

The Effects of Different Message Frames on COVID-19 Vaccine Hesitancy and Beliefs

by

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Abstract

This survey experiment investigated the effect of differently framed public health messages on COVID-19 vaccine beliefs, and whether their effect was influenced by various individual differences. Participants in a Canadian sample ($N=393$) were randomly assigned to read a message addressing either the benefits of vaccinating for others, the health consequences of COVID-19 for vulnerable populations, the safety and efficacy of the vaccines with general or specific information, or the widespread willingness of Canadians to be vaccinated. The control group received no messaging. Overall, exposure to messaging did not predict beliefs toward the vaccines, however, participants who read the message addressing the widespread willingness to be vaccinated reported more negative beliefs. The effect of messaging significantly depended on political orientation and conspiracist ideation, which in addition to younger age, male gender, and greater religiosity, predicted negative beliefs toward the vaccines. These findings may inform efforts to improve COVID-19 vaccine uptake.

Keywords: COVID-19 vaccine hesitancy, COVID-19 vaccine beliefs, public health messaging, message frames

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The Effects of Different Message Frames on COVID-19 Vaccine Hesitancy and Beliefs

The threat of the COVID-19 pandemic has led to various governments implementing large-scale restrictions which, despite being effective in reducing the spread of infection, have had significant economic and social consequences (Brooks et al., 2020; Deady et al., 2020; Fernandes, 2020). With the development of COVID-19 vaccines, adherence to public health recommendations to vaccinate against the virus represents the most effective way of combatting the pandemic (Wang et al., 2020). Nonetheless, the success of these efforts is highly dependent on the number of people willing to follow vaccination guidelines.

Vaccine hesitancy, defined by the World Health Organization as the “delay in acceptance or refusal of vaccination despite the availability of vaccination services” (2018), has been highly volatile in Canada throughout the pandemic (Larson et al., 2022). Concerningly, a recent Global News Ipsos poll conducted between Dec. 14 and 16, 2022 found that Canadians are gradually losing motivation to receive additional doses of COVID-19 vaccines (Wright, 2023). While current vaccination rates have successfully reduced COVID-19 cases and deaths, vaccine uptake is still required to limit the effects of the virus as new variants emerge. Accordingly, further research is needed to help government and public health officials effectively disseminate recommendations to vaccinate to maximize our chances of controlling the pandemic (French et al., 2020; Ghio et al., 2020; WHO, 2021).

To this end, several studies have reported reductions in COVID-19 vaccine hesitancy as a result of exposure to messaging with different frames (e.g., Borah, 2022; Huang & Liu, 2022; Palm et al., 2021). As described by Entman (1993), “To frame is to select some aspects of a perceived reality and make them more salient in a communicating text in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment

recommendation” (p. 52). In other words, framing refers to how certain information is presented and highlighted in a message with the intent to alter attitudes or behaviours (Vliegenthart, 2012). Many of the message frames which have the most evidence supporting their ability to reduce COVID-19 vaccine hesitancy are those which emphasize the safety and efficacy of the vaccines (Palm et al., 2021) or the benefits of vaccinating for the sake of personal health and the health of others (Ashworth et al., 2021). Currently, however, there is no consensus on which message frame is most effective in reducing COVID-19 vaccine hesitancy for the general public. Likewise, the elevated rates of vaccine hesitancy found in certain demographics, such as young adults and those who identify as female, politically conservative, and religious, for example, highlight the importance of further research investigating strategies to effectively tailor recommendations to vaccinate against COVID-19 (Mewhirter et al., 2022).

Canada’s Public Health Messaging During the Pandemic

As we progress through the pandemic, future efforts to improve Canada’s public health messaging should be considered in the context of how previous efforts were received. In this regard, Canada’s previous efforts have been criticized throughout the pandemic, particularly during the early stages when much of the public found the messaging to be unrelatable, outdated, unfair, and confusing (Deschamps, 2020; Glauser, 2020). As new scientific information is gathered, a particular challenge has been communicating changes in public health guidelines for the COVID-19 vaccines, leading many to be fatigued and confused by what some have referred to as mixed messaging (Wright, 2022). It has also been argued that demographics with higher rates of vaccine hesitancy have not been effectively targeted. For example, Tsai, a professor of market research from the University of Toronto, has commented that traditional means of communication, such as having politicians or doctors deliver public health guidelines in televised

press conferences, fail to resonate with younger age groups (Deschamps, 2021). The professor expressed feeling that several of Canada's public health advertisements were "like a boomer trying to make a 'fun ad' for gen Z without actually knowing how to speak to them," adding that the message needs to be delivered on social media platforms in a way that appeals to them.

The way Canada's public health messages have been framed has also been criticized (Struck, 2020). Most of the messaging from public health officials and politicians in Canada was fear-based, according to Struck (2020), meaning they were intended to provoke fear. An example to illustrate includes Ontario's Premiere stating "I've never stressed this so much...we are in a crisis. That's how I can describe it. It is scary and we need to work together" in a press conference on January 8th, 2021 (Wilson, 2021). This raises concerns as many authors have warned against the use of fear-based messaging during the COVID-19 pandemic (see Heffner et al., 2021; Stollow et al., 2020) due to the evidence suggesting they can be ineffective or even counter-productive (Fishbein et al., 2002; Lang & Yegiyani, 2008; Myers et al., 2012; Nabi et al., 2018; Roeser, 2012; Zhao et al., 2006). In contrast, there is evidence supporting the potential effectiveness of several other message frames in reducing vaccine hesitancy warranting further investigation.

What Does an Effective Public Health Campaign Look Like?

During the early stages of the pandemic, a review by Ghio et al. (2020) provided recommendations on how to optimize public health communications in the context of COVID-19. Here, the authors organized the components of effective public health messaging by applying a model developed by Michie and colleagues (2011) known as The Behaviour Change Wheel, also known as the COM-B system. According to this model, public health messaging should support an individual's capability, opportunity, and motivation to practice positive health

behaviours. Broadly, they suggested that an individual's capabilities can be increased through the dissemination of accurate information, that opportunities can be generated via the creation of social norms and physical resources, and that motivation can be increased by emphasizing the importance of following guidelines. Many of the recommendations provided within this review form the basis of the current study, namely, the use of strategically framed messages.

Message Framing and Response to the COVID-19 Pandemic

The Effects of Framing the Importance of Prosocial Actions

Prosocial message framing reflects a collectivist orientation by emphasizing the communal or societal benefit of an action (Heffner et al., 2021). Historically, collectivistic cultures are more likely to practice preventative measures (PMs) when compared to individualistic cultures, making them less susceptible to disease spread and outbreaks (Morand & Walther, 2018). During both the H1N1 and COVID-19 pandemics, concern for the safety of others has proven to be an important determinant in vaccine uptake and adherence to recommended PMs (Lin et al., 2014; Shmueli, 2021). Consequently, the expectation that the COVID-19 vaccines help protect the health of others is one of the primary reasons why we observe higher rates of uptake in collectivist countries (Leonhardt & Pezzuti, 2022).

Individualism, which refers to a focus on personal well-being, is a significant behavioural driver of vaccine hesitancy, leading several authors to recommend messaging which emphasizes prosocial values when communicating COVID-19 public health guidelines (Ghio et al., 2020; Jordan et al., 2020; Khan et al., 2022). The literature suggests that prosocial messaging can often be effective due to its potential to increase empathy, the perception that others are at risk, and by strengthening moral incentives to practice PMs (Cho & Lee, 2015; Everett et al., 2020; Germani et al., 2020; Ghio et al., 2020; Jordan et al., 2020; Ozer et al., 2020). The use of prosocial

messaging highlighting the importance of following public health guidelines for the safety of others has been supported in several studies during the current pandemic (Germani et al., 2020; Heffner et al., 2021; Lawes-Wickwar et al., 2021; Nivette et al., 2021; Zajenkowski et al., 2020).

For example, Capraro and Barcelo (2020) found that intentions to wear a mask were significantly increased by messaging which emphasized the virus' threat to the community when compared to other types of message frames. Similarly, Luttrell and Petty (2020) found that participants perceived prosocial messaging to be more moral and persuasive when compared to self-oriented messaging, especially when participants considered the pandemic to be a moral issue. A similar study by Everett et al. (2020) found that behavioural intentions to practice PMs were strongest after participants were exposed to messaging that emphasized the participant's responsibilities toward others. Nonetheless, Everett et al. (2020) noted that the effects in their study were small and do not survive conventional levels of statistical significance, and many other studies show inconclusive evidence in support of prosocial messaging in the context of COVID-19 (e.g., Favero & Pedersen, 2020; Hacquin et al., 2020; Jordan et al., 2020).

For instance, Hacquin et al. (2020) compared a poster with a prosocial message encouraging the practice of PMs to other posters with different message frames but found no differences in their effectiveness. Favero and Pedersen (2020) were also unable to find any differences in intentions to practice social distancing in a study comparing the effectiveness of five different messages with varying degrees of prosocial appeal. Additionally, a multi-part study by Jordan et al. (2020) found that posters with prosocial messaging were more effective than those with self-oriented messaging in promoting intentions to practice PMs when measured early in March, 2020, ; however, no differences were found when measured a month later.

The studies which examine the effectiveness of prosocial messaging in reducing COVID-19 vaccine hesitancy specifically are also limited and inconclusive (Ashworth et al., 2021; Betta et al., 2022; Borah, 2022; Motta et al., 2021; Yuan & Chu, 2022). For example, Motta et al. (2021) found that messages which emphasized either personal or collective health risks were equally effective at reducing COVID-19 vaccine hesitancy. Moreover, Ashworth et al. (2021) found that exposure to a prosocial message resulted in a greater willingness to vaccinate against COVID-19 when compared to a control group; however, this message was not as effective as the message highlighting personal health benefits, suggesting that vaccine uptake may not be as sensitive to prosocial messaging when compared to PMs (e.g., Capraro & Barcelo, 2020; Luttrell & Petty, 2020).

Despite inconsistent findings regarding the use of prosocial messaging in this context, there are important associations between prosocial values, preventative measures, and vaccine uptake. As such, further research investigating the effectiveness of messaging that attempts to foster prosocial motives to vaccinate against COVID-19 is warranted. Based on the available evidence, the current study expected the following: Exposure to a prosocial message frame that highlights the collective benefit of vaccinating against COVID-19 will be more effective in reducing COVID-19 vaccine hesitancy and improving COVID-19 vaccine beliefs when compared to a control group.

The Effects of Emotional Appeals

Another important consideration when designing public health communications is the emotional response it stands to elicit within its audience (Heffner et al., 2021). According to the Theory of Planned Behaviour, emotions play an important role in determining our motivation for goal-directed behaviour (Perugini & Bagozzi, 2001). Heffner et al. (2021) argue that

“widespread and rapid adoption of preventative measures is unlikely to occur without messages that include emotional appeals” (p.2), and that the emotional appeal of a public health message might serve as an indication of its strength. This has often been observed in public health communication research, as the effectiveness of public health campaigns in numerous studies has been moderated by the emotional response they provoke within participants (Dillard & Nabi, 2006; Heffner et al., 2021; Idoiaga et al., 2016; Lang & Yegiyan, 2008).

Nonetheless, the relationship between emotions and public health campaigns seems to be more nuanced than is often acknowledged in the literature. To illustrate, participants in a study by Idoiaga et al. (2016) who read a news report about a nearby flu epidemic with a “human interest” frame emphasizing the experiences of those affected by the epidemic, perceived themselves to be at higher risk than those who read the news reports with an “attribution of responsibility” frame emphasizing the responsibility of healthcare authorities in managing the epidemic. The authors note that this relationship was explained by the degree of negative emotions experienced by the participants (operationalized as feeling fearful, distressed, scared, jittery, nervous, and upset); in other words, the more negative emotions participants felt when reading the human-interest frame, the more the perceived risk for themselves and others increased. In contrast to previous studies indicating that fear-based appeals are generally ineffective (see Kok et al., 2018; Stolow et al., 2020; Wall & Buche, 2017), negative emotions seem to promote prosocial behaviours when they cause the individual to fear for the safety of others. This finding also seems related to the notion that we are more inclined to avoid taking risks when making decisions based on others’ behalf (Atanasov, 2015).

In contrast to most fear-based appeals, public health campaigns that elicit empathy and prosocial emotional processes seem to have a more persuasive effect in motivating behaviour

change and help make the message more personally relevant (Monahan, 1995). For example, in recent public health communication research on climate change, messaging that describes prosocial actions in the context of public health concerns has been shown to positively influence practical and moral decisions, create a sense of urgency, and provoke positive emotions such as hope and joy (Nabi et al., 2018; Ojala, 2012). In the context of COVID-19, a study by Pfattheicher et al. (2020) demonstrated how a sense of understanding and concern for others (termed affective empathy) was associated with intentions to practice PMs, and that empathy could be induced through messaging that described difficult experiences of vulnerable populations concerning the effects of COVID-19. Likewise, Yang (2022) found that participants in their “altruistic” message condition were more likely to report less COVID-19 vaccine hesitancy if “self-transcendent” emotions (e.g., compassion) were induced.

In light of previous research indicating that concern for others and empathy motivates adherence to public health guidelines, the current proposed study expects the following: Exposure to messaging that highlights a difficult experience related to COVID-19 from the perspective of someone vulnerable to the effects of the virus will be more effective in reducing COVID-19 vaccine hesitancy and improving COVID-19 vaccine beliefs when compared to a control group.

The Effects of Framing Safety and Efficacy

As previously mentioned, concerns about the safety and efficacy of vaccines are one of the primary factors driving vaccine hesitancy (Sweileh, 2020). The controversy surrounding the safety of vaccines first started garnering mainstream attention after a (later retracted) study by Wakefield et al. (1998) alluded to an association between vaccination and autism in children. Since then, anti-vaccination movements and the prevalence of misinformation have contributed

to maintaining a certain level of mistrust towards vaccines (Sallam, 2021). Dixon and Clarke (2013) add that concerns about the safety and efficacy of vaccines are also due, in part, to the way vaccines are reported and discussed in the media. To explain, journalists attempt to be “balanced” in their reporting by providing claims that both refute and support the safety of vaccines, which leaves the false impression that there is little scientific consensus regarding the safety of vaccines amongst the scientific community. Concerningly, the perception of scientific dissent has been shown to negatively impact attitudes towards scientific principles and public health policies (see Aklin & Urpelainen, 2014; Linden et al., 2015). Thankfully, the results of several studies suggest that public health communications that promote safety and efficacy may be particularly useful in decreasing vaccine hesitancy (Lawes-Wickwar et al., 2021).

In research preceding the pandemic, it was found that messaging that emphasized the consensus among experts on the safety of vaccines was associated with improved attitudes toward vaccines (Clarke et al., 2015; Dixon & Clarke, 2013; van der Linden et al., 2015). A study by van der Linden et al. (2015) found that exposure to a message explaining that 90% of medical scientists felt vaccines were safe and that all parents should have their children vaccinated was highly effective in decreasing vaccine concerns and improving perceptions of vaccine efficacy. As explained by the authors, reporting a high level of consensus within the scientific community can help establish a social norm that vaccines are thought to be effective, which people may use as a heuristic to guide their behaviour and thoughts. Similarly, adults who perceived the H1N1 vaccine to be ineffective were found to have improved attitudes towards the vaccine after exposure to a message emphasizing its benefits and safety, suggesting that this message frame may be particularly effective in addressing safety-related concerns among those who are hesitant (Nan et al., 2012).

The effectiveness of messaging which emphasizes the safety and efficacy of COVID-19 vaccines continues to be supported in the context of COVID-19. For instance, a study by Petersen et al. (2021) investigated how transparency in the media surrounding the vaccine could influence vaccine hesitancy by comparing the effects of vague and transparent messaging, which disclosed either negative or positive features of the vaccine. The authors report that transparent positive messaging describing a safe and effective COVID-19 vaccine was most effective in decreasing vaccine hesitancy while messaging describing negative features had the opposite effect. A similar relationship was observed by Palm et al. (2021), who designed messages with various message frames intended to address common concerns driving COVID-19 vaccine hesitancy. Of the investigated messages, the one emphasizing COVID-19 vaccine safety and efficacy was the most effective in decreasing vaccine hesitancy. However, it remains unclear whether providing more general or specific information related to the safety and efficacy of the vaccines might influence the effect of a message using this frame. In sum, based on the recurring evidence that messaging emphasizing safety and efficacy can increase vaccine acceptance, the current study expected the following: Exposure to messaging which highlights the safety and efficacy of a COVID-19 vaccine will be more effective in reducing COVID-19 vaccine hesitancy and improving COVID-19 vaccine beliefs when compared to a control group.

The Effects of Framing Social Norms

Young (2015) defines social norms as the “patterns of behaviour that are self-enforcing within a group: Everyone conforms, everyone is expected to conform, and everyone wants to conform when they expect everyone else to conform” (p.359). According to the Focus Theory of Normative Conduct developed by Cialdini et al. (1991), there are two distinct types of social norms: descriptive and injunctive norms. Simply put, descriptive norms describe our perceptions

of which behaviours others do or do not do. In turn, we use these perceptions as indications of which behaviours are most effective. Injunctive norms describe our perceptions of what is commonly approved and disapproved by others, which motivate our behaviour by indicating which actions earn social rewards or punishments.

In a commentary on how to use behavioural and social science in public health campaigns during COVID-19, Bonell et al. (2020) suggest that “Messages should be presented as reflecting and affirming group culture (injunctive norms: ‘this is who we really are’), and group behaviour (descriptive norms of evolving behaviours: ‘this is what we are doing’)” (p.618). A similar suggestion was made by Bavel et al. (2020), who stated that an effective communication aiming to encourage a health-promoting social norm might say, “the overwhelming majority of people in your community believe that everyone should stay home” (section “Social Norms”). The effectiveness of norm-based messaging such as this is supported across various contexts, with studies showing they can be used to reduce binge drinking (Carey et al., 2010) and home energy consumption (Abrahamse et al., 2005), or to promote the reuse of hotel towels (Goldstein et al. 2008) and voting in an election (Gerber et al., 2008).

The literature on vaccine hesitancy also offers many studies suggesting that the decision to vaccinate is often associated with perceptions of the beliefs and behaviours of peers (e.g., de Bruin et al., 2019; Dillard, 2011; Visser et al., 2018). For example, in recent experimental research, Xiao and Borah (2019) found that messaging emphasizing injunctive norms and positively worded descriptive norms towards the uptake of the HPV vaccine was associated with greater interest in information about the vaccine and decreased the perceptions of risk associated with the vaccine. As it relates to COVID-19 vaccine hesitancy, Graupensperger et al. (2021) found that intentions to vaccinate against COVID-19 were more strongly associated with

descriptive norms than injunctive norms in an American student sample. Additionally, Palm et al. (2021) found that exposure to a message emphasizing that “Most American Say They Will Get Vaccinated against COVID-19” was highly effective in decreasing vaccine hesitancy, while exposure to a message emphasizing that “Many Americans Say They Will Not Get Vaccinated against COVID-19” had the opposite effect on vaccine hesitancy.

The available experimental research on the influence of norm-based messaging on vaccine hesitancy led the current study to expect the following: Exposure to messaging that highlights that most people are getting vaccinated against COVID-19 will be more effective in reducing COVID-19 vaccine hesitancy and improving COVID-19 vaccine beliefs when compared to a control group.

Individual Differences Related to Vaccine Hesitancy

Many of the individual differences often associated with COVID-19 vaccine hesitancy have received limited attention in research examining the effects of different message frames. Notably, variables such as religiosity, politically conservative beliefs, and conspiracist ideation are particularly important to consider in this context due to their associations with vaccine hesitancy, distrust toward science, and hostility toward government regulations (Lewandowsky et al., 2013; Mewhirter et al., 2022; Oreskes & Conway, 2022). Such traits, as Maftai and Holman (2021) argue, might therefore affect how individuals perceive the credibility and acceptability of information provided in public health messages.

The role of certain demographic variables should equally be investigated due to their association with vaccine hesitancy. Notably, Mewhirter (2022) found that age is negatively associated with vaccine hesitancy, meaning those who are younger are more likely to report higher rates of COVID-19 vaccine hesitancy compared to those who are older. Likewise, several

studies have identified gender as a significant predictor of vaccine hesitancy, where it is often reported that females are less likely to be willing to vaccinate against COVID-19 compared to males (Lawes-Wickwar et al., 2021; Mewhirter et al., 2022; Toshkov, 2023; Troiano, 2021).

There was also interest in this study in the potential influence of intolerance of uncertainty (IU), which is characterized by a need for predictability, excessive information seeking, difficulty with decision-making, and negative emotional and cognitive reactions to uncertain situations (Buhr & Dugas, 2009). Higher IU has been associated with greater adherence to public health guidelines (Maftai & Holman, 2021), however, those higher in IU but lower in anxiety have also reported greater vaccine hesitancy (McNeil & Purdon, 2022). Another variable of interest is perfectionism, which is characterized by excessively high standards and overly critical self-evaluations (Flett & Hewitt, 2002). Perfectionism is a vulnerability factor for many negative health outcomes and is linked with maladaptive coping and poor adjustment to change (Molnar et al., 2018). During the current pandemic, perfectionism has been associated with greater fear of COVID-19 and psychological distress (Pereira et al., 2022). IU is often associated with perfectionism and both share several features (e.g., Pozza et al., 2019), such as difficulty in decision-making when given an ambiguous task with limited information (Kobori & Tanno, 2008). When considering the constant rate of news and directives we have received during the pandemic, it may be the case that it is disproportionately difficult for those higher in IU or perfectionism to navigate this information before making decisions related to preventative measures or vaccination. Currently, it is also unknown how perfectionism and intolerance of uncertainty contribute towards influencing individuals' perceptions of different message frames.

Purpose of Study

The above research highlights various message frames that show promise in helping improve COVID-19 vaccine hesitancy and beliefs, however, it remains unclear which type of message frame would be most effective when broadly disseminated. This leads us to the first research question: “What is the effect of public health messaging with different message frames on COVID-19 vaccine hesitancy and beliefs in Canadians?” A better understanding of the effect of differently framed messages advocating the need to vaccinate against COVID-19 on the public will allow us to better optimize messaging strategies for current and future public health concerns. Likewise, as there is large variability in the rates and drivers of vaccine hesitancy in different countries (Sallam et al., 2022), the current study took a more focused approach by investigating this question exclusively in a Canadian context.

Previous research has also reported differences in how subsets of a population can respond to public health communications (e.g., Jensen et al., 2022; Palm et al., 2021; Viskupič & Wiltse, 2022; Zhong & Broniatowski, 2023), highlighting the need to for further research investigating which variables predict peoples’ reactions and attitudes towards different messages to inform targeted communication strategies. Likewise, an understanding of whether the effect of different message frames depends on various individual differences will help inform efforts to develop targeted messaging strategies. This leads us to the second research question “How might individual differences predict outcomes on vaccine hesitancy and beliefs, and does the effect of different message frames depend on individual differences?” The influence of individual differences on COVID-19 vaccine hesitancy-related outcomes following exposure to public health messages was therefore examined, including age, gender, political orientation, religiosity, conspiracist ideation, IU, and perfectionism.

Method

Participants and Sampling Procedure

This study received ethics approval from the Laurentian University Research Ethics Board before data collection. Participants were recruited from November 17th, 2021, to December 15th, 2021, through advertisements on Reddit for an online study on “Public health messages and COVID-19” (see Appendix A for the recruitment script). A total of $N=466$ participants accessed the consent form in the initial study link, and $N=412$ continued to the survey which contained the study measures and messaging conditions (described below). Of those, 19 were removed from the data set; eight participants were removed for not having completed the primary outcome measures, and 11 individuals were removed for not having indicated their age, education, and employment status, as it was unclear as to whether these participants met the study age inclusion criterion. This resulted in a total sample of $N=393$. Regarding exclusion criteria, participants were required to be Canadian, to have lived in Canada since 2020, and to be at least 13 years old as those under the age of 13 are not allowed to create a Reddit account according to the website’s User Agreement (2020). As compensation, participants could provide their email to enter a raffle to win one of three \$50 Amazon gift cards.

Materials

Messaging Conditions

Participants were randomly assigned to one of six messaging conditions: prosocial, empathy, general safety and efficacy, specific safety and efficacy, norm-based, and control. Participants in the control condition were not provided with a message, while those in one of the other five conditions were asked to read a public health message promoting vaccination against

COVID-19, each of which had a unique message frame. The messages can be found in Appendix E and a brief outline of each is summarized below.

The prosocial message emphasized the benefits of vaccinating against COVID-19 for the safety of others. This message was adapted from a similar prosocial message included in a study by Heffner et al. (2020) that originally emphasized the importance of self-isolation to prevent the spread of the virus during the early stages of the pandemic. Moreover, Heffner et al.'s original message began with "Help save our most vulnerable", but this was removed to maintain the condition's distinctiveness from the empathy condition (described below). The safety and efficacy messages were adapted from the "safe and effective" message from Palm et al. (2021) and the "long - no caution" condition from Kerr et al. (2021), both of which emphasized the scientific support and safety of vaccines. The information for both conditions was updated using data from an article titled "Is the COVID-19 Vaccine Safe?" published by John Hopkins Medicine (Maragakis & Kelen, 2021). The safety and efficacy (specific) message provided similar but more specific information than the safety and efficacy (general) message. This was done to assess if messages containing information related to the safety and efficacy of the vaccines differ in their effectiveness based on the amount of detail they provide. The norm-based message was based on advice from Bavell et al. (2020) and Bonell et al. (2020) recommending that public health messaging support the COVID-19 pandemic response by emphasizing a descriptive norm (e.g., "Most people say they will get vaccinated against COVID-19"), and an injunctive norm (e.g., "...and they believe you should too"). The empathy message was an adapted version of the "empathy" message from Pfattheicher et al.'s (2020) study which showed that state empathy towards those most vulnerable to COVID-19 was related to intentions to practice PMs, and that anecdotes about their experiences relating to COVID-19 could increase

state empathy. For the purpose of the current study, their message was edited to be of similar length to the other conditions, and the emphasis was changed from the importance of physical distancing to the importance of vaccinating against COVID-19.

Each message appeared as a Facebook post to investigate if brief, written social media posts can have a significant effect on COVID-19 vaccine hesitancy. Facebook was chosen due to its popularity, especially among the age groups (25-64 years of age) who are most vaccine-hesitant (Gruzd & Mai, 2020; Government of Canada, 2021). The Facebook account seen to be posting the message was created for this study and is intended to represent a public health agency. However, the name of the account and the profile picture were blurred to limit the extent to which it might be identifiable with real organizations. Likewise, based on previous research suggesting that the source of the message (i.e., the account seen to be posting the message) may impact how it is received by participants (e.g., Huang & Liu, 2022), blurring the name and picture was also intended to limit the extent to which the appearance of either might have influenced the messages' effectiveness.

Measures of Individual Difference Variables

Demographics, Political Orientation, and Religiosity

Participants were asked a series of questions to obtain their demographic information (see Appendix D), such as age, gender, vaccination status, political orientation, and religiosity. Political orientation was assessed using the following item, "In politics, many people use the terms 'left' and 'right' or 'liberal' and 'Conservative'. When it comes to politics, where do you place yourself on this scale?", on a 5-point Likert scale, where 1 = *Strongly left wing (very liberal)*, and 5 = *Strongly right-wing (very conservative)*. Religiosity was assessed by asking participants "How important is religion in your life?" on a 7-point Likert scale (1 = *Not at all* to

7 = *Very important*). Both items are consistent with how these variables were assessed by Everett et al. (2020).

Perfectionism

The Multidimensional Perfectionism Scale short form (MPS; see Appendix I) was used to assess three separate dimensions of perfectionism in participants: Self-Oriented (SOP), Other-Oriented (OOP), and Socially Prescribed perfectionism (SPP). The 15-item short-form version has very strong correlations with the original 45-item version developed by Hewitt & Flett (1991), which had several studies supporting its reliability and validity (see Hewitt & Flett, 2004), and can be expected to produce similar results (Stoeber, 2016). Participants were asked on a 7-point Likert scale to rate the extent to which they agree with each of the items provided in the scale (e.g., “One of my goals is to be perfect in everything I do”: 1 = *Disagree* to 7 = *Agree*).

Intolerance of Uncertainty

Intolerance to uncertainty was assessed using the 12-item Intolerance of Uncertainty Scale – Short Form developed by Carleton et al. (2007; see Appendix J). The 12-item short form of the original 27-item measure has a strong correlation with the original (Carleton, Norton, et al., 2007). This scale includes items such as “Unforeseen events upset me greatly” and “The smallest doubt can stop me from acting”. An overall score is obtained from ratings on the 5-point Likert scale where 1 = *Not at all characteristic of me* and 5 = *Entirely characteristic of me*. A higher score indicates a higher degree of intolerance for uncertainty.

Conspiracist Ideation

The 15-item Generic Conspiracist Beliefs Scale (GCBS; Brotherton et al., 2013) was used to measure conspiracist ideation (see Appendix K). This scale has strong test-retest reliability and convergent and discriminant validity (Brotherton et al., 2013; Drinkwater et al.,

2020). Although this scale is comprised of five factors: Government Malfeasance, Extraterrestrial Cover-up, Malevolent Global Conspiracies, Personal Wellbeing, and Control of Information, much of the research utilizes the overall mean score. Participants were asked to rate how true each item is using a 5-point Likert scale, where 1 = *Definitely not true* and 5 = *Definitely true*. A sample item includes “Groups of scientists manipulate, fabricate, or suppress evidence in order to deceive the public”. A higher total score suggests a higher level of conspiracist ideation.

Outcome Measures

COVID-19 Vaccine Hesitancy

Intentions to vaccinate against COVID-19 were assessed using Freeman and colleagues' (2020) seven-item Oxford COVID-19 Vaccine Hesitancy Scale (OCVHS; see Appendix F). The OCVHS was adapted from the Vaccine Hesitancy Scale developed by Shapiro et al. (2018) to fit the context of the COVID-19 pandemic. The scale was found to be highly reliable in the original study by Freeman et al. (2020), and a valid measure of vaccine hesitancy by Huang et al. (2022). Item response options are coded from 1-5, with higher scores reflecting a higher degree of vaccine hesitancy (e.g., “If a COVID-19 vaccine was available at my local pharmacy, I would”: 1 = *Get it as soon as possible* to 5 = *Never get it*). An additional “Don’t know” response option is available for each item and is removed from the scoring. Since this scale was developed for use in the UK, some words were replaced to suit the Canadian context (e.g., change “Would you take a COVID-19 vaccine (approved for use in the UK) if offered?” to “Would you take an approved COVID-19 vaccine if offered?”). Due to the high rates of vaccination in Canada and the increasing availability of “booster shots” at the time of data collection, participants were given each item of the scale twice, where they were instructed to answer the item once as though they

were unvaccinated and being offered their first dose, and then again as though they were fully vaccinated and being offered a booster shot.

COVID-19 Vaccine Beliefs

Attitudes regarding COVID-19 vaccine complacency and confidence were assessed using Kerr et al.'s (2021) adapted version of the Oxford COVID-19 Vaccine Confidence and Complacency Scale (OCVCC; see Appendix G). The original scale by Freeman et al. (2021) was developed using exploratory and confirmatory factor analyses of a larger set of items. The adapted scale removed items with weak loading on their proposed factors and added items with face validity, which improved its reliability (Kerr et al., 2021). Response options are coded from 1-5, with higher scores reflecting more negative beliefs about COVID-19 vaccines. As in the OCVHS, each item includes a “Don’t know” response option that is removed from scoring. In addition to an aggregate score, scores may be interpreted using its four comprised factors: Perceived Collective Importance of a COVID-19 Vaccine (three items, e.g., “If I get the COVID-19 vaccine it will be”: 1 = *Really helpful for the community around me* to 5 = *Really unhelpful for the community around me*), Perceived COVID-19 Vaccine Efficacy (four items, e.g., “The COVID-19 vaccine is likely to”: 1 = *Definitely work for me* to 5 = *Definitely not work for me*), Concerns About the Speed of COVID-19 Vaccine Development (four items, e.g., “The speed of developing and testing the vaccine means it will be” 1 = *Really safe* to 5 = *Really unsafe*), and Concerns About COVID-19 Vaccine Side Effects (four items, e.g., “The side effects for people of getting the COVID-19 vaccine will be”: 1 = *None* to 5 = *Life-threatening*).

Intentions to Adhere to Guidelines Following Vaccination

Following Kerr et al. (2021), unvaccinated participants were asked to indicate their agreement with a single item (“I would still follow whatever coronavirus rules or restrictions

were in place as strictly as I was before getting a vaccine”) on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*) to gauge their intentions to follow COVID-19 public health guidelines after receiving a COVID-19 vaccine. Those who are already fully vaccinated against COVID-19 received the following rewording of this item: “I will continue to follow whatever coronavirus rules or restrictions were in place as strictly as I was before getting a vaccine.”

Willingness to Receive a Booster Shot

Participants were given a single item to assess their willingness to receive an extra dose of a COVID-19 vaccine: “I would be willing to receive an extra dose of a COVID-19 vaccine, also known as a booster shot, if it were recommended by public health officials.” Answers were provided using a 7-point Likert scale where higher scores indicate a higher degree of willingness (1 = *strongly disagree* to 7 = *strongly agree*).

Emotional Response

Emotional responses to the messaging conditions were captured using Marcus et al.’s (2017) ten-item scale consisting of three subscales: Enthusiasm, Anxiety, and Aversion (see Appendix H). Each item represents a different affect term, where *hopeful*, *proud*, and *enthusiastic* define Enthusiasm, *angry*, *hateful*, *bitter*, and *resentful* define Aversion, and *afraid*, *scared*, and *worried* define Anxiety. Participants were asked to rate the degree to which they felt a specific emotion (e.g., hopeful, afraid, angry) on a sliding scale (0 = *Not at all* to 100 = *Extremely*) after reading the message corresponding to their condition. Subscale scores are determined by calculating the means of the items of each subscale.

Second-Order Beliefs About the Effectiveness of a Message

To account for the possibility of ceiling effects on measures of vaccine hesitancy due to the high vaccination rates, a measure of second-order beliefs about the effectiveness of the

messages was included. More specifically, the extent to which participants believed the message they read would be effective in decreasing vaccine hesitancy in others was measured with the following item: “How likely is it that someone else who reads this message would be likely to vaccinate against COVID-19?”. Answers were recorded on a 7-point Likert scale (1 = *Extremely unlikely* to 7 = *Extremely likely*). This item was modelled according to a set of items measuring second-order beliefs in Everett et al.’s (2020) study (e.g., “How likely is it that someone else who reads this would, for the next 2 weeks, always wash their hands whenever they enter work or come home, even if they don't feel sick?). As argued by Everett et al. (2020), a measure of second-order beliefs was expected to be more sensitive to the effects of public health messaging by helping to mitigate the effects of social desirability to be vaccinated while also reflecting the participant’s personal beliefs about the message.

Procedure

As mentioned above, participants could access the link for the study through an advertisement on Reddit. After accessing the link from the advertisement, participants were automatically directed to the online study administered on REDCap. Once consent was provided (see Appendix B for the consent form), using a six-armed, parallel-design (between-subjects) survey experiment, participants were randomly assigned to one of six conditions: 1) prosocial, 2) empathy, 3) general safety and efficacy, 4) specific safety and efficacy, 5) norm-based, and 6) control. Following a series of questions to obtain their demographic information (see Appendix D), participants assigned to a messaging condition were shown the fictional public health message corresponding to their condition, while participants in the control group were not shown a message.

Afterwards, participants advanced to the measures of COVID-19 vaccine hesitancy, COVID-19 vaccine beliefs, intentions to follow public health guidelines post-vaccination and willingness to receive a “booster shot” of a COVID-19 vaccine. Participants in messaging conditions were provided additional outcome measures, including an assessment of their emotional response to the message and their second-order beliefs about the effectiveness of the message. The message corresponding to their condition was redisplayed alongside these measures so that they may be referenced by the participant. Following the outcome measures, participants were asked to complete the short form of the MPS, the IUS, and the GCBS. Upon completion, participants received a detailed debriefing on the current study (Appendix C).

Results

Sample Characteristics

The characteristics of the sample closely align with what is observed in the general Canadian population (Statistics Canada, 2021). However, it should be acknowledged that the territories and less populated provinces have limited representation in the study due to the relatively small sample size. A summary of sample characteristics for the total sample and each condition is presented in Table 1.

Table 1

Sample Characteristics for Total Sample and by Condition

Characteristics	Messaging Conditions						
	Total	Prosocial	Empathy	General	Specific	Norm	Control
	(N=393)	(n=64)	(n=66)	(n=65)	(n=67)	(n=64)	(n=67)
	N(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Gender							
Female	187(47.6)	33(52.4)	28(42.4)	33(50.8)	25(37.3)	33(51.6)	35(52.2)
Male	170(43.3)	21(33.3)	31(47.0)	26(40.6)	36(53.7)	28(43.8)	28(41.8)
Non-conforming	14(3.6)	6(9.5)	3(4.5)	2(3.1)	3(4.5)	-	-
Prefer not to say	8(2.0)	1(1.6)	2(3.0)	-	1(1.5)	2(3.1)	2(3.0)
Transgender female	5(1.3)	1(1.6)	1(1.5)	1(1.5)	-	1(1.6)	1(1.5)
Transgender male	1(0.3)	-	-	1(1.5)	-	-	-

Characteristics	Messaging Conditions						
	Total	Prosocial	Empathy	General	Specific	Norm	Control
	(N=393)	(n=64)	(n=66)	(n=65)	(n=67)	(n=64)	(n=67)
	N(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Ethnicity							
White	309(78.6)	51(79.7)	56(84.8)	48(73.8)	49(73.1)	52(81.3)	53(79.1)
Asian	30(7.6)	8(12.5)	3(4.5)	4(6.2)	5(7.5)	4(6.3)	6(9.0)
Multi-ethnic	16(4.1)	1(1.6)	4(6.1)	2(3.1)	4(6.0)	3(4.7)	2(3.0)
Middle Eastern or North African	15(3.8)	3(4.7)	-	5(7.7)	4(6.0)	2(3.1)	1(1.5)
Other Identification	5(1.3)	-	-	1(1.5)	1(1.5)	2(3.1)	1(1.5)
Métis	5(1.3)	1(1.6)	2(3.0)	1(1.5)	1(1.5)	-	-
First Nations	4(1.0)	-	1(1.5)	1(1.5)	1(1.5)	-	1(1.5)
Black	4(1.0)	-	-	1(1.5)	-	1(1.5)	2(3.0)
Latinx	3(0.8)	-	-	2(3.1)	1(1.5)	-	-
Pacific Islander	2(0.5)	-	-	-	1(1.5)	-	1(1.5)
Student Status							
Not Student	296(75.3)	43(67.1)	54(81.8)	50(76.9)	52(77.6)	51(79.7)	46(68.7)
Full-time	74(18.8)	13(20.3)	6(9.1)	13(20.0)	11(16.4)	12(18.8)	19(28.4)
Part-time	23(5.9)	7(10.9)	6(9.1)	2(3.1)	4(6.0)	1(1.6)	3(4.5)
Employment							
Working full-time	214(54.5)	33(51.6)	42(63.6)	35(53.8)	35(52.2)	32(50.0)	37(55.2)
Working part-time	53(13.5)	8(12.5)	8(12.1)	5(7.7)	11(16.4)	7(10.9)	14(20.9)
Not working, looking	36(9.2)	4(6.3)	4(6.1)	10(15.4)	6(9.0)	5(7.8)	7(10.4)
Not working, not looking	22(5.6)	4(6.3)	2(3.0)	5(7.7)	4(6.0)	4(6.3)	3(4.5)
On disability	20(5.1)	3(4.7)	3(4.5)	4(6.2)	3(4.5)	3(4.7)	4(6.0)
Retired	6(1.5)	2(3.1)	2(3.0)	-	1(1.5)	-	1(1.5)
Education							
Bachelor's degree	126(32.1)	24(37.5)	16(24.2)	23(35.4)	17(25.4)	21(32.8)	25(37.3)
Attended college	78(19.8)	12(18.8)	17(25.8)	9(13.8)	16(23.9)	13(20.3)	11(16.4)
High school	57(14.5)	6(9.4)	9(13.6)	10(15.4)	11(16.4)	9(14.1)	12(17.9)
Graduate degree	54(13.7)	7(10.9)	10(15.2)	9(13.8)	8(11.9)	9(14.1)	11(16.4)
Trade/technical	48(12.2)	7(10.9)	11(16.7)	6(9.2)	9(13.4)	10(15.6)	5(7.5)
Less than high school degree	16(4.1)	3(4.7)	3(4.5)	5(7.7)	2(3.0)	2(3.1)	1(1.5)
Other	12(3.1)	4(6.3)	-	2(3.1)	4(6.0)	-	2(3.0)
Province							
Ontario	196(49.9)	27(42.2)	33(50.0)	32(49.2)	35(52.2)	38(59.4)	31(46.3)
Alberta	68(17.3)	14(21.9)	13(19.7)	10(15.4)	8(11.9)	10(15.6)	13(19.4)
British Columbia	62(15.8)	11(17.2)	9(13.6)	11(16.9)	11(16.4)	8(12.5)	12(17.9)
Quebec	20(5.1)	5(7.8)	1(1.5)	4(6.2)	3(4.5)	5(7.8)	2(3.0)
Saskatchewan	12(3.1)	2(3.1)	3(4.5)	2(3.1)	3(4.5)	-	2(3.0)
Manitoba	10(2.5)	2(3.1)	2(3.0)	2(3.1)	1(1.5)	1(1.6)	2(3.0)
New Brunswick	8(2.0)	-	1(1.5)	2(3.1)	3(4.5)	2(3.1)	-
Nova Scotia	8(2.0)	3(4.7)	1(1.5)	1(1.5)	3(4.5)	-	-
Newfoundland	5(1.3)	-	2(3.0)	-	-	-	3(4.5)
P.E.I.	2(0.5)	-	1(1.5)	-	-	-	1(1.5)
Nunavut	1(0.3)	-	-	-	-	-	1(1.5)
Yukon	1(0.3)	-	-	1(1.5)	-	-	-
Political Orientation							
Strongly left wing	150(38.2)	29(45.3)	22(33.3)	29(44.6)	23(34.3)	21(32.8)	26(38.8)
Slightly left wing	107(27.2)	16(25.0)	22(33.3)	16(24.6)	18(26.9)	18(28.1)	17(25.4)
Centre	65(16.5)	11(17.2)	11(16.7)	4(6.2)	10(14.9)	13(20.3)	16(23.9)
Not sure	35(8.9)	5(7.8)	4(6.1)	10(15.4)	8(11.9)	5(7.8)	3(4.5)
Slightly right	25(6.4)	2(3.1)	6(9.1)	4(6.2)	7(10.4)	3(4.7)	3(4.5)
Strongly right wing	11(2.8)	1(1.6)	1(1.5)	2(3.1)	1(1.5)	4(6.3)	2(3.0)
Vaccination Status							
Has 1 vaccine	360(91.6)	59(92.2)	61(92.4)	61(93.8)	59(88.1)	57(89.1)	63(94.0)
Has 2 vaccines	352(89.6)	58(90.6)	60(90.9)	58(89.2)	59(88.1)	56(87.5)	61(91.0)

Characteristics	Messaging Conditions						
	Total	Prosocial	Empathy	General	Specific	Norm	Control
	(N=393)	(n=64)	(n=66)	(n=65)	(n=67)	(n=64)	(n=67)
	N(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Has 3 vaccines ^a	37(9.4)	6(9.4)	6(9.1)	12(18.5)	3(4.5)	4(6.3)	6(9.0)
Not vaccinated	33(8.4)	5(7.8)	5(7.6)	4(6.2)	8(11.9)	7(10.9)	4(6.0)
Motivation to be vaccinated ^{b, c}							
Protect my health	314(79.9)	53(82.8)	51(77.3)	54(83.1)	53(79.1)	47(73.4)	56(83.6)
Protect others	319(81.2)	53(82.8)	51(77.3)	55(84.6)	55(82.1)	46(71.9)	59(88.1)
Protect community	277(70.5)	46(71.9)	42(63.6)	50(76.9)	51(76.1)	39(60.9)	49(73.1)
Social activities	221(56.2)	36(56.3)	34(51.5)	31(47.7)	40(59.7)	38(59.4)	42(62.7)
Protect co-workers	204(51.9)	33(51.6)	35(53.0)	34(52.3)	37(55.2)	27(42.2)	38(56.7)
To resume travel	170(43.3)	33(51.6)	34(51.5)	25(38.5)	28(41.8)	24(37.5)	26(38.8)
Work/school	127(32.3)	22(34.4)	18(27.3)	18(27.7)	21(31.3)	22(34.4)	26(38.8)
Others encouraged	43(10.9)	6(9.4)	8(12.1)	1(1.5)	8(11.9)	11(17.2)	9(13.4)
Vaccine mandate	33(8.4)	6(9.4)	5(7.6)	6(9.2)	4(6.0)	7(10.9)	5(7.5)
Other	26(6.6)	4(6.3)	6(9.1)	-	3(4.5)	3(4.7)	10(14.9)
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
Age	32.1(10.5)	32.8(10.7)	33.2(10.4)	32.3(11.6)	31.8(11.2)	32.1(10.6)	30.6(8.7)
Religiosity ⁽¹⁻⁷⁾	1.9(1.5)	1.8(1.5)	1.6(1.1)	2.0(1.5)	2.3(1.8)	1.9(1.5)	1.9(1.6)
Perceived Health ⁽¹⁻⁷⁾	5.1(1.0)	5.0(1.0)	5.2(1.0)	5.0(1.2)	5.0(1.1)	5.1(1.1)	5.0(1.0)
Concerns of C19 ⁽¹⁻⁷⁾	3.1(1.3)	3.3(1.3)	3.2(1.4)	3.1(1.2)	3.0(1.4)	2.8(1.1)	3.1(1.4)
News Exposure ⁽¹⁻¹⁰⁰⁾	78.5(19.9)	81.3(18.6)	73.5(24.6)	78.2(15.5)	81.0(16.6)	78.0(22.5)	79.1(20.2)
Follows News ⁽¹⁻¹⁰⁰⁾	65.3(25.8)	69.8(22.2)	64.5(24.1)	61.9(24.9)	66.6(26.5)	63.2(30.6)	66.0(26.2)

Note. Subscripted values in the tables represent scale values from less to more.

^aFor context, Health Canada authorized the use of booster shots for certain vaccines for ages 18 and up a week before data collection, and the actual availability of booster shots varied by province and territory (Vasquez-Peddie & Neustater, 2021). ^bMultiple options could be endorsed. ^cRespondents to this question reported receiving at least one COVID-19 vaccine.

Scale Means and Scale Reliabilities

Table 2 provides a summary of scale means, standard deviations, and scale reliability scores by condition and for the total sample. A high level of internal consistency (α) was observed on all measures. As it pertains to the main variables of interest in the study, the mean score of the OCVHS reflects a high degree of willingness to receive a COVID-19 vaccine, and the mean score of the OCVCC reflects positive beliefs toward the vaccines overall. Notably, the subscale on the OCVCC with the highest mean score is related to concerns regarding the side effects of the vaccines, possibly suggesting that participants were most concerned about this aspect of vaccination in relation to aspects captured by the other subscales.

Since the control condition did not include a message expected to affect COVID-19 vaccine hesitancy and beliefs, scores obtained on the OCVHS and OCVCC within this condition can be compared to values reported in the study by Freeman et al. (2020) where these measures were originally developed. Based on a sample of 5,114 adults in the UK recruited between September 24th and October 17th, 2020, Freeman et al. (2020) reported slightly higher rates of COVID-19 vaccine hesitancy and slightly more negative beliefs about the public importance and efficacy of the vaccines, while beliefs about the sides effects and the speed of development appear very similar. Since the current study was conducted over a year following Freeman et al. (2020), these differences might reflect a positive shift in COVID-19 vaccine hesitancy and beliefs, despite beliefs related to the side effects and speed of development remaining stable.

Table 2*Means, Standard Deviations and Scale Reliabilities of Scales and Subscales by Condition and for the Total Sample*

Scales and Subscales	Messaging Conditions						Total	No. of items	Cronbach's alpha
	Prosocial	Empathy	General	Specific	Norm	Control			
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)		α
OCVHS – 1 st Dose	1.61(1.06)	1.69(1.17)	1.47(0.89)	1.80(1.16)	1.96(1.25)	1.53(0.98)	1.68(1.09)	7	.975
OCVHS – Booster	1.72(1.10)	2.00(1.27)	1.69(0.99)	2.10(1.27)	2.31(1.41)	1.92(1.16)	1.96(1.20)	7	.980
OCVCC	1.89(0.74)	2.06(0.97)	1.90(0.76)	2.10(0.89)	2.30(1.03)	1.97(0.80)	2.04(0.88)	15	.949
Public Importance	1.45(0.78)	1.63(0.97)	1.42(0.64)	1.62(0.80)	1.78(0.97)	1.52(0.86)	1.57(0.85)	3	.906
Vaccine Efficacy	1.70(0.85)	1.79(1.04)	1.73(0.93)	1.78(0.98)	2.03(1.05)	1.71(0.78)	1.79(0.94)	4	.877
Side Effects	2.06(0.95)	2.27(1.15)	2.10(0.89)	2.38(1.09)	2.45(1.14)	2.17(0.95)	2.24(1.03)	3	.770
Speed	1.89(0.74)	2.56(1.06)	2.37(0.93)	2.74(1.12)	2.86(1.20)	2.49(1.07)	2.55(1.04)	4	.851
Guidelines - Vaxed	5.38(1.86)	5.28(1.84)	5.48(1.66)	5.12(1.82)	4.65(2.22)	5.22(1.96)	5.19(1.90)	1	-
Guidelines - No Vax	2.20(2.17)	2.40(1.52)	2.75(2.21)	3.13(2.03)	3.00(1.53)	2.75(1.50)	2.76(1.73)	1	-
Intentions – Booster	5.71(2.13)	5.33(2.23)	5.89(1.68)	5.30(2.23)	4.84(2.54)	5.52(2.07)	5.43(2.17)	1	-
Emotional Response									
Enthusiasm	57.44(26.41)	30.42(27.66)	59.97(24.77)	55.86(25.95)	56.31(31.31)	-	51.78(29.34)	3	-
Anxiety	22.65(22.64)	41.80(28.44)	17.20(20.22)	21.42(28.28)	19.71(25.73)	-	24.68(26.70)	3	-
Aversion	18.12(26.15)	38.68(29.12)	9.51(15.82)	17.70(26.53)	18.63(26.90)	-	20.58(27.01)	4	-
Second Order	3.77(1.40)	3.36(1.44)	3.80(1.44)	3.89(0.94)	3.33(1.48)	-	3.63(1.37)	1	-
IUS	2.88(0.86)	2.70(0.83)	2.75(0.77)	2.74(0.87)	2.75(0.81)	2.79(0.93)	2.77(0.84)	12	.904
MPS								15	
SOP	4.24(1.70)	3.80(1.53)	3.90(1.60)	4.00(1.57)	3.73(1.56)	4.20(1.60)	3.99(1.59)	5	.910
SPP	3.99(1.56)	3.58(1.31)	3.70(1.57)	3.87(1.43)	3.77(1.53)	3.86(1.56)	3.80(1.49)	4	.836
OOP	3.73(1.60)	3.40(1.34)	3.62(1.44)	3.63(1.32)	3.21(1.16)	3.58(1.29)	3.53(1.37)	5	.857
GCBS	1.98(0.89)	2.22(0.96)	2.19(0.94)	2.21(0.75)	2.25(0.93)	2.18(0.79)	2.17(0.88)	15	.937

Note. OCVHS = Oxford Covid-19 Vaccine Hesitancy Scale; OCVCC = Oxford COVID-19 Vaccine Confidence and Complacency Scale; Guidelines – Vaxed = willingness to follow public health COVID-19 guidelines amongst those who are vaccinated; Guidelines – No Vax = willingness to follow public health COVID-19 guidelines amongst those who are not vaccinated; Intentions – Booster = Intentions to receive a third dose of a COVID-19 vaccine; IUS = Intolerance of Uncertainty Scale Short Form; MPS = Multidimensional Perfectionism Scale; SOP = Self-Oriented Perfectionism; SPP = Socially-Prescribed Perfectionism; OOP = Other-Oriented Perfectionism; GCBS = Generic Conspiracist Beliefs Scale.

Data Cleaning

On average, less than 4% of the data was missing in the outcome measures within each condition. To address missing data, the means of multi-item outcome measures were calculated using data from participants who completed at least 80% of items for each scale and subscale. Therefore, participants with a large amount of missing data were excluded from the calculations. This approach to addressing missing data is supported by the high α values found in Table 2.

Analyses

The outcome measures were assessed using general linear models (GLMs). All GLMs were conducted using the *lm* function from the *stats* package in R. Cook's distance was used to identify data points that had a significant impact on regression parameters. Given previous research suggesting that age and gender play an important role in predicting vaccine hesitancy and attitudes (e.g., Mewhirter et al., 2022), these variables were accounted for in the models. Due to an insufficient number of participants endorsing options other than male or female (i.e., "Not listed" and "Prefer not to answer"), gender was analyzed as a binary variable. Those who identified as transgender females were coded as female, those who identified as transgender males were coded as male, and those who reported that their gender was not listed or who preferred not to answer were excluded from the analysis. A separate GLM was run for each outcome (mean scale or mean subscale score), with all the relevant predictors entered together in the model.

COVID-19 Vaccine Hesitancy

Although the study intended to examine the influence of message framing on COVID-19 vaccine hesitancy, as assessed using both a single item inquiring about intentions to receive a 3rd dose of a COVID-19 vaccine and the OCVHS, most of the sample reported a high degree of

willingness to receive the vaccine with little variability in their responses. As such, the data were not well suited for analysis. Further, there was an insufficient number of participants who had not received a COVID-19 vaccine ($n=33$ across 6 conditions) to accurately assess the potential influence of message framing on vaccine hesitancy using the OCVHS in this specific subsample. In anticipation of ceiling effects, COVID-19 vaccine hesitancy was also assessed using a measure of second-order beliefs, which is reported in the “Perceptions of Messaging” section. Further, since COVID-19 vaccine hesitancy and COVID-19 vaccine attitudes and beliefs are very closely linked (Freeman et al., 2020; Paul et al., 2021), results related to vaccine attitudes and beliefs as assessed with the OCVCC may reflect the effects of messaging on vaccine hesitancy.

COVID-19 Vaccine Attitudes and Beliefs

Table 3 reports the results of the GLMs used to evaluate if condition, age, or gender significantly predicted attitudes and beliefs about the COVID-19 vaccines. Separate GLMs were conducted for the total mean score of the OCVCC and the mean score of each of its subscales: Perceived Public Importance of a COVID-19 Vaccine (Public Importance), Perceived COVID-19 Vaccine Efficacy (Vaccine Efficacy), Concerns About the Speed of COVID-19 Vaccine Development (Speed), and Concerns About COVID-19 Vaccine Side Effects (Side Effects). The mean score of the OCVCC will hereafter simply be referred to as the OCVCC. For reference, higher scores on the OCVCC and its subscales reflect more negative attitudes and beliefs, while lower scores reflect more positive attitudes and beliefs.

First, older age significantly predicted lower scores on the OCVCC, the Public Importance subscale, and the Side Effects subscale. In other words, older adults were more likely to report more positive beliefs about the vaccines overall and that they were important for the

safety of the public, while also being less concerned about the side effects when compared to those of younger age groups. Additionally, a significant main effect of gender was observed in all outcomes related to vaccine attitudes and beliefs. Those who identified as male were significantly more likely to report more negative beliefs about the vaccines.

Overall, the results of the GLMs do not suggest that public health messages had a significant effect on COVID-19 vaccine attitudes and beliefs. While no main effect of messaging condition was observed in the model predicting the overall score on the OCVCC, the contrasts indicate that beliefs about the vaccines were significantly more negative in the norm condition when compared to the empathy, general, and control condition. The only subscale on the OCVCC where a main effect of messaging condition was observed was the Speed subscale, where the contrasts indicate that beliefs toward the vaccines scores were significantly more negative in the norm condition compared to the prosocial, general, and empathy conditions, and in the specific condition compared to the general condition.

Table 3

General Linear Model Results for the Regression of The OCVCC on Age, Gender, and Messaging Condition

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	F	B	sr ²	F	B	sr ²	F	B	sr ²	F	B	sr ²	F	B	sr ²
Age	4.43*	-.01*	.01	5.5*	-.01*	.01	1.42	-.01	.004	8.59**	-.01**	.02	2.76	-.01	.01
Gender ^a	14.66***	.33***	.04	12.9***	.27***	.04	7.75**	.25**	.02	6.25*	.26*	.02	11.05***	.36***	.03
M. Cond.	1.50	-	.02	0.48	-	.005	0.73	-	.01	1.32	-	.01	2.85*	-	.04
	Model Adj. R ² = 0.05			Model Adj. R ² = 0.04			Model Adj. R ² = 0.02			Model Adj. R ² = 0.04			Model Adj. R ² = 0.06		
M. Cond. Contrasts^b															
Pro-Emp		.05	<.001		.04	<.001		-.01	<.001		-.13	.001		-.11	<.001
Pro-Gen		.09	.001		.02	<.001		-.04	<.001		-.05	<.001		.07	<.001
Pro-Spc		-.05	<.001		-.06	<.001		-.01	<.001		-.30	.007		-.35	.009
Pro-Nrm		-.25	.008		-.09	.001		-.23	.006		-.24	.004		-.48*	.018
Pro-Ctrl		.03	<.001		.03	<.001		-.01	<.001		.01	<.001		-.14	.002
Emp-Gen		.04	<.001		-.01	<.001		-.04	<.001		.08	<.001		.18	.002
Emp-Spc		-.10	.001		-.10	.002		-.01	<.001		-.17	.003		-.23	.005
Emp-Nrm		-.30*	.012		-.12	.003		-.23	<.001		-.11	.001		-.36*	.011
Emp-Ctrl		-.02	<.001		-.01	<.001		-.01	<.001		.13	.002		-.03	<.001
Gen-Spc		-.14	.002		-.09	.001		-.04	<.001		-.25	.006		-.42*	.014
Gen-Nrm		-.34*	.015		-.11	.002		-.22	.006		-.20	.001		-.54**	.024
Gen-Ctrl		-.06	<.001		.01	<.001		.01	<.001		.05	.008		-.20	.003
Spc-Nrm		-.21	.005		-.02	<.001		.23	.007		.06	<.001		-.13	.001
Spc-Ctrl		.08	<.001		.09	.002		.23	.007		.30	.005		.21	.004
Nrm-Ctrl		.29*	.011		.12	.003		-.23	.007		.25	.005		.34	.010

Note. For the reporting of the main effect of age, gender, and condition, the control condition was used as the reference. sr² = squared semi-partial correlation coefficient; M. Cond. = main effect of messaging condition; Pro = prosocial; Emp = empathy; Gen = general safety and efficacy; Spc = specific safety and efficacy; Nrm = norm-based; Ctrl = control.

^aFemale was the reference group (female = 1, male = 2). ^bPairwise comparisons among all levels of messaging condition.

p* < .05, *p* < .01, and ****p* < .001.

Correlational Analyses

Pearson correlations were conducted to assess which individual difference variables were highly correlated to COVID-19 vaccine beliefs (as assessed using the OCVCC). Variables correlated at the $p=.001$ level with the OCVCC were later included in GLMs to help answer the second research question, “How might individual differences predict outcomes on vaccine hesitancy and beliefs and does the effect of different message frames depend on individual differences?” The use of the mean score of the OCVCC is consistent with how the results obtained from this scale have been analyzed in previous studies (e.g., Grech et al., 2023).

The variables which met this criterion were religiosity, political orientation, and conspiracist ideation, as assessed using the mean score on the Generic Conspiracist Beliefs Scale (GCBS). The Pearson correlations between the OCVCC and these variables are provided in Table 4. A moderately positive correlation between the OCVCC and both religiosity and political orientation was observed. In other words, those who highly endorsed that their religion is important to them and those who reported being more conservative were more likely to report more negative beliefs about the vaccines. A strong positive correlation was also observed between the OCVCC and the GCBS, meaning those who more strongly endorsed believing conspiracy theories were also more likely to report more negative beliefs about the vaccines. Table 4 also provides the correlations between the OCVCC and additional characteristics measured in this study, including intolerance of uncertainty and the three perfectionism facets. No significant correlations between the OCVCC and measures of perfectionism and intolerance of uncertainty were found.

Table 4*Pearson Correlations Between the OCVCC and Individual Differences*

	1	2	3	4	5	6	7	8
1. OCVCC	--							
2. IUS	-.07	--						
3. SOP	.01	.38**	--					
4. SPP	-.01	.43**	.74**	--				
5. OOP	.09	.37**	.74**	.67**	--			
6. GCBS	.60**	.12*	.07	.10	.17**	--		
7. Religiosity	.30**	.02	.13*	.14**	.15**	.15**	--	
8. Pol. Or.	.48**	-.15**	-.02	-.03	.05	.28**	.22**	--

Note. OCVCC= Total Mean on the Oxford Covid-19 Vaccine Confidence and Complacency Scale; IUS =

Total Mean on the Intolerance of Uncertainty Scale Short Form; SOP = Self-Oriented Perfectionism; SPP

= Socially-Prescribed Perfectionism; OOP = Other-Oriented Perfectionism; GCBS = Generic

Conspiracist Beliefs Scale; Pol. Or. = Political Orientation.

* $p < .05$, ** $p < .01$, and *** $p < .001$.

The Effect of Political Orientation, Religiosity, and Conspiracist Ideation on COVID-19 Vaccine Attitudes and Beliefs

Table 5 provides the results of the three GLMs used to evaluate whether there were significant interactions between the condition and either political orientation, religiosity, or conspiracist ideation on vaccine attitudes and beliefs. The GLM results related to the subscales of the OCVCC can be found in Table 7 in Appendix P (political orientation), Table 8 in Appendix Q (religiosity), and Table 9 in Appendix R (conspiracist ideation). While the main effect of age was not significant, a significant main effect of gender was observed in each model, indicating that male gender predicted negative beliefs toward the vaccines.

Table 5

Results from General Linear Models Including Interaction Between Condition and Political Orientation, Religiosity, or Conspiracist Ideation on the OCVCC

	OCVCC Mean								
	Political Orientation			Religiosity			Conspiracist Ideation		
	F	B	sr ²	F	B	sr ²	F	B	sr ²
Age	3.09	-.01	.005	0.14	-.002	.001	0.22	.001	<.001
Gender ^a	7.41**	.17**	.008	16.40***	.31***	.036	3.31	.15*	.007
Pred.	117.82***	.34***	-	18.28***	.14***	-	215.98***	.51***	-
M. Cond.	1.87	-	-	2.67*	-	-	1.90	-	-
Cond*Pred	3.94**	-	.041	1.54	-	.02	3.87**	-	.035
	Model Adj. R ² = 0.30			Model Adj. R ² = 0.11			Model Adj. R ² = 0.42		
M. Cond. Contrasts^b									
Pro-Emp		.02	<.001		.03	<.001		.06	<.001
Pro-Gen		.15	.002		-.14	.001		.14	.002
Pro-Spc		.01	<.001		-.06	<.001		.09	.001
Pro-Nrm		-.20	.004		-.10	<.001		-.17	.003
Pro-Ctrl		.09	<.001		-.06	<.001		.10	.001
Emp-Gen		.13	<.001		-.17	.001		.08	.001
Emp-Spc		.001	<.001		-.09	<.001		.02	<.001
Emp-Nrm		-.21	.005		-.13	.001		-.24*	.007
Emp-Ctrl		.08	<.001		-.09	<.001		.03	<.001
Gen-Spc		-.13	.002		.08	<.001		-.05	<.001
Gen-Nrm		-.35**	.014		.04	<.001		-.31**	.012
Gen-Ctrl		-.05	<.001		.08	<.001		-.04	<.001
Spc-Nrm		-.21	.005		-.04	<.001		-.26*	.008
Spc-Ctrl		.08	<.001		.001	<.001		.01	<.001
Nrm-Ctrl		.29*	.002		.04	<.001		.27*	.009
Cond*Pred Contrasts^c									
Pro-Emp		.02	<.001		-.04	<.001		-.22	.004
Pro-Gen		.16	.007		.16	.006		-.14	.002
Pro-Spc		.16	.006		.01	<.001		.30	.006
Pro-Nrm		-.17	.006		-.12	.003		-.31*	.009
Pro-Ctrl		.08	.001		.04	<.001		.02	<.001
Emp-Gen		.14	.004		.20	.006		.08	.001
Emp-Spc		.14	.004		.05	<.001		.51**	.019
Emp-Nrm		-.19	.007		-.08	.001		-.10	.001
Emp-Ctrl		.06	<.001		.08	.001		.24	.005
Gen-Spc		.001	<.001		-.15	.006		.43**	.014
Gen-Nrm		-.33***	.032		-.28**	.019		-.18	.003
Gen-Ctrl		-.08	.002		-.12	.004		.16	.002
Spc-Nrm		-.33***	.029		-.13	.005		-.61***	.028
Spc-Ctrl		-.09	.002		.02	<.001		-.27	.005
Nrm-Ctrl		.25**	.014		.16	.007		.34*	.010

Note. sr² = squared semi-partial correlation coefficient; M. Cond. = effect of messaging condition; Pred. = effect of the predictor variable (either political orientation, religiosity, or conspiracist ideation depending on the column); Cond*Pred = interaction term of condition and predictor; Pro = prosocial; Emp = empathy; Gen = general safety & efficacy; Spc = specific safety & efficacy; Nrm = norm-based; Ctrl = control.

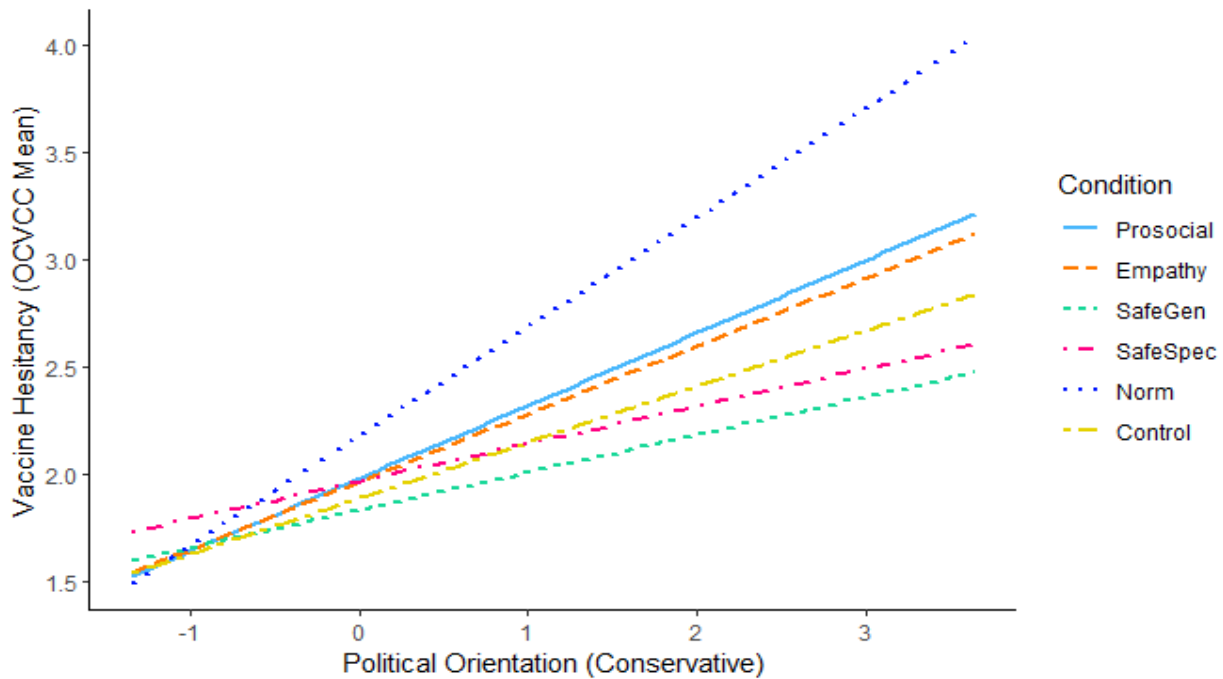
^aFemale was the reference group (female = 1, male =2). ^bPairwise comparisons among all levels of messaging condition. ^cInteraction contrasts involving each of the pairwise comparisons.

* $p < .05$, ** $p < .01$, and *** $p < .001$.

Figure 1 displays the combined influence of political orientation and message framing on the OCVCC. The general pattern suggests that those who hold stronger conservative beliefs reported more negative beliefs about the vaccines. The interaction contrasts in Table 5 indicate that those who reported stronger conservative political beliefs had significantly more negative beliefs in the norm condition compared to the general, specific, and control conditions.

Figure 1

Interaction of Political Orientation and Condition on COVID-19 Vaccine Attitudes and Beliefs

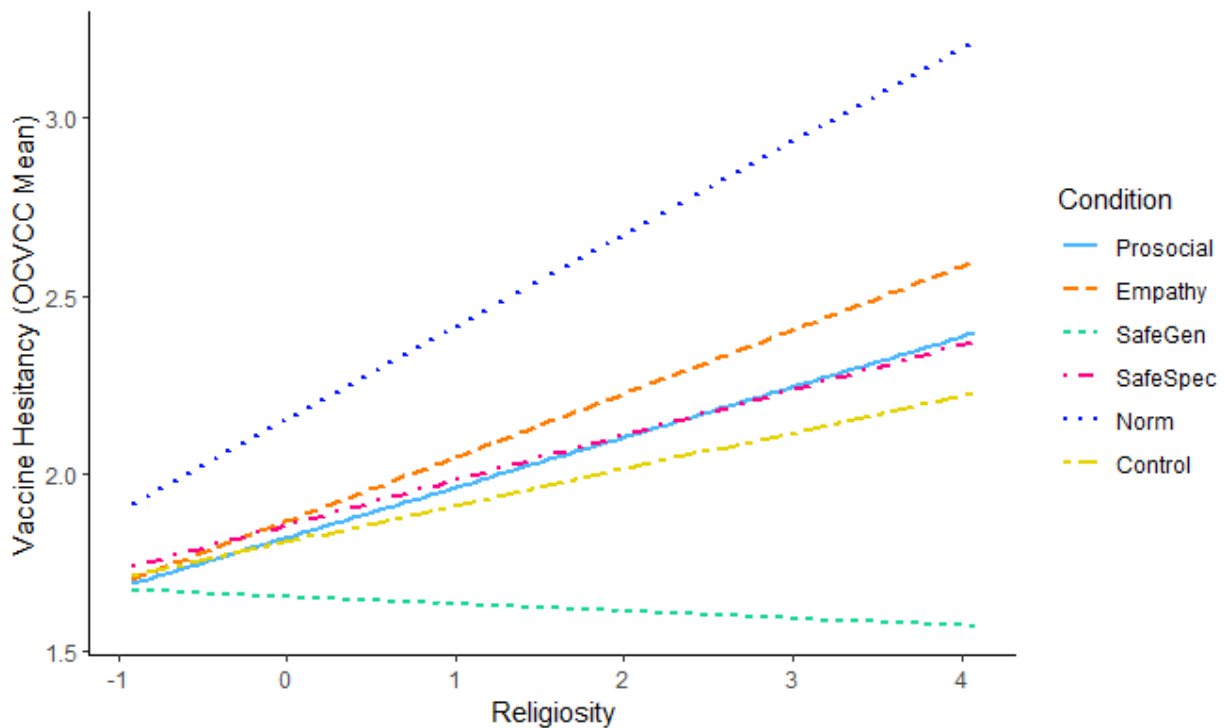


Note. A centred score for political orientation was used in the analysis. OCVCC= Oxford Covid-19 Vaccine Confidence & Complacency Scale mean score. SafeGen = general safety & efficacy; SafeSpec = specific safety & efficacy.

Figure 2 displays the combined influence of religiosity and message framing on the OCVCC. In general, we see that those who reported higher levels of religiosity tended to report more negative beliefs about the vaccines. The exception was the general safety and efficacy condition, where scores on the OCVCC saw a slight decrease (reflecting more positive beliefs) as religiosity increased. The interaction contrasts found in Table 5 indicate that higher levels of religiosity predicted significantly lower scores on the OCVCC in the general condition when compared to the norm condition.

Figure 2

Interaction of Religiosity and Condition on COVID-19 Vaccine Attitudes and Beliefs

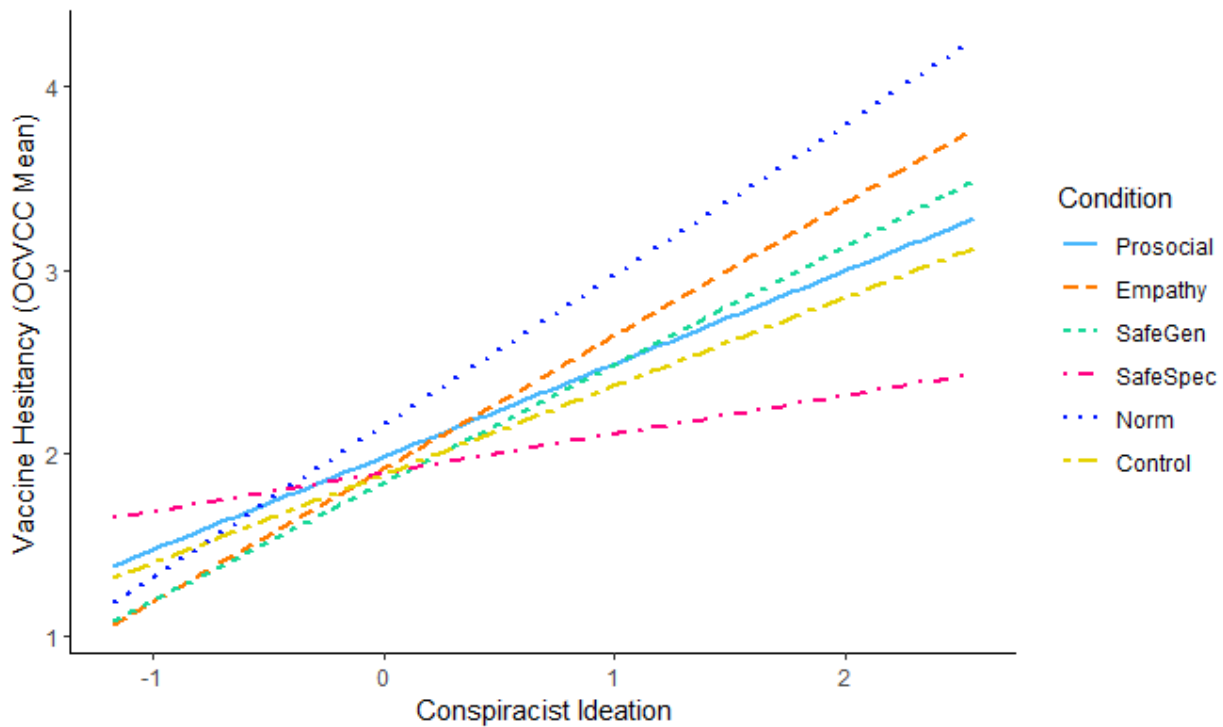


Note. A centred score for religiosity was used in the analysis. OCVCC = Oxford Covid-19 Vaccine Confidence and Complacency Scale mean score. SafeGen = general safety & efficacy; SafeSpec = specific safety & efficacy.

Figure 3 displays the combined influence of conspiracist ideation (as assessed using the mean score of the Generic Conspiracist Beliefs Scale) and message framing on the OCVCC. Here, we see that those who reported higher levels of conspiracist ideation tended to report more negative beliefs toward the vaccines. The interaction contrasts in Table 5 indicate that higher levels of conspiracist ideation significantly predicted more negative beliefs in the norm condition when compared to the prosocial, specific and control conditions. Likewise, beliefs were significantly more positive in the specific condition when compared to the empathy and general condition.

Figure 3

Interaction of Conspiracist Ideation and Condition on COVID-19 Vaccine Attitudes and Beliefs



Note. A centred score for conspiracist ideation was used in the analysis. OCVCC = Oxford Covid-19 Vaccine Confidence and Complacency Scale mean score. SafeGen = general safety & efficacy; SafeSpec = specific safety & efficacy.

Perceptions of Messaging

A summary of the findings related to the participants' perceptions of the public health messages, provided in the messaging conditions, can be found in Table 6. This includes the item assessing second-order beliefs and the emotional outcome measures assessing levels of enthusiasm, anxiety, and aversion participants felt after reading their message. For reference, in the item assessing second-order beliefs, participants were asked, "How likely is it that someone else who reads this message would get vaccinated against COVID-19?"

In the GLM used to assess second-order beliefs, the main effects of age, gender, and condition were not significant. Nonetheless, the contrast analysis indicates that participants more frequently reported believing that the message they read would be effective in encouraging others to vaccinate against COVID-19 in the specific condition when compared to those in the norm and empathy condition. In the GLMs for the emotional outcome measures, the main effect of age was not found to be significant, while the main effect of gender was significant in the Enthusiasm and Anxiety subscales. More specifically, identifying as female predicted higher levels of enthusiasm and anxiety after reading the public health message. A significant main effect of condition was also observed for each of the emotional outcome measures. The contrasts indicate that participants reported significantly less enthusiasm and more aversion and anxiety after reading the public health message in the empathy condition when compared to all other messaging conditions.

Table 6*General Linear Model Results for Condition, Age, and Gender on Second-Order Beliefs and Emotional Outcome Scores*

	Second-Order			Enthusiasm			Anxiety			Aversion		
	F	B	sr ²	F	B	sr ²	F	B	sr ²	F	B	sr ²
Age	0.18	.003	.001	0.55	-.13	.002	0.71	.01	.002	0.18	-.06	.001
Gender ^a	1.15	.17	.004	8.07**	-9.11**	.02	7.11**	-7.42**	.02	0.18	-1.15	.001
M. Cond.	1.66	-	.02	15.93***	-	.18	12.59***	-	.15	14.19***	-	.17
	Model Adj. R ² = .01			Model Adj. R ² = .20			Model Adj. R ² = .16			Model Adj. R ² = .16		
M. Cond. Contrasts^b												
Pro-Emp		0.32	.006		29.86***	.01		-23.24***	.08		-23.57***	.091
Pro-Gen		0.12	.001		-3.80	.002		1.0	<.001		3.73	.002
Pro-Spc		-0.16	.001		-0.69	<.001		2.28	<.001		2.10	<.001
Pro-Nrm		0.36	.007		0.84	<.001		0.21	<.001		-1.32	<.001
Emp-Gen		-0.21	.002		-33.65***	.13		24.24***	.099		27.30***	.130
Emp-Spc		-0.48*	.013		-30.54***	.11		25.52***	.108		25.68***	.113
Emp-Nrm		0.05	<.001		-29.02***	.10		23.45***	.094		22.24***	.087
Gen-Spc		-0.27	.004		3.11	.001		1.28	<.001		-1.62	<.001
Gen-Nrm		0.26	.004		4.63	.003		-.22	.006		5.06	.004
Spc-Nrm		0.53*	.016		1.52	.001		.23	.007		-3.44	.002

Note. sr² = squared semi-partial correlation coefficient; M. Cond. = main effect of messaging condition; Pro = prosocial; Emp = empathy; Gen = general safety and efficacy; Spc = specific safety and efficacy; Nrm = norm-based; Ctrl = control.

^aFemale was the reference group (female = 1, male =2). ^bPairwise comparisons among all levels of messaging condition.

* $p < .05$, ** $p < .01$, and *** $p < .001$.

Discussion

Although 90% of Canadians received two doses at the time of our study in December of 2021, the need for additional doses to maintain immunity against COVID-19 persists. To support efforts to improve vaccine uptake, it remains essential to know how the public's attitudes and perceptions toward the COVID-19 vaccines are influenced by public health messages. To address these concerns, this study compared the effect of six different messaging conditions on COVID-19 vaccine hesitancy and beliefs. Participants were randomly assigned to a messaging condition that included either a prosocial message emphasizing the benefits of vaccinating for the safety of others (referred to as the prosocial condition), a message describing a negative experience related to contracting COVID-19 from the perspective of someone with an autoimmune disorder (the empathy condition), two different messages emphasizing the safety and efficacy of the vaccine with general information (the general condition) and specific information containing statistics (the specific condition), a norm-based message emphasizing how a majority of Canadians plan to vaccinate against COVID-19 (the norm condition), or no message (the control condition). We aimed to answer two research questions: "What is the effect of public health messaging with different message frames on COVID-19 vaccine hesitancy and beliefs in Canadians?", and "How might individual differences predict outcomes on COVID-19 vaccine hesitancy and beliefs, and does the effect of different message frames depend on individual differences?"

Research Question 1: The Effect of Message Framing

As mentioned previously, the data obtained on our measure of COVID-19 vaccine hesitancy was not suitable for analysis. Therefore, the current discussion focuses on data obtained on our measure of COVID-19 vaccine beliefs. However, since COVID-19 vaccine

hesitancy and beliefs are very closely linked (Freeman et al., 2020), it should be noted that differences between groups in COVID-19 vaccine beliefs may extend to differences in COVID-19 vaccine hesitancy.

The results indicated that messaging condition did not significantly predict beliefs toward the COVID-19 vaccines. However, contrary to expectations, beliefs toward the vaccines were significantly more negative in the norm condition when compared to the control, prosocial, and general conditions. While certain studies have failed to find differences in the effectiveness of different message frames in reducing hesitancy toward the vaccines (see Duquette, 2020; Favero & Pederson, 2020; Hacquin et al., 2020), to our knowledge, the only other authors to report significantly greater vaccine hesitancy after exposure to a message are Palm et al. (2021). In their study, this effect was observed after participants read a message communicating the descriptive norm that many Americans were unwilling to vaccinate against COVID-19 in the context of the suspected health risks. The norm-based message included in the current study was distinct in that it did not purposefully highlight negative information. Rather, following the advice of Bavell et al. (2020) and Bonnett et al. (2020), it was designed to highlight both a positive descriptive norm, i.e., “there is a widespread willingness to vaccinate against COVID-19”, and an injunctive norm, i.e., “most people believe that it is important for everyone to be vaccinated to stop the COVID-19 pandemic.”

While it is only possible to speculate as to why such a result was obtained, there is evidence to suggest that descriptive and injunctive norms can provoke unique behavioural responses and influence vaccination intentions differently (Grauspensperger et al., 2021). Some authors have suggested that it is more effective to bring attention to the injunctive norm of what is socially approved or disapproved rather than the descriptive norm of what is being done or not

done (see Cialdini et al., 2006). The argument can be made that when attention is brought to what people *are* doing, for example, it can inadvertently bring attention to what people are also *not* doing. As such, the inclusion of the descriptive norm that many people are vaccinated might have inadvertently installed the counterproductive descriptive norm that many people are not vaccinated. However, several studies have reported reductions in COVID-19 vaccine hesitancy following exposure to norm-based messages (Liu et al., 2022; Moehring et al., 2021; Sinclair & Agerström, 2023), suggesting that the more negative attitudes of those in the norm-based messaging condition (as compared to the control, prosocial and general conditions) in the current study may be attributable to other factors as well.

Notably, while the sentence “Please, take part in what most people are doing, and get vaccinated against COVID-19” included in the norm-based condition was designed to help establish the descriptive norm of a widespread willingness to be vaccinated, this call for individual action might have provoked a contrarian attitude similar to what was observed in a study by Palm et al. (2020). They found that messages advocating for personal behaviour changes to combat climate change inadvertently reduced willingness to do so when compared to messages advocating for policy changes. In fact, messages containing calls for individual action led to a more negative response towards the entire message, as evidenced by participants reporting reduced trust and increased skepticism towards climate scientists. Importantly, while other messaging conditions in the current study advocated for behaviour changes, the emphasis was on societal action rather than individual action. For example, in the empathy condition, it was stated, “Please, we need to all get vaccinated...,” and in the prosocial condition, it was stated, “Together, by getting vaccinated for COVID-19, we can save millions of lives.”

In sum, bearing in mind the small effect sizes, the differences in the way these messages advocate for change might help to explain why beliefs in the norm condition were significantly more negative. The current study might offer supporting evidence that messages explicitly advocating for personal behaviour changes, or norm-based messages containing a descriptive norm describing widespread willingness to vaccinate against COVID-19, are at higher risk of backfiring.

Message Framing and Second-Order Beliefs

When considering the general lack of differences in beliefs toward COVID-19 vaccines between messaging conditions for our primary outcome measures, the messages were perhaps insufficiently salient in the context of a public space already saturated with public health messages at the time of recruitment. Given the frequent exposure to COVID-19 vaccine-related information in daily life and the strong social desirability of vaccinating, a ceiling effect on our outcome measures was anticipated. Therefore, a measure of second-order beliefs was used, which asked participants “How likely is it that someone else who reads this message would get vaccinated against COVID-19?” Based on an argument made in a study by Everett et al. (2020), this measure was expected to be less sensitive to the effects of the social desirability of vaccination while also reflecting personal beliefs about the message. The results of this measure indicated that those in the specific condition reported believing that the message they were exposed to would be more effective in encouraging others to vaccinate relative to those in the norm-based and empathy-based messages. Although the size of the effect is small, this finding seems compatible with other research indicating that transparent information about the safety and efficacy of the COVID-19 vaccines is perceived more positively and increases trust and support when compared to other types of messages (Palm et al., 2021; Petersen et al., 2021). While this is

not direct evidence of this message's efficacy in reducing COVID-19 vaccine hesitancy, it suggests that the message in the specific condition was perceived as more persuasive, at least when compared to the norm and empathy condition.

The Role of Emotions in The Effect of Message Framing

Based on previous research highlighting the importance of emotions in COVID-19 vaccination campaign efforts (Chou & Budenz, 2020; Heffner et al., 2020; Pfattheicher et al., 2020), we asked participants to rate the extent to which they felt enthusiasm, anxiety, and aversion after reading the message included in their condition. Unsurprisingly, the results indicated that the empathy-based message describing the experience of someone with an autoimmune disorder contracting COVID-19 provoked significantly less enthusiasm and more anxiety and aversion compared to all other messages. Medium effect sizes were observed in each comparison. Recent studies have reported an interactive effect between the emotions elicited by a message and changes in COVID-19 vaccine hesitancy (Liu et al., 2022; Yang, 2022); however, since the empathy-based message was not found to be more effective on our outcome measures when compared to the control condition, the potential for this message to provoke stronger emotions does not appear to have had an impact on its effectiveness.

The message in the empathy condition was adapted from a study by Pfattheicher et al. (2020), who found that a message that provoked empathy for vulnerable populations was effective in motivating participants to wear a mask to reduce the spread of COVID-19. It could be speculated that a message designed to provoke empathy for vulnerable populations might be more effective earlier in the pandemic before the introduction of COVID-19 vaccines when the perceived health risks of contracting the virus might have been greater. This assumption would be supported by a trend observed during the H1N1 pandemic. The introduction of the H1N1

vaccines reduced the expected risk of contracting the virus, which in turn reduced the perceived need and motivation to take the vaccine (Bults et al., 2015). Relatedly, it is perhaps worth noting that at the time of recruitment, news had begun circulating that the COVID-19 vaccines were effective in reducing COVID-19-related incidences, hospitalizations, and deaths (Moghadas et al., 2021).

Research Question 2: The Role of Individual Differences

Demographic Traits

As it pertains to the demographic variables examined in the current study, those who identified as male and those of younger age reported more negative beliefs toward the COVID-19 vaccines. The effects of both variables were small. Other sample characteristics, including education, employment, ethnicity, and the province of residence, were not significantly associated with beliefs toward the vaccines. The findings related to age and beliefs are consistent with much of the literature published during the pandemic, where those of younger age groups have often been reported as more hesitant than those of older age (Hudson & Montelpare, 2021; Lawes-Wickwar et al., 2021; Mewhirter et al., 2022). Many studies have indicated that older age is associated with greater perceived susceptibility to disease, which has uniquely predicted COVID-19 vaccination uptake (Hudson & Montelpare, 2021; Mewhirter et al., 2022). However, age was not associated with differences in beliefs between conditions, meaning that beliefs after exposure to the different message frames included in the current study do not appear to have been influenced by age. In other words, while age predicted beliefs, no clear indications as to how messages could be tailored for specific age groups were obtained.

Further, the finding that identifying as male predicted negative beliefs towards the vaccine appears inconsistent with much of the published literature (for meta-analyses, see Cénat

et al., 2022; Nikpour et al., 2021). For example, in a study examining vaccine hesitancy and beliefs in Ontario, females were found to report greater vaccine hesitancy and greater concerns over vaccine safety (Syan et al. 2021). More recently, Morales et al. (2022) also found that hesitancy in women is more strongly associated with lower perceived safety of the vaccine, while in men it is more strongly associated with lower perceived health risks from contracting COVID-19. However, these studies may reflect beliefs held earlier in the pandemic, as data from the Public Health Agency of Canada (2023) indicates that vaccination rates are higher in females than in males (see also Gepner & Chehbouni, 2021). If the perceived safety of the COVID-19 vaccines was improving at the time at which our data were collected, the findings may reflect a change in trends of vaccine hesitancy and beliefs according to gender. Lastly, exploratory analyses indicated that there was no significant interaction between gender and condition, suggesting that the effect of message framing on COVID-19 vaccines did not depend on gender.

Political conservatism, religiosity, and conspiracist ideation all had significant positive correlations with the OCVCC, meaning participants who reported higher levels of these psychological traits also reported more negative beliefs about the COVID-19 vaccines. These findings are consistent with several studies highlighting the association between these variables and COVID-19 vaccine hesitancy (Cénat et al., 2022; Freeman et al., 2022; Hudson & Montelpare, 2021; Jensen et al., 2022; Muhajarine et al., 2021). The current study also investigated whether facets of perfectionism and intolerance of uncertainty were related to negative beliefs about the vaccines, however, no associations were found. In other words, the findings of the current study do not suggest that perfectionism and intolerance of uncertainty are important targets for COVID-19 public health messaging.

Political Orientation

The significant interaction between political orientation and messaging condition indicated that the effect of message framing depended on participants' political orientation (a large effect size was observed). Those who were more politically conservative, for example, reported more negative COVID-19 beliefs in the norm condition when compared to the general, specific, and control conditions. Small effect sizes were observed for each comparison. The association between political conservatism and negative beliefs about the COVID-19 vaccines is consistent with what has been reported in other studies (Borah, 2022; Jensen et al., 2022; Palm et al., 2021).

Interestingly, when political orientation was not accounted for in our models, beliefs toward the vaccines in the empathy condition were significantly more positive when compared to the norm condition (a small effect size was observed). However, no difference between the empathy and norm conditions was observed in models accounting for political orientation, suggesting that more conservative participants were less responsive to the message designed to provoke empathy when compared to other participants. These findings might be explained by research reporting that those who are more conservative tend to express less empathy and less willingness to help those outside of close social circles when compared to those with more liberal views (Hasson et al., 2018). Hill et al. (2022) have also found that lower levels of empathy mediate the association between political conservatism and lower levels of engagement in COVID-19 preventative measures. Relatedly, a study by Boral et al. (2022) examining the impact of various messages on COVID-19 vaccine hesitancy reported that those who consumed more conservative media were more impacted by a message emphasizing the individual benefits of vaccinating when compared to a message emphasizing the collective benefits.

It was also found that among more conservative participants, beliefs toward the COVID-19 vaccines were significantly more positive in the specific and general conditions relative to the norm condition (small to medium effect sizes were observed). When political orientation was not accounted for in the models, only participants in the general condition reported more positive beliefs toward the vaccines when compared to the norm condition. Since the general and specific messages both emphasize the safety the vaccine provides to the individual, this could further illustrate how more conservative participants may be more responsive to messages emphasizing the individual benefits of vaccinating as opposed to the collective benefits (Borah, 2022). Again, while more conservative participants did not report more positive beliefs toward the vaccines in any condition relative to control, these findings highlight the unique influence political orientation can have on the effect of message framing.

Religiosity

Several studies have described associations between religiosity and hesitancy (e.g., Berg & Lin, 2021; Garcia & Yap, 2021; Kibongani Volet et al., 2022; Mewhirter et al., 2022), however, few have investigated how religiosity might influence the effect of different message frames on beliefs toward the COVID-19 vaccines (see Viskupič & Wiltse, 2022). While the effect of message framing on beliefs toward the vaccines did not depend on participants' religiosity, a trend in Figure 2 illustrates that these beliefs were more negative among participants higher in religiosity in all conditions except the general condition. Likewise, beliefs toward the vaccines among more religious participants were significantly more negative in the norm condition when compared to the general condition. A small effect size was observed in this comparison. Taken together, these findings suggest that those with stronger religious beliefs report more positive beliefs toward the vaccines after reading messages containing general

information about the safety and efficacy of the vaccines, especially when compared to the norm condition.

Interestingly, while both the general and specific conditions report information about the safety and efficacy of the vaccines, only the general condition was associated with more positive beliefs toward the vaccines relative to the norm condition in those with stronger religious beliefs. This finding is perhaps related to reports from other studies identifying higher rates of mistrust towards scientific information and authorities among those who are more religious (Kibongani Volet et al., 2022; Mewhirter et al., 2022; Viskupič & Wiltse, 2022). For example, in one of the few studies which specifically examined the influence of religiosity on the effectiveness of messaging in reducing COVID-19 vaccine hesitancy, Viskupič and Wiltse (2022) found that an endorsement message from a religious leader was significantly more effective than an identical message presented by either a political or medical leader. Such experimental findings are consistent with suggestions made in a recent review by Kibongani Volet et al. (2022) examining potential communications strategies to reduce hesitancy among religious groups. The authors argue that to effectively develop messages tailored to religious demographics, they should “be based on transparency to build trust, dialogue to involve the targeted community, identify its potential reluctances and address them through the exchange of scientific information” (p.2). Taken together, findings from the current study and recent literature seem to highlight the importance of addressing concerns related to the safety and efficacy of the vaccines for those who are more religious, while also being mindful of factors that appear to influence the perceived trustworthiness of messaging for this demographic.

Conspiracist Ideation

The significant interaction between conspiracist ideation and messaging condition indicated that the effect of message framing depended on participants' levels of conspiracist ideation (a large effect was observed). For those who reported higher levels of conspiracist ideation, more negative beliefs were observed in the norm condition when compared to the prosocial, specific, and control conditions, and in the empathy and general conditions when compared to the specific condition. The effect of the message in the specific condition for those with more conspiratorial beliefs when compared to the messages in the general and empathy conditions is particularly interesting. Although the messages in the specific and general conditions both emphasized the safety and efficacy of the COVID-19 vaccines, this finding suggests that participants with stronger conspiratorial beliefs respond more favourably to this message frame when provided with specific information (e.g., statistics). Likewise, the message in the empathy condition emphasized the need to vaccinate to protect those most vulnerable to the effects of COVID-19, suggesting that those with higher levels of conspiracist ideation are less responsive to messages designed to provoke empathy when compared to a message with specific scientific information.

In light of other research reporting associations between conspiracist ideation, exposure to misinformation and distrust of the COVID-19 vaccines (Cénat et al., 2022; Hudson & Montelpare, 2021; Jennings et al., 2021; Petersen et al., 2021; Tan et al., 2022), these findings might suggest that beliefs toward the vaccines for those higher in conspiracist ideation are most malleable when confronted with specific information about the safety and efficacy of the vaccines because they address knowledge gaps or sources mistrust. As suggested by Mewhirter et al. (2022), increasing trust in the COVID-19 vaccines appears to be the most important

pathway to reducing hesitancy. Relatedly, a study by Petersen et al. (2020) found that transparent information about the COVID-19 vaccines was effective in increasing trust in health authorities. Therefore, while providing transparent and specific information about the vaccines may not result in strong immediate changes in beliefs toward the vaccines, it might prove helpful in long-term efforts to build trust and limit factors that drive COVID-19 vaccine hesitancy and negative beliefs toward the vaccines, especially for those higher in conspiracist ideation.

Limitations and Future Directions

As with any study, certain limitations should be noted. First, the online recruitment method introduced certain limitations. For reference, participants were recruited online using advertisements on Reddit from November 17th to December 15th, 2021. Given the state of the pandemic, in-person recruitment methods were avoided, and social media sites offered an ideal way to obtain a representative Canadian sample. Additional websites were considered; however, Reddit was the only social media site known to the researchers that did not involve important delays in the time required to start advertising. For example, Meta owned platforms such as Facebook and Instagram required over a week for the account verification process. While the sample appears to be representative of Canadian demographics, this recruitment method might have limited the generalizability of results and introduced bias as to who agreed to participate. This potential bias might help explain why we obtained a limited number of unvaccinated participants. Future research should consider broader recruitment methods to improve the generalizability of findings, and additional recruitment methods suitable for overrecruiting unvaccinated participants, such as targeted advertisements on specific social media forums where those higher in vaccine hesitancy are more likely to frequent.

Likewise, given the frequency of changes in news, recommendations, and mandates regarding COVID-19 vaccines, the recruitment period was kept relatively brief to limit the potential for significant differences occurring in how participants perceived the COVID-19 vaccines from the beginning of the recruitment period to the end. However, extending the recruitment period could be seen as having important benefits. Naturally, it would have assisted in obtaining a larger sample size and perhaps a larger number of unvaccinated participants. Moreover, it would have allowed the study to investigate if the effect of different message frames changes according to the state of the pandemic by comparing results from one period of recruitment to another.

Additionally, due to the relatively few unvaccinated participants who were recruited, our ability to analyze their scores on vaccine hesitancy-related outcomes was limited. A larger sample size for this group might have provided more nuanced findings as to which message frame was more effective, or which individual differences were most relevant, within this cohort. However, although the proportion of unvaccinated participants was small, comparatively higher rates of vaccine hesitancy were captured within the sample. Given the vaccination requirements present in Canada at the time of recruitment, it is important to note that an individual's vaccination status against COVID-19 is not fully representative of their levels of vaccine hesitancy. For example, several participants who received a COVID-19 vaccine might have only done so to meet the vaccination requirements of their school or workplace. As such, future research should consider variables such as participants' vaccine beliefs and willingness to take additional doses of a vaccine when assessing vaccine hesitancy.

Participants were also recruited nearly two years after the COVID-19 pandemic was announced, a point at which they would have likely already been exposed to significant amounts

of public health messaging addressing COVID-19 vaccines. Although this could not be controlled for, prior exposure to COVID-19 vaccine public health messaging might have limited internal validity. Research examining the effectiveness of message framing remains relevant at all points of a pandemic; however, future research conducted in the early stages of a pandemic, or more specifically, before perceptions of a vaccine are well-established, might provide stronger contributions toward efforts dedicated to limiting vaccine hesitancy.

Likewise, there are also limitations regarding the appearance and design of the messages. For context, the messages in the current study were screenshots of fictional Facebook posts where the name and profile picture of the account were blurred. The anonymity of the messages was intended to limit the potential influence of design elements other than message framing on our outcomes. However, since messages promoting vaccination in real-world settings are unlikely to be anonymous, the appearance of the investigated messages might limit the external validity of our findings. Therefore, future research could benefit from manipulating elements of messages that more closely resemble real-world public health messages. Studies have also shown that design elements such as message source (i.e., the individual or organization providing the message; Betta et al., 2022; Huang & Liu, 2022; Motta et al., 2021), media type (e.g., video, flyer; Jin et al., 2021), and length (Kerr et al., 2021) can also affect a message's effectiveness. It follows that the messages included in the current study might have been more or less effective if other design elements were incorporated. Future research could consider investigating the influence of a wider scope of design elements on messages promoting COVID-19 vaccines.

This study is also limited in the variations of the message frames it examined. Although two variations of the safety and efficacy frame were used (general versus specific information), only one variation of the other frames was examined. The fact that the messages with the safety

and efficacy frame did not have the same effect on various outcomes highlights the possibility that variations of other investigated frames could have been more effective. Therefore, future research investigating a certain message frame would be better equipped to assess its effectiveness by examining multiple variations. Notably, given the polarized political climate in Canada regarding COVID-19 vaccinations, future research might benefit from investigating norm-based messages tailored to different political groups. The norm-based message in the current study promoted vaccination against COVID-19 as a broad national norm, however, it stands that vaccination was heavily politicized. Members of vaccine-hesitant groups in Canada were often characterized by conservative political partisanship with views strongly opposed to those of the liberal government of Canada (Peng, 2022), who might be seen as the face of the “national” norm. Although the importance of a unified and consistent message is well established in the literature (e.g., Morganstein, 2022), the political divide was perhaps too severe for a unified message to have a positive effect because the message no longer applied to the perceived norm of all Canadians. In this case, those who are right-leaning might have a more positive response to a message explaining that many conservatives (as opposed to “Canadians”) plan on getting vaccinated since the norm is attributed to a political group with which they identify.

Lastly, this study did not obtain a baseline of COVID-19 vaccine hesitancy and beliefs in participants before exposure to messaging. Obtaining a baseline could have allowed the study to investigate potential changes in COVID-19 hesitancy and beliefs toward the COVID-19 vaccines as a result of messaging as opposed to investigating differences between groups. Future research may want to consider a methodology assessing COVID-19 vaccine hesitancy and beliefs before and after exposure to public health messaging with different message frames.

Conclusion

This study investigated the effect of differently framed public health messages on COVID-19 vaccine beliefs. Ultimately, message framing did not have a significant impact on beliefs toward the vaccines. However, the unexpected finding that beliefs were more negative following exposure to the norm-based message when compared to the general, empathy, and control conditions is highly relevant for vaccination campaign efforts. While it is unclear why this result was obtained, findings from other studies might suggest it could be related to the norm-based message's inclusion of a descriptive norm or its call for individual action (Graupensperger et al., 2021; Palm et al., 2020). As some authors have previously reported reductions in COVID-19 vaccine hesitancy following exposure to norm-based messages (Liu et al., 2022; Moehring et al., 2021; Sinclair & Agerström, 2023), future research should further investigate how to optimally apply this message frame.

This study also utilized measures assessing how participants perceived the message included in their condition. According to a measure of second-order beliefs, participants were more likely to report that the message with specific information about the safety and efficacy of the vaccines would be effective in encouraging others to vaccinate against COVID-19 when compared to the norm-based and empathy-based messages. While this is not a direct measure of change in COVID-19 vaccine hesitancy, the perceived effectiveness of this message when compared to the norm and empathy conditions remains relevant. In addition, participants were asked to rate how much enthusiasm, aversion, and anxiety they felt in response to reading the message in their condition. The message in the empathy condition provoked significantly less enthusiasm, more aversion, and more anxiety compared to all other conditions, however, no associations between emotional reactions and message effectiveness were observed. Future

research should consider examining a broader range of emotions to potentially uncover associations between emotional outcomes and COVID-19 vaccine hesitancy and beliefs to inform messaging strategies.

The role of individual differences in predicting COVID-19 vaccine beliefs was also explored. Those of younger age and those who identified as male reported more negative beliefs about the COVID-19 vaccines as compared to older and female participants. However, the effect of messaging was not influenced by either of these variables. In addition, higher levels of conservative political beliefs, religiosity, and conspiracist ideation were all positively correlated with negative beliefs, but the effect of message framing was only significantly influenced by political orientation and conspiracist ideation. For those who rated highly on either of these three variables, none of the messages resulted in more positive beliefs when compared to the control group. However, participants who were more politically conservative showed more negative beliefs toward the vaccines in the norm condition when compared to the general and specific conditions; those who were more religious showed more negative beliefs about the vaccines in the norm condition when compared to the general condition; and participants with higher levels of conspiracist ideation showed more negative beliefs about the vaccines in the norm condition when compared to the specific and prosocial conditions, and in the empathy and general condition when compared to the specific condition. As a general trend, we see that messages emphasizing the safety and efficacy of the vaccines were most effective for those who reported higher levels of these three individual differences. While beliefs following exposure to the messages in the specific and general conditions were not significantly different from the control group, their relative influence compared to other messages is highly relevant when deciding how to tailor messages for those who rate more highly on these traits.

In conclusion, this study provides important information on the effect of message framing and individual differences on messages promoting vaccination against COVID-19. To those responsible for designing and disseminating public health messages, we suggest that messages addressing either the benefits of vaccinating for others, the health consequences of contracting COVID-19 for vulnerable populations, or the safety and efficacy of the vaccines with specific or general information, may have a limited ability to affect beliefs about the COVID-19 vaccines. Although we were unable to conclusively determine why this message had a negative effect on beliefs, our findings would also caution against the use of a message addressing widespread willingness to be vaccinated. Likewise, we suggest that those of younger age, those who identify as male, and those with higher levels of politically conservative beliefs, religiosity, and conspiracist ideation reported more negative beliefs about the vaccines, and messages addressing the safety and efficacy of the vaccines may be most effective when targeting these demographics. Thus, our findings provide important insights for researchers and public health practitioners developing messages promoting vaccination against COVID-19.

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Appendix A

Social Media Recruitment Script



Study Title: Public Health Messages and COVID-19

We are looking for participants 13 years and older to take part in a study on public health messaging and COVID-19. You will be asked to complete a brief online questionnaire that asks about your attitudes and beliefs towards the COVID-19 pandemic and public health guidelines, your personality and your beliefs about the world. The study will consist of one session and will take approximately 15 minutes to complete. For completing this study, you can choose to be entered in a draw to win 1 of 3 \$50 Amazon gift cards. If you would like to participate, please click on the following link:

Appendix B
Informed Consent Form



Study title: Public Health Messages and COVID-19

Researchers: Luc Huneault and Dr. Chantal Arpin-Cribbie

The purpose of this study is to gain a better understanding of public health messaging and individuals' experiences with the Covid19 pandemic. You will be asked to complete a brief online questionnaire that asks about your attitudes and beliefs towards the COVID-19 pandemic and public health guidelines, your personality and your beliefs about the world. This online study will take approximately 15 minutes to finish. At the end of the study, you will be told more about what we are trying to understand. In case you have questions, we will also give you contact information for the researchers.

We don't expect this study will cause any harm. If answering the questions makes you feel uncomfortable and you feel like you need help or you want to talk with someone, these are some free places you can visit online to find help centers in your regional area:

National and International Help Centers (in your country/area):

(W): <https://www.iasp.info/crisis-centres-helplines/>

Canadian Mental Health Association (in your regional area):

(W): <https://cmha.ca/find-your-cmha>

For information on coping with stress related to the pandemic along with additional resources:

(W): <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>

If you decide to participate in this study, you have the right to withdraw at any time without penalty or consequence. We won't ask you for your name, so any answers you give us cannot be linked to you in any way. The information we get in this study will be kept safely in password-protected files. We may share general information from this study in presentations or research papers.

If you used Instagram, Facebook, or Reddit to click on the study link:

Instagram, Facebook, and Reddit are based in the United States and follow the U.S Patriot Act. These social media sites could see that you clicked on our study link, if they wanted to share this information with Third Parties, such as advertisers. However, they will only see that you clicked on the study link, and they will not be able to see any information you give us.

When you clicked on our study link, you left Instagram, Facebook, or Reddit and were directed to RedCap, a safe website that holds data collected from people who complete research studies. RedCap cannot track anyone who provides answers. Now that you are on RedCap, any answers you provide us will be private.

Please click on the links below for the privacy policies of Instagram, Facebook, and Reddit:

Instagram Privacy Policy: <https://help.instagram.com/519522125107875>

Facebook Privacy Policy: <https://www.facebook.com/policy.php>

Reddit Privacy Policy: <https://www.redditinc.com/policies/privacy-policy>

If you have questions about the study, you may contact either researcher:

Dr. Chantal Arpin-Cribbie – carpincribbie@laurentian.ca

Luc Huneault - lhuneault@laurentian.ca

For questions about the ethics of your participation in the study, you may contact a Research Ethics Officer from the Laurentian University Research Office at ethics@laurentian.ca or 1-800-461-4030 (toll-free).

At the end of the study, you will be redirected to a separate RedCap website and will have the opportunity to enter the **draw for 1 of 3 \$50.00 CAD Amazon gift cards** by providing your email address. Your email address will not be linked to any of the information you provide us throughout the study.

I have read the information and agree to participate in this study by answering the questions. I know that even though I did not sign a consent form, information related to my participation is sent to the researchers, and answering questions can be understood as consent.

I agree to participate in this study ____

I do not agree to participate in this study ____

Appendix C

Debriefing Form



Thank you for participating in the study conducted by Luc Huneault under the supervision of Dr. Chantal Arpin-Cribbie.

The main purpose of this research is to explore how public health messages can influence attitudes and beliefs toward the COVID-19 vaccines and to learn we can use public health messages more effectively.

This study had six groups in total. One group did not receive any public health messages. The other five groups each received a different public health message: one that explained why it was important to vaccinate to help protect others, one that explained how most people were planning to vaccinate against COVID-19, one that described a difficult experience related to contracting COVID-19, one that described the safety and efficacy of the vaccine with specific details and another with less specific details. Each of these public health messages was expected to be effective in improving beliefs and attitudes towards the vaccines, but the main goal was to see which was generally most effective and to see how certain types of public health messages might be better used with certain groups of people (for example, men, students, those who are younger, etc...).

At the beginning of the study, you were asked about your demographic information, and you might have been shown a public health message. Afterwards, you were asked about your attitudes and beliefs towards the COVID-19 vaccines, and your intentions to follow public health guidelines following vaccination. These questions will help us assess how the public health messages included in this study might be able to influence actions and perceptions that are important in stopping the COVID-19 pandemic.

This study also asked you about your emotional responses to the messages and your thoughts about the message. These questions will be used to assess how they were received by participants and to learn how they might be effective or how they might be improved. It is believed that messages associated with more positive emotions and positive language would be more effective.

Lastly, you were asked about levels of perfectionism, your intolerance of uncertainty and your beliefs about the world. The purpose of asking these questions, in addition to the sociodemographic questions, was to see how different people respond to different messages. A lack of previous research makes it unclear how these characteristics might influence responses and feelings towards different public health messages regarding the COVID-19 vaccines.

Although the researchers have made every effort to minimize any negative emotional reactions, there is a possibility that you may experience feelings of uneasiness during the study. If you feel

the need for additional help and support, these are some free places you can visit online to find help centers in your regional area:

Canadian Mental Health Association (in your regional area):

(W): <https://cmha.ca/find-your-cmha>

National and International Help Centers (in your country/area):

(W): <https://www.iasp.info/crisis-centres-helplines/>

For information on coping with stress related to the pandemic along with additional resources:

(W): <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>

Once you click the “submit” button below on the screen you will be redirected to a separate RedCap website and will have the opportunity to enter into the **draw for a \$50.00 Amazon gift card** by providing your email address. You will also be asked if you would like to get a summary of the information we find in this study. If you want, you can provide us with your email address and we will send this to you once the results are available. It is important to mention that your email address will not be linked to any of the other information you provided to us throughout the study.

If you have questions about the study, you may contact either researcher:

Luc Huneault – lhuneault@laurentian.ca

Dr. Chantal Arpin-Cribbie – carpincribbie@laurentian.ca

For questions about the ethics of your participation in the study, you may contact a Research Ethics Officer from the Laurentian University Research Office at ethics@laurentian.ca or 1-800-461-4030 (toll free).

Appendix D

Demographic Information

- 1) **[in_Canada] Do you live in Canada?**
 - a) Yes
 - b) No
- 2) **[can_2years] Have you lived in Canada for the majority of the past two years?**
 - a) Yes
 - b) No
- 3) **[province] Which province do you live in?**
 - a) Alberta
 - b) British Columbia
 - c) Manitoba
 - d) New Brunswick
 - e) Newfoundland
 - f) Labrador
 - g) Nova Scotia
 - h) Ontario
 - i) Prince Edward Island
 - j) Quebec
 - k) Saskatchewan
- 4) **[city] What city do you live in?**
 - a) _____
 - b) Prefer not to say
- 5) **[urban_rural] Urban areas have large populations of people that live and work closely together (e.g., cities and towns), while rural areas are the opposite (e.g., farmland and villages). Which best describes the area where you live?**
 - a) Urban
 - b) Rural
 - c) Not sure
- 6) **[postal_code] What is your postal code?**
 - a) _____
 - b) Prefer not to say
- 7) **[age] Please indicate your age:**
 - a) _____
- 8) **[gender] How do you describe your gender identity?**
 - a) Female
 - b) Male
 - c) Transgender female
 - d) Transgender male
 - e) Not listed
 - f) Prefer to not answer
 - g) Prefer to self-describe: _____

9) [sex] What sex were you assigned at birth?

- a) Female
- b) Male
- c) Prefer not to answer

10) [ethnicity] How would you best describe your ethnicity?

- a) Asian
- b) Black or African American
- c) First Nations
- d) Metis
- e) Inuit
- f) Middle Eastern or North African
- g) Native Hawaiian or Other Pacific Islander
- h) White
- i) Other (Please specify): _____
- j) Prefer not to say

11) [education] Highest level of education completed:

- a) Have not yet attended high school
- b) Less than a high school degree
- c) High school diploma
- d) Technical college
- e) Attended College
- f) Bachelor's degree
- g) Graduate Degree
- h) None of the above
- i) Other (please specify): _____

12) [employment] What is your current employment status? Check ALL that apply

- a) Full-time student
- b) Part-time student
- c) Working full time
- d) Working part time
- e) Not currently employed, looking for work
- f) Not currently employed, not looking for work
- g) Retired
- h) Disabled (not working because of a permanent or temporary disability)
- i) Other (please specify): _____

13) [health] Overall, considering any health conditions that you have, how would you evaluate your health?

- a) Terrible
- b) Very bad
- c) Bad
- d) Moderate
- e) Good
- f) Very good
- g) Excellent

- 14) [c19_cases] *Rate how much you agree:* There are a lot of cases of COVID-19 in my local area.
- a) Strongly disagree
 - b) Disagree
 - c) Neither agree nor disagree
 - d) Agree
 - e) Strongly agree
- 15) [c19_concern] *Rate how much you agree:* I am concerned about the number of COVID-19 cases in my local area.
- a) Strongly disagree
 - b) Disagree
 - c) Neither agree nor disagree
 - d) Agree
 - e) Strongly agree
- 16) [has_vax] Have you received a COVID-19 vaccine?
- a) Yes
 - b) No
- 17) [full_vax] Are you fully vaccinated against COVID-19?
- a) Yes
 - b) No
- 18) [has_booster] Have you received a booster shot of the COVID-19 vaccine?
- a) Yes
 - b) No
- 19) [vax_motiv] What motivated you to get vaccinated? Select ALL that apply.
- a) Protect my health
 - b) Protect health of family/friends
 - c) Protect health of co-workers
 - d) Protect health of community
 - e) To get back to work/school
 - f) To resume social activities
 - g) To resume travel
 - h) Others encouraged me to get vaccinated
 - i) I was required to because of a vaccination mandate
 - j) Other (please specify): _____
 - k) Not sure

20) [had_c19] What makes it difficult for you to get a COVID-19 vaccine? Select ALL that apply.

- a) I am concerned side effects will prevent me from going to work.
- b) I can't go on my own (I have a physical limitation)
- c) It's too far away
- d) I don't know where to go to get vaccinated.
- e) I'm not eligible to get a COVID-19 vaccine.
- f) I have a medical reason that makes me ineligible to get vaccinated (e.g., I have had a severe allergy to vaccines in the past).
- g) I don't have transportation.
- h) The hours of operation are inconvenient.
- i) The waiting time is too long.
- j) It was difficult to find or make an appointment.
- k) I don't have time off work.
- l) Other (please specify): _____
- m) Not sure

21) [had_c19] To your knowledge, do you have, or have you had COVID-19?

- a) Yes
- b) No

22) [pol_orient] In politics, many people use the terms “left” and “right” or “liberal” and “Conservative”. When it comes to politics, where do you place yourself on this scale?

- a) Strongly left wing (very liberal)
- b) Slightly left wing (liberal)
- c) In the centre (moderate)
- d) Slightly right (conservative)
- e) Strongly right wing (very conservative)
- f) Not sure

23) [pol_party] Which political party in the recent Canadian federal election did you most strongly support?

- 1. Liberal
- 2. Conservative
- 3. Bloc Québécois
- 4. New Democratic
- 5. Green
- 6. People's Party of Canada
- 7. Not sure

24) [pol_matter] How much do your political beliefs matter to you?

- a) Not at all
- b) –
- c) –
- d) –
- e) –
- f) Very important

25) [religious] How important is religion in your life?

- a) Not at all
- b) –
- c) –
- d) –
- e) –
- f) Very important

26) [news_follow] How closely have you been following news about the coronavirus (COVID-19)?”

- a) 0 (almost none) - 100 (an enormous amount)

27) [news_exposure]_Prior to taking this survey, how much information were you exposed to about COVID-19?
















- a) 0 (almost none) - 100 (an enormous amount)











28) [news source] Where do you normally receive news about COVID-19 and COVID-19 vaccines?

- a) Social media
- b) Radio
- c) Television
- d) Other (please specify): _____

Appendix E

Content of Messaging Conditions

Condition	Content
Prosocial	 <p>Help save the lives of other Canadians.</p> <p>Everyone's actions count, and you can help to stop this crisis. The COVID-19 vaccine has shown to significantly reduce the chance of transmission, meaning that you can help save the lives of others and help protect your loved ones.</p> <p>Together, by getting vaccinated for COVID-19, we can save millions of lives.</p> <p style="text-align: center;">  Like  Comment  Share  </p>
Empathy	 <p>Noah is 21-year-old Canadian, and this is their story:</p> <p>"I am suffering from a very rare type of immune disorder, and about six weeks ago, I tested positive for Covid-19. I was so sick that I had to be placed in an artificial coma for eleven days. The doctors said I just made it. After returning home, I felt sick and very weak again, and now I am back in the intensive care unit.</p> <p>Please, we need to all get vaccinated to help those like me".</p> <p style="text-align: center;">  Like  Comment  Share  </p>
General Safety and Efficacy	 <p>The COVID-19 vaccines available in Canada have been shown to be safe and effective.</p> <p>They have been tested and evaluated by several scientists and medical professionals in clinical trials with many participants. These trials demonstrate that the vaccines have limited side effects, and most importantly, they are effective in preventing COVID-19 and in preventing illness.</p> <p style="text-align: center;">  Like  Comment  Share  </p>

<p>Specific Safety and Efficacy</p>	 <p>The COVID-19 vaccines available in Canada have proven to be safe and effective.</p> <p>They have been carefully tested and evaluated by several scientists and medical professionals in clinical trials with tens of thousands of participants. These trials demonstrate that the vaccines have few side effects, which may include some pain, redness and swelling at the injection site, tiredness, headaches, chills, fever, and nausea.</p> <p>But most importantly, they have shown to be effective in preventing the illness by up to 95% and they reduce the risk of severe illness by up to 90%.</p> <hr/> <p>  Like  Comment  Share  </p>
<p>Norm-Based</p>	 <p>Most Canadians have been vaccinated against COVID-19, and they believe you should too.</p> <p>According to a recent tracking survey, there is widespread willingness to be vaccinated, and most people believe that it is important for everyone to be vaccinated to stop the COVID-19 pandemic.</p> <p>Please, take part in what most Canadians are doing, and get vaccinated against COVID-19.</p> <hr/> <p>  Like  Comment  Share  </p>

Appendix F

Oxford Covid-19 Vaccine Hesitancy Scale

Question	Available Answers
1. Would you take an approved COVID-19 vaccine if offered?	<ul style="list-style-type: none"> <input type="radio"/> Definitely (1) <input type="radio"/> Probably (2) <input type="radio"/> I may or I may not (3) <input type="radio"/> Probably not (4) <input type="radio"/> Definitely not (5) <input type="radio"/> Don't know
2. If there is a COVID-19 vaccine available to me:	<ul style="list-style-type: none"> <input type="radio"/> I will want to get it as soon as possible (1) <input type="radio"/> I will take it when offered (2) <input type="radio"/> I'm not sure what I will do (3) <input type="radio"/> I will put off (delay) getting it (4) <input type="radio"/> I will refuse to get it (5) <input type="radio"/> Don't know
3. I would describe my attitude towards receiving a COVID-19 vaccine as:	<ul style="list-style-type: none"> <input type="radio"/> Very keen (1) <input type="radio"/> Pretty positive (2) <input type="radio"/> Neutral (3) <input type="radio"/> Quite uneasy (4) <input type="radio"/> Against it (5) <input type="radio"/> Don't know
4. If a COVID-19 vaccine were available at my local pharmacy, I would:	<ul style="list-style-type: none"> <input type="radio"/> Get it as soon as possible (1) <input type="radio"/> Get it when I have time (2) <input type="radio"/> Delay getting it (3) <input type="radio"/> Avoid getting it for as long as possible (4) <input type="radio"/> Never get it (5) <input type="radio"/> Don't know
5. If my family or friends were thinking of getting a COVID-19 vaccination, I would:	<ul style="list-style-type: none"> <input type="radio"/> Strongly encourage them (1) <input type="radio"/> Encourage them (2) <input type="radio"/> Not say anything to them about it (3) <input type="radio"/> Ask them to delay getting the vaccination (4) <input type="radio"/> Suggest that they do not get the vaccination (5) <input type="radio"/> Don't know
6. I would describe myself as:	<ul style="list-style-type: none"> <input type="radio"/> Eager to get a COVID-19 vaccine (1) <input type="radio"/> Willing to get the COVID-19 vaccine (2) <input type="radio"/> Not bothered about getting the COVID-19 vaccine (3) <input type="radio"/> Unwilling to get the COVID-19 vaccine (4) <input type="radio"/> Anti-vaccination for COVID-19 (5) <input type="radio"/> Don't know
7. Taking a COVID-19 vaccination is:	<ul style="list-style-type: none"> <input type="radio"/> Really important (1) <input type="radio"/> Important (2) <input type="radio"/> Neither important nor unimportant (3) <input type="radio"/> Unimportant (4) <input type="radio"/> Really unimportant (5) <input type="radio"/> Don't know

Appendix G

Oxford COVID-19 Vaccine Confidence and Complacency Scale (OCVCC)

Subscale	Question	Answer
<i>Perceived collective importance of a COVID-19 vaccine</i>	1. If I get the COVID-19 vaccine it will be:	<ul style="list-style-type: none"> <input type="radio"/> Really helpful for the community around me (1) <input type="radio"/> Helpful for the community around me (2) <input type="radio"/> Neither helpful nor unhelpful for the community around me (3) <input type="radio"/> Unhelpful for the community around me (4) <input type="radio"/> Really unhelpful for the community around me (5) <input type="radio"/> Don't know
	2. If individuals like me get the COVID-19 vaccine it will:	<ul style="list-style-type: none"> <input type="radio"/> Save a large number of lives (1) <input type="radio"/> Save some lives (2) <input type="radio"/> Have no impact (3) <input type="radio"/> Lead to more deaths (4) <input type="radio"/> Lead to a large number of deaths (5) <input type="radio"/> Don't know
	3. If many people do not get the vaccine this:	<ul style="list-style-type: none"> <input type="radio"/> Will be dangerous (1) <input type="radio"/> May be dangerous (2) <input type="radio"/> Will have no consequences at all (3) <input type="radio"/> May be good (4) <input type="radio"/> Will be good (5) <input type="radio"/> Don't know
<i>Perceived COVID-19 vaccine efficacy</i>	4. The COVID-19 vaccine is likely to:	<ul style="list-style-type: none"> <input type="radio"/> Work for almost everyone (1) <input type="radio"/> Work for most people (2) <input type="radio"/> I am unsure how many people it will work for (3) <input type="radio"/> Not work for most people (4) <input type="radio"/> Not work for anyone (5) <input type="radio"/> Don't know
	5. The COVID-19 vaccine is likely to:	<ul style="list-style-type: none"> <input type="radio"/> Definitely work for me (1) <input type="radio"/> Probably work for me (2) <input type="radio"/> May or may not work for me (3) <input type="radio"/> Probably not work for me (4) <input type="radio"/> Definitely not work for me (5) <input type="radio"/> Don't know
	6. The COVID-19 vaccine is effective in preventing COVID-19	<ul style="list-style-type: none"> <input type="radio"/> Strongly agree (1) <input type="radio"/> Somewhat agree (2) <input type="radio"/> Neither agree nor disagree (3) <input type="radio"/> Somewhat disagree (4) <input type="radio"/> Strongly disagree (5)

		<ul style="list-style-type: none"> ○ Don't know
	7. People who are vaccinated against COVID-19 are less likely to get sick from the virus	<ul style="list-style-type: none"> ○ Strongly agree (1) ○ Somewhat agree (2) ○ Neither agree nor disagree (3) ○ Somewhat disagree (4) ○ Strongly disagree (5) ○ Don't know
<i>Concern of side effects of COVID-19 vaccine</i>	8. I expect that receiving the vaccine will be:	<ul style="list-style-type: none"> ○ Hardly noticeable (1) ○ A little unpleasant (2) ○ Moderately unpleasant (3) ○ Painful (4) ○ Extremely painful (5) ○ Don't know
	9. The side effects for people of getting the COVID-19 vaccine will be:	<ul style="list-style-type: none"> ○ None (1) ○ Mild (2) ○ Moderate (3) ○ Significant (4) ○ Life-threatening (5) ○ Don't know
	10. Taking a new COVID-19 vaccine will make me feel like a guinea pig.	<ul style="list-style-type: none"> ○ Do not agree (1) ○ Agree a little (2) ○ Agree moderately (3) ○ Agree a lot (4) ○ Completely agree (5) ○ Don't know
	11. I am concerned about the potential side-effects of the vaccine.	<ul style="list-style-type: none"> ○ Strongly agree (1) ○ Somewhat agree (2) ○ Neither agree nor disagree (3) ○ Somewhat disagree (4) ○ Strongly disagree (5) ○ Don't know
<i>Concern over speed of vaccine development</i>	12. The speed of developing and testing the vaccine means it will be:	<ul style="list-style-type: none"> ○ Really good (1) ○ Good (2) ○ Will not affect how good or bad it is (3) ○ Bad (4) ○ Really bad (5) ○ Don't know
	13. The speed of developing and testing the vaccine means it will be:	<ul style="list-style-type: none"> ○ Really safe (1) ○ Safe (2) ○ It will not affect how safe it is (3) ○ Unsafe (4) ○ Really unsafe (5) ○ Don't know

	14. I have concerns about the speed at which the COVID-19 vaccine was developed and approved.	<ul style="list-style-type: none">○ Strongly agree (1)○ Somewhat agree (2)○ Neither agree nor disagree (3)○ Somewhat disagree (4)○ Strongly disagree (5)○ Don't know
	15. COVID-19 vaccines have been approved too quickly	<ul style="list-style-type: none">○ Strongly agree (1)○ Somewhat agree (2)○ Neither agree nor disagree (3)○ Somewhat disagree (4)○ Strongly disagree (5)○ Don't know

Appendix H

Emotional Response to Messages

Participants were asked to rate the degree to which they felt a specific emotion (e.g., hopeful, afraid, angry) on a sliding scale when reading the message corresponding to their messaging condition.

Emotion Subgroup	Emotion	Sliding scale (where 0 = <i>Not at all</i> and 100 = <i>Extremely</i>)
Enthusiasm	Enthusiastic	
	Proud	
	Hopeful	
Anxiety	Scared	
	Worried	
	Afraid	
Aversion	Resentful	
	Bitter	
	Angry	
	Hateful	

Appendix I

Multidimensional Perfectionism Scale (MPS)

Participants were asked to decide whether they agree or disagree with each of the following items on a 7-point Likert scale, where 1 = *Disagree*, and 7 = *Agree*.

1. One of my goals is to be perfect in everything I do.
2. Everything that others do must be top-notch quality.
3. The better I do, the better I am expected to do.
4. I strive to be as perfect as I can be.
5. It is very important that I am perfect in everything I attempt.
6. I have high expectations for the people who are important to me.
7. I demand nothing less than perfection of myself.
8. I can't be bothered with people who won't strive to better themselves.
9. Success means that I must work even harder to please others.
10. If I ask someone to do something, I expect it to be done flawlessly.
11. I cannot stand to see people close to me make mistakes.
12. I must work to my full potential at all times.
13. My family expects me to be perfect.
14. People expect nothing less than perfection from me.
15. I set very high standards for myself.

Appendix J

The Intolerance of Uncertainty Scale – Short Form

Instructions: Please circle the number that best corresponds to how much you agree with each item.

	Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely characteristic of me
1. Unforeseen events upset me greatly.	1	2	3	4	5
2. It frustrates me not having all the information I need.	1	2	3	4	5
3. Uncertainty keeps me from living a full life.	1	2	3	4	5
4. One should always look ahead so as to avoid surprises.	1	2	3	4	5
5. A small unforeseen event can spoil everything, even with the best of planning.	1	2	3	4	5
6. When it's time to act, uncertainty paralyses me.	1	2	3	4	5
7. When I am uncertain I can't function very well.	1	2	3	4	5
8. I always want to know what the future has in store for me.	1	2	3	4	5
9. I can't stand being taken by surprise.	1	2	3	4	5
10. The smallest doubt can stop me from acting.	1	2	3	4	5
11. I should be able to organize everything in advance.	1	2	3	4	5
12. I must get away from all uncertain situations.	1	2	3	4	5

Appendix K

Generic Conspiracist Beliefs Scale

Instructions: There is often debate about whether or not the public is told the whole truth about various important issues. This brief survey is designed to assess your beliefs about some of these subjects.

Please indicate the degree to which you believe each statement is likely to be true on the following scale: Definitely not true; Probably not true; Not sure/cannot decide; Probably true; Definitely true.

1. The government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret.
2. The power held by heads of state is second to that of small unknown groups who really control world politics.
3. Secret organizations communicate with extraterrestrials, but keep this fact from the public.
4. The spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organization.
5. Groups of scientists manipulate, fabricate, or suppress evidence in order to deceive the public.
6. The government permits or perpetrates acts of terrorism on its own soil, disguising its involvement.
7. A small, secret group of people is responsible for making all major world decisions, such as going to war.
8. Evidence of alien contact is being concealed from the public.
9. Technology with mind-control capacities is used on people without their knowledge.
10. New and advanced technology which would harm current industry is being suppressed.
11. The government uses people as patsies to hide its involvement in criminal activity.
12. Certain significant events have been the result of the activity of a small group who secretly manipulate world events.
13. Some UFO sightings and rumors are planned or staged in order to distract the public from real alien contact.
14. Experiments involving new drugs or technologies are routinely carried out on the public without their knowledge or consent.
15. A lot of important information is deliberately concealed from the public out of self-interest.

Appendix L

Table 7

General Linear Model Results for Interactions Between Condition and Political Orientation

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²
Age	3.09	.08	.005	1.46	.23	.002	1.08	.30	.001	2.31	.13	.004	3.33	.07	.005
Gender ^a	7.41	.007	.008	6.82	.009	.006	5.99	.02	.008	4.98	.03	.007	0.29	.59	<.001
M. Condition	1.87	.10	-	2.12	.06	-	1.62	.15	-	1.68	.14	-	3.47	.005	-
Pol. Orient.	117.82	< .001	-	97.54	< .001	-	85.48	.001	-	68.24	< .001	-	121.3	< .001	-
Cond*Pol	3.94	.002	.04	5.39	< .001	.057	11.33	.002	.042	2.41	.04	.03	4.06	.001	.04
	Model Adj. R ² = 0.30			Model Adj. R ² = 0.28			Model Adj. R ² = 0.24			Model Adj. R ² = 0.20			Model Adj. R ² = 0.31		
	B			B			B			B			B		
Age	-.01	.08	.005	-.004	.13	.002	-.01	.44	.001	-.006	.20	.004	-.01	.02	.005
Gender ^a	.17	.007	.008	.14	.08	.006	.17	.05	.008	.18	.08	.007	.02	.85	<.001
Pol. Orient.	.34	.002	.042	.28	< .001	.057	.46	.001	.042	.31	.003	.03	.18	.15	.04
M. Cond. Contrasts^b															
Pro-Emp	.02	.91	<.001	-.10	.48	.001	.25	.10	.006	-.08	.68	<.001	-.24	.16	.004
Pro-Gen	.15	.30	.002	.13	.36	.002	.28	.07	.007	.16	.39	.002	-.07	.67	<.001
Pro-Spc	.01	.92	<.001	-.003	.99	<.001	.24	.12	.005	-.11	.56	.001	-.47	.007	.015
Pro-Nrm	-.20	.16	.004	-.23	.10	.006	-.04	.80	<.001	-.19	.29	.003	-.52	.002	.019
Pro-Ctrl	.09	.51	<.001	.09	.52	<.001	.24	.12	.005	.03	.88	<.001	-.25	.15	.004
Emp-Gen	.13	.33	<.001	.23	.09	.006	.02	.88	<.001	.23	.18	.004	.17	.31	.002
Emp-Spc	.001	.99	<.001	.10	.47	.001	-.01	.92	<.001	-.03	.85	<.001	-.23	.17	.004
Emp-Nrm	-.21	.11	.005	-.13	.33	.002	-.29	.04	.009	-.12	.50	.001	-.28	.09	.006
Emp-Ctrl	.08	.57	<.001	.19	.16	.004	-.02	.91	<.001	.10	.54	.001	-.01	.97	<.001
Gen-Spc	-.13	.33	.002	-.13	.33	.002	-.04	.81	<.001	-.27	.12	.006	-.39	.02	.012
Gen-Nrm	-.35	.01	.014	-.36	.01	.016	-.31	.03	.011	-.35	.04	.010	-.44	.007	.015
Gen-Ctrl	-.05	.68	<.001	-.04	.77	<.001	-.04	.79	<.001	-.13	.45	.001	-.17	.29	.002
Spc-Nrm	-.21	.11	.005	-.23	.09	.006	-.28	.05	.008	-.08	.62	.001	-.05	.77	<.001
Spc-Ctrl	.08	.56	<.001	.09	.49	.001	-.01	.98	<.001	.14	.42	.002	.22	.19	.004
Nrm-Ctrl	.29	.03	.002	.32	.02	.013	.28	.05	.009	.22	.19	.004	.27	.10	.006
Cond*Pol Contrasts^c															
Pro-Emp	.02	.84	<.001	-.17	.12	.005	.31	.008	.016	-.05	.75	<.001	-.17	.16	.004
Pro-Gen	.16	.08	.007	.18	.04	.009	.32	.003	.020	.16	.20	.004	-.05	.66	<.001
Pro-Spc	.16	.09	.006	.12	.16	.004	.29	.008	.016	.13	.31	.002	-.25	.03	.010
Pro-Nrm	-.17	.09	.006	-.18	.06	.008	.04	.73	<.001	-.16	.22	.004	-.43	< .001	.029

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²
Cond*Pol Contrasts^c															
Pro-Ctrl	.08	.44	.001	.05	.64	<.001	.22	.06	.008	.09	.50	.001	-.27	.03	.010
Emp-Gen	.14	.17	.004	.35	<.001	.027	.01	.95	<.001	.21	.09	.007	.12	.28	.002
Emp-Spc	.14	.18	.004	.30	.004	.018	-.03	.78	<.001	.18	.16	.005	-.09	.48	.001
Emp-Nrm	-.19	.08	.007	-.01	.95	<.001	-.28	.007	.016	-.12	.37	.002	-.26	.03	.010
Emp-Ctrl	.06	.61	<.001	.22	.05	.008	-.10	.36	.002	.14	.30	.003	-.10	.43	.001
Gen-Spc	.001	.99	<.001	-.06	.47	.001	-.03	.69	<.001	-.03	.77	<.001	-.21	.06	.008
Gen-Nrm	-.33	<.001	.032	-.36	<.001	.039	-.28	.002	.022	-.32	.003	.022	-.38	<.001	.027
Gen-Ctrl	-.08	.33	.002	-.14	.12	.005	-.10	.27	.003	-.07	.53	.001	-.22	.06	.008
Spc-Nrm	-.33	<.001	.029	-.30	<.001	.026	-.25	.007	.016	-.29	.01	.017	-.17	.14	.004
Spc-Ctrl	-.09	.35	.002	-.08	.38	.002	-.07	.47	.001	-.04	.72	<.001	-.02	.90	<.001
Nrm-Ctrl	.25	.01	.002	.22	.02	.012	.18	.07	.007	.25	.03	.011	.16	.21	.003

Note. Statistically significant results are highlighted in bold. sr² = squared semi-partial correlation coefficient; M. Condition =

messaging condition; Pol. Orient. = political orientation; Cond*Pol = the interaction term between condition and political orientation;

Pro = prosocial; Emp = empathy; Gen = general safety and efficacy; Spc = specific safety and efficacy; Nrm = norm-based; Ctrl = control.

^aFemale was the reference group (female = 1, male =2). ^bPairwise comparisons among all levels of messaging condition. ^cInteraction contrasts involving each of the pairwise comparisons.

Appendix M

Table 8

General Linear Model Results for Interactions Between Condition and Religiosity

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²
Age	0.14	.71	.001	0.27	.60	.001	0.002	.96	<.001	1.50	.22	.003	0.016	.90	<.001
Gender ^a	16.40	<.001	.036	18.56	<.001	.041	13.22	<.001	.039	9.86	.002	.022	8.20	.005	.017
M. Condition	2.67	.02	-	1.32	.26	-	0.39	.85	-	1.27	.28	-	3.54	.004	-
Religiosity	18.28	<.001	-	22.54	<.001	-	11.31	<.001	-	38.45	<.001	-	38.89	<.001	-
Cond*Rel	1.54	.18	.021	1.68	.14	.022	0.99	.42	.014	2.95	.01	.037	2.35	.04	.029
	Model Adj. R ² = 0.11			Model Adj. R ² = 0.11			Model Adj. R ² = 0.05			Model Adj. R ² = 0.15			Model Adj. R ² = 0.16		
	B			B			B			B			B		
Age	-.002	.66	.001	-.002	.59	.001	<-.001	.98	<.001	-.006	.25	.003	-.001	.88	<.001
Gender ^a	.31	<.001	.036	.32	<.001	.041	.34	<.001	.039	.32	.003	.022	.27	.01	.017
Religiosity	.14	.08	.021	.29	.001	.022	.10	.24	.014	.19	.06	.037	.19	.04	.029
M. Condition Contrasts^b															
Pro-Emp	.03	.92	<.001	-.04	.87	<.001	-.04	.89	<.001	.42	.19	.004	.14	.64	.001
Pro-Gen	-.14	.55	.001	-.23	.35	.002	.07	.80	<.001	.42	.19	.004	-.31	.30	.003
Pro-Spc	-.06	.79	<.001	-.12	.61	.001	.22	.39	.002	-.16	.58	.001	-.10	.73	<.001
Pro-Nrm	-.10	.66	<.001	-.39	.11	.007	-.41	.13	.007	-.21	.48	.001	-.30	.30	.003
Pro-Ctrl	-.06	.79	<.001	-.33	.15	.005	.11	.66	.001	-.21	.47	.001	-.15	.59	.001
Emp-Gen	-.17	.51	.001	-.19	.45	.001	.10	.71	<.001	-.002	.99	<.001	-.46	.15	.005
Emp-Spc	-.09	.73	<.001	-.08	.74	<.001	.26	.34	.003	-.59	.07	.009	-.24	.43	.002
Emp-Nrm	-.13	.61	.001	-.35	.16	.005	-.37	.19	.005	-.63	.05	.010	-.44	.15	.005
Emp-Ctrl	-.09	.72	<.001	-.29	.23	.004	.15	.58	.001	-.63	.04	.010	-.30	.32	.002
Gen-Spc	.08	.73	<.001	.11	.64	.001	.15	.54	.001	-.59	.06	.009	.21	.48	.001
Gen-Nrm	.04	.87	<.001	-.16	.49	.001	-.48	.08	.009	-.63	.05	.010	.02	.96	<.001
Gen-Ctrl	.08	.72	<.001	-.10	.65	.001	.04	.86	<.001	-.63	.04	.011	.16	.59	.001
Spc-Nrm	-.04	.86	<.001	-.27	.24	.004	-.63	.02	.016	-.05	.88	<.001	-.20	.50	.001
Spc-Ctrl	.001	.99	<.001	-.21	.34	.002	-.11	.65	.001	-.04	.87	<.001	-.05	.85	<.001
Nrm-Ctrl	.04	.85	<.001	.06	.79	<.001	.52	.04	.011	.001	.99	<.001	.14	.61	.001
Cond*Rel Contrasts^c															
Pro-Emp	-.04	.79	<.001	.05	.74	<.001	.07	.62	.001	-.44	.02	.015	-.27	.08	.008
Pro-Gen	.16	.14	.006	.24	.03	.013	-.03	.77	<.001	-.25	.11	.007	.21	.12	.006
Pro-Spc	.01	.89	<.001	.12	.25	.003	-.07	.52	.001	.02	.89	<.001	-.13	.30	.003
Pro-Nrm	-.12	.27	.003	.15	.21	.004	.18	.19	.005	-.03	.80	<.001	-.10	.41	.002

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²	B	<i>p</i>	sr ²
Cond*Rel Contrasts^c															
Pro-Ctrl	.04	.71	<.001	.25	.02	.014	-.02	.85	<.001	.11	.40	.002	.001	.99	<.001
Emp-Gen	.20	.14	.006	.20	.13	.006	-.11	.45	.002	.19	.31	.003	.49	.003	.022
Emp-Spc	.05	.68	<.001	.07	.55	.001	-.14	.30	.003	.46	.01	.019	.15	.34	.002
Emp-Nrm	-.08	.54	.001	.10	.45	.002	.10	.52	.001	.41	.02	.014	.17	.26	.003
Emp-Ctrl	.08	.55	.001	.20	.11	.007	-.10	.50	.001	.55	.001	.026	.28	.07	.008
Gen-Spc	-.15	.12	.006	-.12	.16	.005	-.04	.70	<.001	.27	.05	.010	-.34	.01	.017
Gen-Nrm	-.28	.01	.019	-.10	.35	.002	.21	.09	.008	.22	.14	.006	-.31	.02	.014
Gen-Ctrl	-.12	.20	.004	.004	.97	<.001	.01	.90	<.001	.36	.01	.017	-.21	.11	.007
Spc-Nrm	-.13	.16	.005	.03	.77	<.001	.24	.04	.012	-.05	.65	.001	.03	.82	<.001
Spc-Ctrl	.02	.78	<.001	.13	.12	.006	.05	.60	.001	.09	.40	.002	.13	.27	.003
Nrm-Ctrl	.16	.10	.007	.10	.31	.003	-.20	.10	.007	.14	.23	.004	.10	.39	.002

Note. Statistically significant results are highlighted in bold. sr² = squared semi-partial correlation coefficient; M. Condition =

messaging condition; Cond*Rel = the interaction term between condition and religiosity; Pro = prosocial; Emp = empathy; Gen = general safety and efficacy; Spc = specific safety and efficacy; Nrm = norm-based; Ctrl = control.

^aFemale was the reference group (female = 1, male =2). ^bPairwise comparisons among all levels of messaging condition. ^cInteraction contrasts involving each of the pairwise comparisons.

Appendix N

Table 9

General Linear Model Results for Interactions Between Condition and Conspiracist Ideation

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²	F	p	sr ²
Age	0.22	.64	<.001	<0.001	.99	<.001	0.88	.35	.002	0.08	.77	<.001	0.43	.51	.001
Gender ^a	3.31	.07	.007	3.91	.05	.009	1.74	.19	.006	0.84	.36	.002	1.37	.24	.004
M. Condition	1.90	.09	-	2.56	.03	-	2.50	.03	-	2.05	.07	-	4.12	.001	-
Conspiracy	215.98	<.001	-	84.75	<.001	-	104.57	<.001	-	163.01	<.001	-	155.51	<.001	-
Cond*Con	3.87	.002	.035	3.86	.002	.045	5.14	<.001	.057	1.92	.09	.020	2.52	.03	.025
	Model Adj. R ² = 0.42			Model Adj. R ² = 0.25			Model Adj. R ² = 0.30			Model Adj. R ² = 0.35			Model Adj. R ² = 0.36		
	B			B			B			B			B		
Age	.001	.73	<.001	-.001	.87	<.001	.003	.35	.002	.001	.85	<.001	.002	.63	.001
Gender ^a	.15	.05	.007	.14	.06	.009	.12	.10	.006	.09	.29	.002	.13	.19	.004
Conspiracy	.51	<.001	.035	.44	<.001	.045	.19	.14	.057	.31	.07	.020	.33	.02	.025
M. Condition Contrasts^b															
Pro-Emp	.06	.61	<.001	-.26	.46	.001	.94	.01	.015	-.15	.39	.002	-.13	.45	.001
Pro-Gen	.14	.27	.002	.16	.62	.001	.74	.04	.010	.003	.99	<.001	-.02	.92	<.001
Pro-Spc	.09	.49	.001	-.60	.10	.007	-.07	.86	<.001	-.28	.10	.006	-.37	.03	.010
Pro-Nrm	-.17	.16	.003	.37	.25	.003	.93	.007	.017	-.27	.11	.005	-.53	.001	.021
Pro-Ctrl	.10	.44	.001	-.36	.30	.002	.24	.51	.001	-.08	.64	<.001	-.12	.46	.001
Emp-Gen	.08	.54	.001	.42	.23	.003	-.19	.59	.001	.14	.34	.002	.11	.50	.001
Emp-Spc	.02	.85	<.001	-.35	.37	.002	-.99	.009	.015	-.14	.37	.002	-.24	.13	.005
Emp-Nrm	-.24	.05	.007	.63	.07	.008	-.01	.98	<.001	-.12	.42	.001	-.41	.01	.013
Emp-Ctrl	.03	.79	<.001	-.11	.78	<.001	-.70	.06	.008	.07	.66	<.001	.00	.99	<.001
Gen-Spc	-.05	.67	<.001	-.76	.04	.010	-.81	.03	.010	-.28	.07	.007	-.35	.03	.010
Gen-Nrm	-.31	.01	.012	.21	.51	.001	.18	.59	.001	-.26	.08	.006	-.52	.001	.021
Gen-Ctrl	-.04	.72	<.001	-.53	.14	.005	-.50	.17	.004	-.08	.61	.001	-.11	.51	.001
Spc-Nrm	-.26	.03	.008	.98	<.001	.017	.99	.007	.016	.02	.92	<.001	-.16	.30	.002
Spc-Ctrl	.01	.95	<.001	.24	.54	.001	.31	.43	.001	.20	.18	.004	.25	.13	.005
Nrm-Ctrl	.27	.03	.009	-.74	.04	.010	-.69	.05	.009	.19	.21	.003	.41	.01	.013
Cond*Con Contrasts^c															
Pro-Emp	-.22	.12	.004	.21	.19	.004	-.44	.009	.015	-.55	.01	.014	-.40	.03	.009
Pro-Gen	-.14	.32	.002	.002	.99	<.001	-.36	.03	.011	-.41	.04	.008	-.36	.06	.007
Pro-Spc	.30	.06	.006	.32	.05	.009	.06	.75	<.001	-.26	.26	.003	-.42	.05	.008
Pro-Nrm	-.31	.02	.009	-.23	.10	.006	-.56	<.001	.028	-.49	.02	.012	-.62	.001	.021

	OCVCC Mean			Public Importance			Perceived Efficacy			Side Effects			Speed		
	B	p	sr ²	B	p	sr ²	B	p	sr ²	B	p	sr ²	B	p	sr ²
Cond*Con Contrasts^c															
Pro-Ctrl	.02	.87	<.001	.24	.13	.005	-.10	.53	.001	-.24	.29	.002	-.14	.52	.001
Emp-Gen	.08	.55	.001	-.22	.16	.005	.07	.63	.001	.14	.40	.001	.04	.82	<.001
Emp-Spc	.51	.001	.019	.11	.53	.001	.50	.004	.019	.30	.13	.005	-.02	.90	<.001
Emp-Nrm	-.10	.48	.001	-.45	.004	.020	-.12	.42	.001	.06	.72	<.001	-.22	.20	.003
Emp-Ctrl	.24	.11	.005	.02	.89	<.001	.33	.04	.010	.31	.11	.005	.25	.21	.003
Gen-Spc	.43	.005	.014	.33	.04	.010	.42	.004	.014	.16	.41	.001	-.06	.75	<.001
Gen-Nrm	-.18	.18	.003	-.23	.08	.007	-.19	.18	.004	-.08	.62	<.001	-.26	.14	.004
Gen-Ctrl	.16	.27	.002	.24	.11	.006	.26	.10	.006	.17	.37	.002	.22	.29	.002
Spc-Nrm	-.61	< .001	.028	-.56	< .001	.031	-.61	< .001	.033	-.24	.22	.003	-.20	.32	.002
Spc-Ctrl	-.27	.11	.005	-.09	.61	.001	-.16	.34	.002	.01	.95	<.001	.28	.22	.003
Nrm-Ctrl	.34	.02	.010	.47	.002	.024	.45	.002	.021	.25	.19	.004	.47	.02	.011

Note. Statistically significant results are highlighted in bold. sr² = squared semi-partial correlation coefficient; M. Condition =

messaging condition; Conspiracy = conspiracist ideation; Cond*Con = the interaction term between condition and conspiracist

ideation; Pro = prosocial; Emp = empathy; Gen = general safety and efficacy; Spc = specific safety and efficacy; Nrm = norm-based;

Ctrl = control.

^aFemale was the reference group (female = 1, male =2). ^bPairwise comparisons among all levels of messaging condition. ^cInteraction

contrasts involving each of the pairwise comparisons.