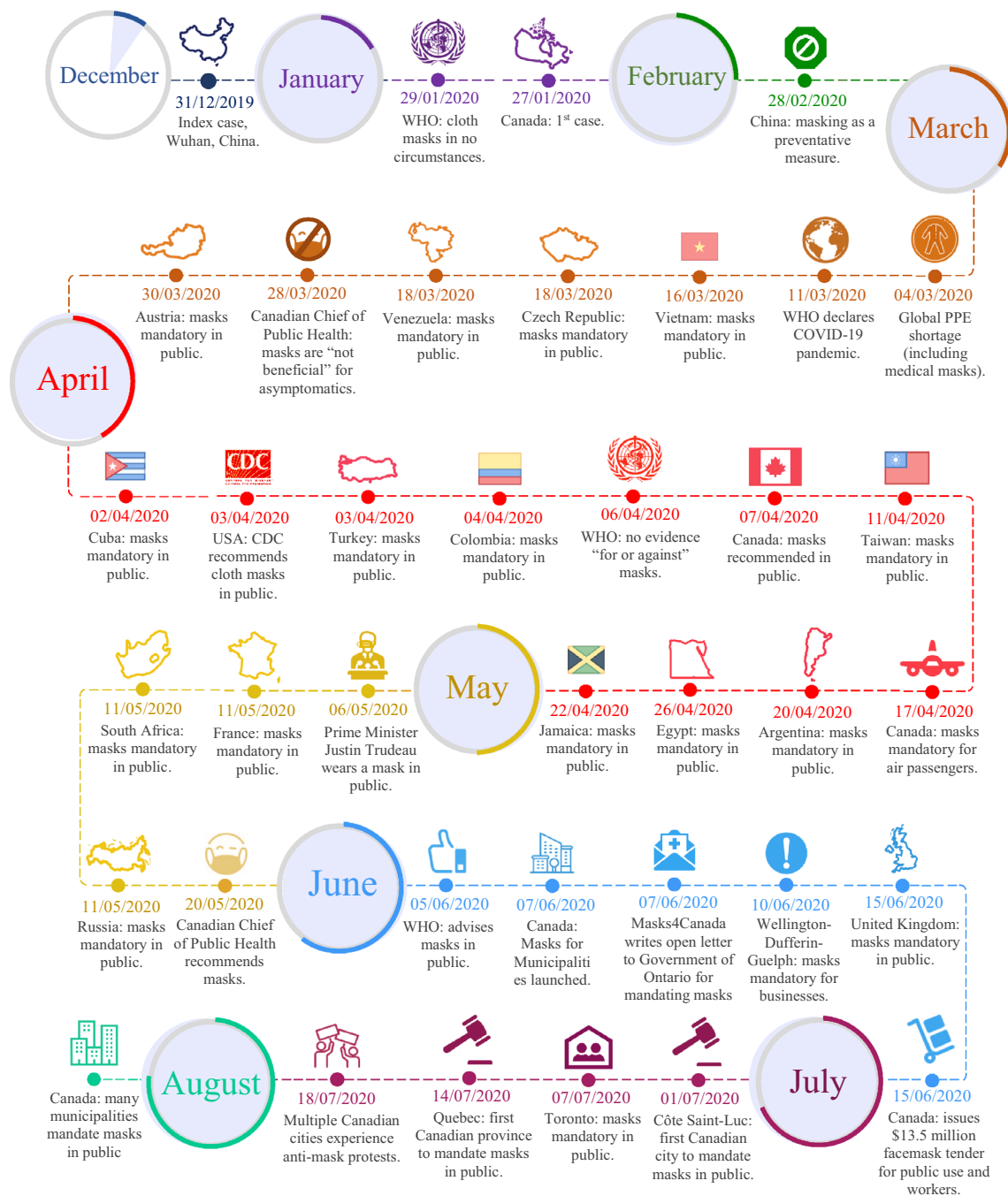


Fig. 1 Timeline of significant public health events and recommendations on the use of facemasks

into the subjective experiences of Canadians across Canada with the early public health messaging on mask use in the COVID-19 pandemic. Specifically, we were interested in the public health messages Canadians received, sources they trusted, and their opinions as to how Canadian public health messaging could be improved.

Method

Participants

A convenience sample of 47 Canadian citizens and

permanent residents (30 females; 17 males) were recruited via various social media platforms (e.g., Facebook, Twitter, Reddit) to participate in online focus group interviews. This study was approved by the University of Alberta's research ethics board. The participants' age ranged from 20 to 64 years, with an average age of 39.13 years, $SD = 13.71$. Thirty-one participants were born in Canada, three were born in Iran, three were born in the United States, and one was born in each of the following countries: China, England, Italy, Mexico, Romania, Slovakia, the United Kingdom, and Venezuela. The average length of residence in Canada among all participants was 25 years ($SD = 15.2$) with a range from 5 to 59 years. Twenty-seven participants resided in Alberta, nine in Ontario, two in British Columbia, two in Nova Scotia, one in Saskatchewan and one in Manitoba. Five participants did not report a province of residence. At the time of interview, 27 participants had previously worn a face mask, while the remaining 20 had not. Participants' professions, which were reported voluntarily during the interviews, included construction, customer service, higher education, journalism, medicine, naval services, and transportation.

Materials and Procedures

As part of a bigger study that investigates Canadians' attitudes and opinions of PPE during the COVID-19 pandemic (grant number: CIHR OV6-170365), participants responded to an online recruitment survey that obtained informed consent, demographic information, and previous use of masks. The focus group interviews were conducted from April to May 2020, using Zoom. Each interview was video-recorded and transcribed using Zoom's transcription service, with accuracy checking and speech-to-text transcription correction by research assistants. To ensure accuracy and credibility of the responses, participants were given the opportunity to review and correct their transcripts before the responses were analyzed. Each participant received a debriefing form and a \$30 honorarium.

Nine focus groups were held in total. Each contained four to six participants, and lasted between 60 and 90 minutes. Interviews were conducted by either Young-Leslie or Zhang, following a common script of open-ended questions and prompts that inquired about (1) personal protective equipment choices (e.g., "What have you been using to protect yourselves against COVID-19?"), (2) mask-relevant public health information sources (e.g., "How did you learn about using/caring for/disposing of a face mask?"), and (3) advice to Canadian authorities to improve public health messaging on mask use (e.g., "What advice would you give to health authorities to improve public health messaging around masks?"). Interactions between the participants were encouraged to ensure natural and spontaneous discussions.

Diverse perspectives were represented in each interview: after sorting for availability, each cohort varied in terms of age, country of birth, length and city of residence, and previous mask use. The only exception was sex. While seven groups were mixed, two same-sex groups (one all-female, one all-male) were created to ensure that comments and concerns, which might be inhibited in mixed-group discussions, could be collected. This particular design was discontinued after two interviews, as the discussions did not significantly differ from the mixed-groups.

Analytic Strategy

The interview transcripts were imported into NVivo for thematic analysis. We used the open-coding approach [25] to capitalize on the explorative nature of this study. The coding process entailed the following steps. First, all responses were thoroughly read to increase the researchers' familiarity with the data. Then, preliminary codes were generated and assigned to each statement of interest. Next, all codes were intensively reviewed and collated on shared similarities. Each group of codes was then assigned a label that captured the theme or common essence of the collated responses. To achieve objectivity and dependability in the findings, discrepancies in coding and the development of themes were discussed among the coding team until consensus was reached.

Results

Four major categories of themes related to public health messaging were identified, which included *Information Sources and Credibility*, *Inconsistencies and Mistrust*, *Information Wanted—The Proper Use, Effectiveness, and Benefits of Face Masks*, and *Guilt and Shame in Using Medical-Grade Masks*. Each meta-theme is presented below in detail (see Table 1).

Information Sources and Credibility

The participants identified various sources to obtain health advice and news related to the pandemic, including health professionals and organizations (e.g., Chief Medical Officer, Health Canada, CDC), social media platforms (e.g., Facebook, Twitter, Tiktok), news stations (e.g., CBC, Global News, CNN), government officials and websites (e.g., the Prime Minister, Canada.ca), internet search engine (e.g., Google), scientific and medical journals (e.g., *The Lancet*, *Nature*, *Science*), as well as from family and friends. Some also reported receiving information from other electronic sources, such as via TED talks and podcasts. Regardless of the information source, the participants voiced trust in the

Table 1 Themes in Canadians' opinions of the public health messages on face mask use early in the COVID-19 pandemic ($n=47$)

Meta-themes	Themes	Number of participants
1. Information sources and credibility	Information sources	
	1. Health professionals and organizations	28
	2. Social media	25
	3. Government officials and websites	17
	4. News	16
	5. Google	7
	6. Family and friends	4
	7. Scientific and medical journals	2
	8. Other	4
	Trust in public health spokesperson	9
2. Inconsistencies and mistrust	Inconsistencies in messaging on mask use	18
	Frustration and mistrust	8
3. Information wanted	Proper use of masks	24
	Effectiveness of homemade/cloth masks	12
	Scientific evidence supporting mask use	2
4. Guilt and shame in using medical-grade masks	Self-ascribed guilt	9
	"N-95" shaming	4

advice of health professionals over non-medical professionals (e.g., "I do trust our health professionals," "I'm relying on our Chief Medical Officer for those kinds of recommendations"). Specifically, some participants perceived health officials as more trustworthy than politicians (e.g., "I really trust [our] chief medical officer, I don't necessarily trust our premier," "In Alberta we have Dr. Deena Hinshaw. So what she says, people were listening to her and we're believing her. When the premier tried to step in and do a chart... it didn't work... [Y]ou need to have the proper person giving the information, someone that the public believes in." The trust in medical professionals was connected to their perceived neutrality from politics (e.g., "[Dr. Hinshaw] doesn't have anything at stake, other than keeping the most people alive and healthy. Politicians have other things to worry about").

Inconsistencies and Mistrust

Participants spoke about inconsistency, ambiguity, and mixed messages with specific respect to health authorities' recommendations on mask use. The inconsistencies left the participants uncertain about whether to wear masks in public areas, and whether for the protection of oneself or others (e.g., "[T]here was also some confusion that came from the World Health Organization, through Dr. Tam at the start too: should you wear it, should you not wear it... you know that uncertainty... create some uncertainty in my mind"). The inconsistencies and contradictions in public health recommendations not only frustrated the participants (e.g., "We

were told, remember, early on, not to wear masks... so that's annoying because we should have been wearing masks all the time"), it also created public skepticism and mistrust toward health authorities (e.g., "I think by switching the message around, it just fosters mistrust").

Information Wanted—The Proper Use, Effectiveness, and Benefits of Face Masks

We have identified three areas of public health information deficits pertaining to the *use*, *effectiveness*, and *benefits of face masks*, beginning with requests for education on the proper use of masks. Many participants recounted instances of what they perceived to be improper use of face masks in public areas (e.g., "[M]ost people wear [face mask] inside out," "I saw somebody... wearing an actual N95 mask on her neck"). A number of participants stressed a need for public health messages to underscore the accurate use of masks (e.g., "I think now that they have come around to... recommending the use of... masks... They could perhaps improve messaging on proper use because I have also seen people like just pulling [masks] on and off as they're talking"). Aside from expressing their concerns with improper wear, the participants also conveyed uncertainty in how to safely clean, store, and dispose face masks after use (e.g., "I wouldn't know how to wash [a mask] properly," "I'm trying to figure out... where can I put [a mask] to hang it because I'm not going to use it for another week and a half"), which may impede the use of masks in some cases (e.g., "[Th]e other reason I'm not using [masks] is I don't know how

to dispose of them afterwards”). Relatedly, the participants shared their outrage on the irresponsible disposal of used masks in the community (e.g., “[I]t’s appalling to see so many... masks just being left on the floor,” “[P]eople who are wearing these disposable masks... are... leaving them in... grocery carts”).

The second deficit in early public health messaging pointed to a lack of scientific evidence underpinning the effectiveness of fabric masks, especially homemade face coverings. Reflecting on the WHO’s early advice against the use of cloth masks, participants questioned the effectiveness of cloth masks in slowing the spread of COVID-19, believing that masks “may induce a false sense of security” and that a “mask will not protect you,” as it could induce “more risk of contamination inadvertently.” Further, doubts were casted on the efficacy of homemade masks in preventing COVID-19 transmission (e.g., “They have tested medical facemask and... respirator. So there is science and there is data on that. But the data on wearing something homemade is not conclusive”). Demonstrating confidence in scientific research, the participants called for clearer, evidence-based guidelines to assist them in choosing the most appropriate masks for personal protection (e.g., “I think there needs to be standards. I think you need to understand what is a good face mask, what is going to be the right thing to wear in what condition because it’s going to be different wherever... [There] is going to be one kind of mask in an airplane. Another one in the grocery store, another one in your car when you’re driving home”).

The third information deficit called for more public education on the benefits of mask use in effort to control the spread of COVID-19. In particular, the participants believed that Canadians need to be better informed about the protective efficacy of face masks against respiratory infections (e.g., “[There] just needs to be more education about the benefits of a face mask”). One participant recommended the use of more scientific illustrations in public health messaging to clearly demonstrate how masks work to contain the spread of respiratory viruses. Specifically, the participant disclosed, “I saw a video done by these Japanese scientists, it really opened my eyes... as to why people wear a mask. [I]f everyone saw that video I thought there’d be a huge, huge change in how people think.”

Guilt and Shame in Using Medical-Grade Masks

An unanticipated theme emerged from the interviews, which concerned the participants’ ascribed shame and guilt for using medical-grade masks outside of medical settings. Specifically, some participants believed that people who wore medical-grade masks (e.g., N95 respirators) should donate the masks to healthcare workers instead, who were perceived to be more deserving of its use (e.g., “With all

the hoarding that was going on near the start... if I saw people... wearing an [N95] out... I would think... that could go to someone who really needs it, who’s working in... a healthcare setting,” “if I saw someone wearing an N95... maybe I’d be like, hey, why you got that? Where’d you get that from? Why didn’t you give it to your nurse friend?”). There was also concern about avoiding public judgement for using PPE needed by frontline healthcare workers (e.g., “I saw a video of someone shaming people wearing masks”). Paradoxically, some participants who owned N95 respirators or medical masks before the COVID-19 pandemic eschewed using them, even though they understood that such equipment offered the greatest level of respiratory protection (e.g., “I don’t think I’d wear [N95 respirators] out, because of this concern that someone might be like oh, you’re taking those from healthcare workers,” “I feel bad using [an N95 respirator]... what are people gonna think, I stole these from medical professionals?”). The stigma of using medical PPE in public subjected the owners to even more guilt for owning these masks, and yet, not using them. For instance, the participants disclosed, “I feel guilty about having that many [N95 respirators] and not using them,” and “I feel bad... maybe I should donate the [N95 respirators].”

Discussion

Our study shows that the Canadians who participated in our study were attentively following public health recommendations for guidance and directives in this global health crisis. They were using a variety of sources to obtain public health information, and appreciated having scientific evidence to support the recommended measures. Further, we found that Canadians stood in solidarity with public health workers, held high regard for Canadian health authorities, and voiced trust in the messaging communicated by public health officials. This is reflected in the way the participants adopted terminologies rooted in public health, such as “self-contamination” and “false sense of security”. However, despite demonstrating loyalty and a high regard for health professionals, results from the thematic analysis highlighted several issues with Canada’s early public health messaging concerning mask use. We first discuss each issue in detail, before proceeding to the recommendations for future health messaging.

First, our interviews captured an emerging sense of mistrust connected expressly to the mixed and shifting messages around the use of face masks. In the early phases of Canada’s pandemic response, the shifts in public health recommendations led to frustration and skepticism among Canadians. Particularly when trust and solidarity are well recognized pillars of public health messaging [26], the early decline in trust could lead to more severe public criticism of authorities

in the second wave of the pandemic [27]. This finding provides a timely precaution for Canada. Rather than accepting the loss of trust as an inevitable part of pandemic-fatigue, public health messaging in the coming months should aim at building on the strong base of solidarity that Canadians have expressed for health workers (restoring trust), and confidence in science. This messaging will be particularly vital when medical interventions (e.g., a vaccine) or political actions (e.g., further lockdowns) become viable and necessary measures to contain the spread of COVID-19.

Second, our findings delineated Canadians' desire and requests for more information and education concerning the safe use, maintenance, and disposal of face masks, according to prescribed medical standards. Particularly, equal emphasis should be placed on informing the public on the benefits of wearing masks, as well as the importance of wearing masks *properly* to achieve the intended level of protection. In other words, the degree of protection achieved by wearing masks and wearing masks *correctly* (e.g., covering both the mouth and nose, avoiding unnecessary touching of masks) can be very different. The participants stressed that while Canadians have received a clear message emphasizing mask use, not enough information has reached the public on the consequences of improper wear, including its detrimental impact on the nation's effort to "flatten the curve" of COVID-19 transmission. Relatedly, Canadians expected to receive more information concerning the proper care of masks between use (e.g., cleaning and storage), as well as how to safely dispose of masks after use. Especially when the outer layer of masks are directly exposed to potential pathogens, proper wear and care helps to minimize unexpected health risks.

Third, expressing a high regard for healthcare professionals, the participants eschewed using medical PPE that they believed should be reserved for frontline medical workers. Specifically, the guilt of using and owning medical-grade masks, along with the participants' disapproval of others who wore medical masks in times of PPE shortage, are rooted in Canadians' loyalty to medical workers and professionals. In respect to Canadians' solidarity with healthcare workers, it is imperative to reassure the public that using certain PPE would not compromise the use and safety of medical workers, which helps to alleviate the associated guilt and encourages wider public endorsement.

Recommendations for Future Health Messaging

For a communications campaign to be credible and effective in impacting behaviour, it should be coordinated, clear, consistent, and fact-based. It should recognize that people use multiple channels to gain information, and are likely to trust non-partisan, local speakers [27]. Specifically, our findings underscore the importance of designating reputable medical professionals as spokespersons to

deliver public health guidelines, in addition to role-modelling the recommended behaviours, to increase the credibility of the messages and strengthen public receptiveness. Further, when change in public health messaging is inevitable due to the rapidly evolving nature of the situation, all changes should be clearly justified and explained based on new scientific evidence [28]. Doing so also increases transparency in public health messaging, which helps the public to better understand the underlying reasons for each recommendation and enforced measures to make more informed choices regarding personal protection.

Since March, 2020, Canadians have endured lockdowns, phased relaunches, fearsome infection numbers and deaths, and are now facing a powerful second wave of the pandemic. Masks are firmly entrenched as a recommended public health measure, and are becoming normalized in many communities. Yet, with airborne transmission recognized [29], and an emerging anti-masking resistance, public health messaging should include scientific evidence of the efficacy of public mask-wearing in combating community transmission, including recent research into fabric efficacy, and the potential for an antiviral coating (e.g., [30]).

Moreover, when introducing new PPE, the public needs to be educated early in regards to the benefit of use, and the criticality of proper use, storage, and disposal, in reference to specific scientific evidence. Pertaining to mask use, we recommend a harm-reduction approach that recognizes that people will need to adjust masks that slip, glasses that fog, and hearing aids that get tangled. We recommend acknowledging that people may need to re-use a single mask in multiple locations in a day. Messaging should include user-friendly options for disinfecting a cloth mask when laundering is not possible, and instructions for safe disposal of disposable masks. These instructions would also include assuring public access to the appropriate means and facilities for mask disposal.

Furthermore, it appears that not enough messaging has underscored the severity of personal health consequences, if one refuses to comply with the recommended public health measures. Hence, aside from promoting social responsibility, strengthening the emphasis on personal health consequences of non-compliance in this critical time may help to override the concerns contributing to non-compliance, such as infringement on personal rights and freedom.

In addition, since Canadians tend to use a variety of sources to obtain public health information, we recommend creating news items, social media memes, instructional posters, cartoons, and videos to disseminate key messages. These should be targeted to varied local, linguistic, cultural, age, and especially at-risk or vulnerable communities. The messaging should be honest, realistic, clear, that avoids technical jargons and considers the various literacy levels of the

general public to achieve broad-reaching effects among a diverse Canadian population.

Limitations and Directions for Future Research

There are a few limitations with the current study that need to be considered in interpreting the findings. The current sample may lack representativeness in two aspects. First, the small sample size necessitated by an interview study poses geographical restrictions, leaving certain provinces unrepresented or under-represented in the interviews. Second, this is a self-selected sample, meaning only the opinions of Canadians who were interested to converse about PPE were included in the study; hence, the findings may not generalize to all Canadians. Moreover, the opinions were gathered from a general population via interviews that were conducted in English, which may overlook the informational needs of specific ethnolinguistic groups in Canada (e.g., French-Canadians, Chinese-Canadians, Indigenous populations, etc.). As Canada is a multicultural nation, the perspectives of various ethnic groups should be reflected in order for Canada's public health messaging to provide more informed guidance. For instance, interviewing diverse ethnic-racial groups in different languages may give rise to other perspectives, especially from the groups that are more advanced in using certain PPE, which could offer additional insight to Canada's public health strategies at this unprecedented time.

Moreover, as the use of fabric masks becomes increasingly common in public sectors, better scientific knowledge and testing on textile products (e.g., more rigorous testing of the filtration efficiency of different fabrics and fabric treatments), and including this research in public health messaging would ally concerns about the effectiveness of fabric masks in preventing infection [31]. Since public use of face masks is a relatively new cultural practice in Canada, anthropological and sociological research into understanding the reasons for wearing a mask, the applicability of different masks, and how masks can be handled would help public health authorities design more targeted and effective messages.

Furthermore, as education and work continue into the second wave of the pandemic, health and safety protocols, including mass-masking, are pressing matters under discussion to safeguard the well-being of students and employees against COVID-19. As mask-wearing extends into Canadians' daily lives, public health messaging should also address concerns related to practical-use, such as the challenges experienced by persons with accessibility concerns (e.g., the deaf). In response, we are currently interviewing health services and frontline workers, parents of school-aged children, and potentially Canadians with hearing impairment, to acquire their perspectives on preventative health measures, and to identify their emerging concerns and needs in public

health messaging. Although our research is ongoing, we felt the rapidly changing situations warranted this publication. The present study strives to provide timely information for improving Canada's public health messaging, to ensure Canadians are equipped with the appropriate knowledge to make informed choices regarding personal protection in this rapidly evolving pandemic.

Conclusion

Public health messaging plays a vital role in the COVID-19 pandemic. In the struggle to ensure health and safety amid the second wave, public health officials have become an important source of guidance and direction. Focusing on the importance of public health information during the pandemic, the present study identified several issues with Canada's early public health messaging regarding personal protective measures against COVID-19. Despite the rapidly changing nature of the pandemic, public health messages should strive for consistency and clarity. Inconsistency in public health recommendations caused confusion, frustration and mistrust, laid the ground for mask skepticism, and resulted in "N95 shame"—paradoxical behaviour by some well-meaning Canadians. To combat the negative effects of change, shifts in public health messages should be clearly explained and accompanied by the best available evidence, to help the public understand why the changes were necessary. Importantly, as mask use extends, Canadians voiced a need for public health messaging for mask-literacy: (1) train the public on the proper ways of using and disposing of face masks, following standardized guidelines, while raising public awareness on the health consequences of improper wear and disposal; (2) use clear, simple, and evidence-based information to educate the public on the science behind face masks in regards to protection against the transmission of respiratory infections; and (3) be honest and transparent with the public on the benefits and precautions in using certain PPE and preventative measures, especially in relation to personal safety and protection, thereby helping Canadians to form more realistic expectations on the pros and cons of use and non-use. Incorporating these areas of information into future health messaging could help Canadians to gain a clearer understanding of the recommended measures, and guide them to make more informed choices in preventative health practices during this unprecedented time.

Acknowledgements We thank Rachel Kastendieck for her editorial assistance. We are deeply grateful for Camilla Osman and Ramanjot Kalher for their research assistance.

Author contributions Ying Shan Doris Zhang, Heather Young Leslie, Kimberly Noels, and Nigel Mantou Lou contributed to the study

conception and design. Material preparation, data collection and analysis were performed by Ying Shan Doris Zhang and Heather Young Leslie. The first draft of the manuscript was written by Ying Shan Doris Zhang. The timeline figure was prepared by Yekta Sharafaddin-zadeh. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding This research was supported by the Canadian Institutes of Health Research (CIHR) Operating Grant (OV6-170365).

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval This study has been approved by the University of Alberta Research Ethics Board (Pro00099471).

Informed Consent All participants provided their informed consent, including their acknowledgement of the purpose, benefits, and potential risks of this study, as well as their rights as participants prior to their participation. All participants have agreed for their responses to be presented anonymously for publication purposes.

References

- Government of Canada. (2020a). *Coronavirus disease 2019 (COVID-19): Epidemiology update*. <https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html>
- World Health Organization. (2020a). *WHO Director-General's opening remarks at the media briefing on COVID-19, 11 March 2020*. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
- Government of Canada. (2020b). *Public health guidance for schools (K-12) and childcare programs (COVID-19)*. [https://www.publicboard.ca/News/PublicHealthAdvisory/Documents/Govt%20of%20Canada%20Feb%2028%202020%20Public%20Health%20Guidance%20for%20Schools%20\(K-12\)%20and%20Childcare%20Programs%20\(COVID-19\).pdf](https://www.publicboard.ca/News/PublicHealthAdvisory/Documents/Govt%20of%20Canada%20Feb%2028%202020%20Public%20Health%20Guidance%20for%20Schools%20(K-12)%20and%20Childcare%20Programs%20(COVID-19).pdf)
- Centers for Disease Control and Prevention [CDC]. (2020a). *Transcript for CDC telebriefing: CDC update on novel coronavirus*. <https://www.cdc.gov/media/releases/2020/t0212-cdc-telebriefing-transcript.html>
- World Health Organization [WHO]. (2020c). *Stay healthy—Protect yourself against COVID-19*. <http://www.emro.who.int/omn/oman-news/stay-healthy-protect-your-self.html>
- CBC News. (2020a, December 2). *Anti-mask organizers charged for weekend rally in Calgary*. <https://www.cbc.ca/news/canada/calgary/anti-mask-rally-bylaw-tickets-issued-police-pawlowski-1.5825853>
- Franklin, M. (2020, April 3). Alberta Health says face masks only required if you are sick. *CBC News*. <https://calgary.ctvnews.ca/alberta-health-says-face-masks-only-required-if-you-are-sick-1.4881751?cache=yes%3FclipId%3D89578>
- CTV News (Producer). (2020, March 30). *Dr. Tam on Whether Public Should Wear Masks* [Video file]. <https://www.ctvnews.ca/video?clipId=1930965>
- Maher, S. (2020, March 31). The coronavirus question: To mask or not to mask. *MACLEAN'S*. <https://www.macleans.ca/news/canada/the-coronavirus-question-to-mask-or-not-to-mask/>
- Howard, J. (2020, June 5). WHO calls on nations to encourage the public to wear fabric face masks where coronavirus is spreading. *CNN*. <https://www.cnn.com/2020/06/05/health/face-mask-coronavirus-who-recommendations-bn/index.html>
- Centers for Disease Control and Prevention [CDC]. (2020b). *Interim Guidance: Wearing of face masks while on public conveyances and at stations, ports, and similar transportation hubs*. <https://www.cdc.gov/quarantine/masks/mask-travel-guidance.html>
- Tasker, J. P. (2020, April 6). Canada's top doctor says non-medical masks can help stop the spread of COVID-19. *CBC News*. <https://www.cbc.ca/news/politics/non-medical-masks-covid-19-spread-1.5523321>
- World Health Organization [WHO]. (2020b). *Advice on the use of masks in the context of COVID-19: Interim guidance, 05 June 2020*. <https://apps.who.int/iris/handle/10665/332293>
- Gilmore, R. (2020, May 20). It's now recommended that Canadians wear face masks. *CTV News*. <https://www.ctvnews.ca/politics/it-s-now-recommended-that-canadians-wear-face-masks-1.4946752>
- CBC News. (2020b, May 20). *Ontario recommends masks for public transit riders as 390 new COVID-19 cases confirmed*. <https://www.cbc.ca/news/canada/toronto/covid-19-coronavirus-ontario-may-20-update-1.5576659>
- Transport Canada. (2020). *New measures introduced for non-medical masks or face coverings in the Canadian transportation system*. <https://www.canada.ca/en/transport-canada/news/2020/04/new-measures-introduced-for-non-medical-masks-or-face-coverings-in-the-canadian-transportation-system.html>
- Masks4Canada. (2020). *Masks4Canada—Canadian doctors, professionals, and citizens for universal masks*. <https://masks4canada.org>
- Tunney, C. (2020, November 3). Canada's top public health doctor now recommends 3-layer non-medical masks. *CBC News*. <https://www.cbc.ca/news/politics/three-layer-mask-tam-1.5787946>
- Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., Schünemann, H. J., et al. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis. *The Lancet*, 395(10242), 1973–1987. [https://doi.org/10.1016/S0140-6736\(20\)31142-9](https://doi.org/10.1016/S0140-6736(20)31142-9)
- MacIntyre, C. R., Wang, Q., Cauchemez, S., Seale, H., Dwyer, D. E., Yang, P., et al. (2011). A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. *Influenza and Other Respiratory Viruses*, 5, 170–179.
- Cowling, B. J., Chan, K. H., Fang, V. J., Cheng, C. K., Fung, R. O., Wai, W., et al. (2009). Facemasks and hand hygiene to prevent influenza transmission in households: A cluster randomized trial. *Annals of Internal Medicine*, 151(7), 437–446. <https://doi.org/10.7326/0003-4819-151-7-200910060-00142>
- Larson, E. L., Ferng, Y. H., Wong-McLoughlin, J., Wang, S., Haber, M., & Morse, S. S. (2010). Impact of non-pharmaceutical interventions on URIs and influenza in crowded, urban households. *Public Health Reports*, 125(2), 178–191. <https://doi.org/10.1177/003335491012500206>
- Chan, J. F., Yuan, S., Zhang, A. J., Poon, V. K., Chan, C. C., Lee, A. C., et al. (2020). Surgical mask partition reduces the risk of noncontact transmission in a golden Syrian hamster model for coronavirus disease 2019 (COVID-19). *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, 71(16), 2139–2149. <https://doi.org/10.1093/cid/ciaa644>
- Fisman, D. N., Greer, A. L., & Tuite, A. R. (2020). Bidirectional impact of imperfect mask use on reproduction number of COVID-19: A next generation matrix approach. *Infectious*

- Disease Modelling*, 5, 405–408. <https://doi.org/10.1016/j.idm.2020.06.004>.
25. Green, J. J. (2006). *Analyzing data from focus groups* [PowerPoint slides]. Delta State University. <http://ntweb.deltastate.edu/abarton/OldCourses/SOC474SP06/SOC474Pages/Green,%20Focus%20Grp%20Analysis.pdf>
 26. Bernhardt, J. M. (2004). Communication at the core of effective public health. *American Journal of Public Health*, 94(12), 2051–2053. <https://doi.org/10.2105/ajph.94.12.2051>.
 27. Moreno, C., Wykes, T., Galderisi, S., Nordentoft, M., Crossley, N., Jones, N., et al. (2020). How mental health care should change as a consequence of the COVID-19 pandemic. *The Lancet Psychiatry*, 7(9), 813–824. [https://doi.org/10.1016/S2215-0366\(20\)30307-2](https://doi.org/10.1016/S2215-0366(20)30307-2).
 28. Crowley, A. E., & Hoyer, W. D. (1994). An integrative framework for understanding two-sided persuasion. *Journal of Consumer Research*, 20(4), 561–574.
 29. World Health Organization [WHO]. (2020d). *Transmission of SARS-CoV-2: Implications for infection prevention precautions*. <https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions>
 30. Quan, F. S., Rubino, I., Lee, S. H., Koch, B., & Choi, H. J. (2017). Universal and reusable virus deactivation system for respiratory protection. *Scientific Reports*, 7, 39956. <https://doi.org/10.1038/srep39956>.
 31. Bissonnette, A. (2020, May 7). *Cloth face masks: Merging science & home remedies*. <https://clothingtextiles.ualberta.ca/clothfaceasks/>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.