

How Do Individuals With Conspiracy Beliefs Respond to Humorous Public Service Announcements Promoting COVID-19 Vaccination? The Role of Scientific Consensus and Vaccine Confidence

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Individuals with higher COVID-19 conspiracy beliefs tend to distrust vaccine initiatives and counterargue the actions of the government or scientific experts. Still, there has been limited research on the messaging strategies that effectively promote these individuals' COVID-19 vaccine confidence and vaccination intention. Guided by humor theories, this study investigates the impact of humorous public service advertisements (PSAs) containing scientific consensus information about the necessity of COVID-19 vaccinations. The findings suggested that people holding moderate or strong (vs. weak) beliefs in conspiracy theories were more likely to have confidence in the COVID-19 vaccine when humor was used in messages that did not include scientific consensus information endorsed by experts. This increased vaccine confidence also led to a higher intention of getting vaccinated. However, when the scientific consensus was present in the message, humor exhibited a significant and negative impact on vaccine confidence for individuals with high conspiracy beliefs, which lowered their vaccination intention.

Keywords: humor messaging, COVID-19, conspiracy beliefs, scientific consensus, vaccination intention

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The coronavirus disease 2019 (COVID-19) pandemic has been an unprecedented public health emergency for the health and well-being of people worldwide. The COVID-19 vaccination program has been well recognized as a critical public health initiative in preventing infection and the spread of the disease (World Health Organization [WHO], 2022). However, soon after the pandemic began, numerous COVID-related conspiracy theories emerged, with a recent survey conducted in the United States and Canada reporting about 49% of survey participants believed in them (Leibovitz, Shamblaw, Rumas, & Best, 2021). Vaccine hesitancy often stems from conspiracy beliefs and mistrust in science, making people hesitant to follow recommended guidelines (van Prooijen, Etienne, Kutiyiski, & Krouwel, 2022). Therefore, developing and testing effective provaccine messages for this population is crucial.

Public service announcements (PSAs) aimed at encouraging vaccination commonly contain the potential risks or consequences of COVID-19 infection, accompanied by a call to action advocating for vaccination as the recommended response. Although effective, the threat-based messaging strategy is prone to maladaptive responses for the vaccine-hesitant, conspiracy-minded people, potentially leading to defensive message processing, including avoidance of the message and further information about the topic or refusal to engage in the suggested vaccination behavior (Chou & Budenz, 2020; Dillard & Shen, 2005; Moyer-Gusé, Robinson, & Mcknight, 2018; Stolow, Moses, Lederer, & Carter, 2020; Witte, 1992).

One strategy to lessen the adverse effects is framing vaccine messages using humor, known to disrupt and mitigate the chain of negative thoughts in response to the advocated recommendation, thereby resulting in the greater receptiveness of the message and behavioral intention (Moyer-Gusé, Mahood, & Brookes, 2011; Skurka, Niederdeppe, Romero-Canyas, & Acup, 2018; Xiao & Yu, 2022; Yoon & Tinkham, 2013). Scholars have examined the positive, persuasive effects of humor in vaccination messages (Geniole, Bird, Witzel, McEvoy, & Proietti, 2022; Johanson et al., 2020; Moyer-Gusé et al., 2018), whereas others have reported contradictory results, suggesting that humor may not always contribute to persuasion efforts and can sometimes even undermine them (English, Sweetser, & Ancu, 2011). There are some research gaps in understanding the specific conditions under which humor plays significant but varied roles in explaining persuasion outcomes. For example, the positive effect of humor may not hold if the humor frame in a provaccine PSA fails to counteract the negative cognitions and emotions it may trigger. One such case might be that individuals with higher conspiracy beliefs were exposed to a humorous provaccine PSA endorsed by scientists. Given that previous studies document a strong relationship between conspiracy theory endorsement and mistrust in scientific experts (Imhoff, Lamberty, & Klein, 2018), even if humor attracts attention and acceptance of the message, message recipients are likely to exert skepticism, discounting, or avoidance toward the message or topic (Nabi, Moyer-Gusé, & Byrne, 2007).

The current study first investigates (a) how individuals with higher conspiracy beliefs respond to humorous PSAs containing scientific consensus information about the necessity of COVID-19 vaccination and how such interplay influences their vaccine confidence levels. Following this, we examine (b) the mediating role of vaccine confidence in predicting the key outcome variable of COVID-19 vaccination intention and how such mediating mechanisms are determined by how individuals with varying conspiracy beliefs process the humor-framed PSAs with the scientific consensus. The current study contributes to a more nuanced understanding of when and how humorous provaccine messaging works for individuals with conspiracy beliefs. We have limited knowledge of the boundary conditions under which humor can positively or negatively impact vaccination confidence and intention. The findings from this study also offer valuable insights for public health officials and

practitioners aiming to use humor-framed provaccine messages in their future vaccine initiatives effectively. By applying insights from humor theories and information processing theories, we seek to make a valuable contribution to strategic communication practices, which can inform decision making for policymakers and risk communicators striving to design effective and ethical risk mitigation campaigns.

In the following literature review section, we discuss two key explanatory variables of interest, humor, and scientific consensus, and their effects on the focal outcome variable, vaccine-related attitude, and intention. To explore the mechanism, we review the role of a moderator, COVID-19 vaccine conspiracy, and a mediator, vaccine confidence, leading to the development of hypotheses.

Literature Review

The Humor Process and Its Effects on Vaccine Attitude and Intention

According to humor theories, humor has been conceived as a cognitive and affective process (Alden, Mukherjee, & Hoyer, 2000; Martin, 2007; Young, 2008). This is because humor demands attention and further processing to *get* the punchline of the humor. The incongruity-resolution model explains the primary process of humor (Martin, 2007; Speck, 1991). First, it involves incongruity. Something that is unexpected from our daily lives and what's considered normal is presented in front of us like a puzzle, creating surprise and intrigue (e.g., a grown man chanting and dancing in his backyard, "We got the spirit, we're hot, we can't be stopped"). What follows next is resolution. Resolution is the *punchline* of the humor where an alternative and understandable reason and meaning for the incongruent element is presented as the solution to the puzzle (e.g., he is dancing next to his daughter who is practicing her cheer, and this is an Ad Council Public Service Announcement for father involvement). This rise in arousal (i.e., incongruity) and back down to equilibrium (i.e., resolution) is supposed to be a pleasant experience that generates mirth and positive feelings (Speck, 1991; Zillman & Cantor, 1976). Thus, the incongruity-resolution model presents a complex and demanding process that combines humor's cognitive and affective processing (Martin, 2007). Since humor comprehension demands processing resources, scholars have suggested that it may subsequently reduce cognitive resources available for scrutinizing message arguments (Cline & Kellaris, 2007; Yoon & Tinkham, 2013; Young, 2008). *Humor as a distractor* assumes that people have limited cognitive capacity to critically analyze and challenge message arguments while simultaneously processing and appreciating humor (Young, 2008).

Likewise, the affective component of humor processing can influence one's motivation to engage with the message arguments (Young, 2008). The mood-maintenance hypothesis argues that people are less likely to be motivated to carefully analyze message arguments to maintain the positive emotional experience engendered by humor (Bless, Bohner, Schwarz, & Strack, 1990). The basic assumption is that careful processing of the message arguments will diminish their positive mood, reducing motivation for systematically processing the message's premises. Other scholars argue that humor may serve as a *discounting cue*, influencing one's motivation to engage with the message seriously (Nabi et al., 2007). The discounting cue hypothesis suggests that when humor is presented with a message argument, it signals that careful analysis of the message is unnecessary or inappropriate because people may perceive the message as *just a joke* (Nabi et al., 2007; Young, 2008). It is argued in this research that humor as a mood

maintenance or discounting cue will depend on the individual's conspiracy belief background and other message elements, such as scientific consensus.

Although various explanations for humor processing have been discussed in the literature, limited studies have considered the persuasive effects of humor in vaccination messages. Moyer-Gusé et al. (2018) found that a satirical message, compared with a serious message, reduced reaction to the message and increased the perceived severity of the threat, which reduced vaccine hesitancy. In a flu vaccination scenario where the robot assisted patients while booking appointments, the humorous (vs. neutral) robot increased positive user evaluations by increasing likeability, safety, and empathy (Johanson et al., 2020). Further, exposure to vax-supportive or antivax-critical memes lowered COVID-19 vaccination hesitancy and increased vaccination intentions (Geniole et al., 2022).

Scientific Consensus and Its Effects on Vaccine Attitude and Intention

Scientific consensus—scientists' agreement on a specific scientific issue—is a form of a descriptive norm that exerts informational influence on people (Kobayashi, 2018; van der Linden, Leiserowitz, Feinberg, & Maibach, 2015). Informational influence, here, refers to processes that impact individuals' attitudes and beliefs by informing them about reality (Deutsch & Gerard, 1955). The scientific consensus is also an indicator of tentatively accepted knowledge (Miller, 2013).

Previous literature has demonstrated that providing people with scientific consensus information influences their beliefs about scientific issues, ranging from climate change to vaccine safety (Bolson & Druckman, 2018; Kobayashi, 2018; van der Linden, Clarke, & Maibach, 2015; van der Linden, Maibach, & Leiserowitz, 2019). According to the gateway belief model, minimizing the discrepancy between an individual's subjective perception and the actual level of scientific agreement can induce meaningful changes in his or her beliefs (van der Linden, Leiserowitz, et al., 2015). One way to reduce this discrepancy could be by communicating scientific consensus information. In the context of vaccination, it was found that providing people with scientific consensus messages increased their support for childhood vaccines and reduced their vaccine-related concerns (van der Linden, Clarke, et al., 2015). One possible explanation is that highlighting scientific consensus informs people about a descriptive norm and what is typically regarded as correct (van der Linden, Leiserowitz, et al., 2015), serving as a guideline for their judgments and allowing them to adjust their beliefs and behaviors by the descriptive norm (Kobayashi, 2018; van der Linden, Leiserowitz, et al., 2015). Studies have also found that highlighting consensus among scientists increases certainty about scientific issues such as vaccine safety, climate change, and water pollution (Dunwoody & Kohl, 2017; Koehler, 2016; Kohl et al., 2016). Clarke, Dixon, Holton, and McKeever (2015) demonstrated that scientific consensus messages that debunk the vaccine-autism link made people more certain about the vaccine's benefits and safety than messages without such consensus information.

The current study aims to investigate how people with conspiracy beliefs respond to a humorous PSA message containing consensus information about the necessity of COVID-19 vaccination. We begin by examining the moderating role of conspiracy beliefs in explaining an individual's vaccine confidence level when processing a humorous message with scientific consensus information. This will lead to the development of the first set of hypotheses. Subsequently, we will explore the mechanisms strengthening

vaccination intention by linking moderated humor processing to vaccine confidence as a mediator. The discussion will lead to the development of the second set of hypotheses.

COVID-19 Vaccine Conspiracy Belief as a Moderator

Studies have shown that conspiracy beliefs negatively impact health beliefs and behaviors, including decreased HIV treatment adherence (Gaston & Alleyne-Green, 2013), decreased intentions to get vaccinated (Freeman et al., 2022; Jolley & Douglas, 2014), and more support for interventions not endorsed by science (Marinthe, Brown, Delouvé, & Jolley, 2020). Conspiracy beliefs are a shared belief system about “causal explanations of events or circumstances that posit a powerful group acting in secret for their benefit and against the common good” (Connolly, Uscinski, Klofstad, & West, 2019, p. 469). These beliefs have often been activated during social anxiety, fear, or uncertainty, including in the COVID-19 pandemic. In the context of COVID-19, scholars argued that conspiracy beliefs erode the trust people have in institutions holding power or knowledge (e.g., experts, government), resulting in a tendency to avoid the recommendations or solutions endorsed by these institutions (van Prooijen et al., 2022).

The negative effects of conspiracy beliefs on vaccine acceptance have been well-documented (Freeman et al., 2022; Jolley & Douglas, 2014; van Prooijen et al., 2022). However, the role of conspiracy beliefs in processing humorous provaccine messages containing scientific consensus information has not been studied in the context of vaccines or health-messaging campaigns. To fill the gap, the current study experimentally investigates how people with conspiracy beliefs respond to a humorous PSA message containing consensus information scientists endorsed about the necessity of the COVID-19 vaccination. We focus on COVID-19 vaccine confidence as our proximal outcome to investigate this inquiry. Extant research conceives vaccine confidence as a complex concept, referring to both trust in vaccines’ safety and effectiveness and competence in the health services and public health authorities (Betsch et al., 2018). Although similar terms such as “hesitancy,” “confidence,” or “acceptance” have been interchangeably used to describe one’s attitude toward the recommended vaccinations, scholars have agreed that it is one of the key goals for the success of immunization programs during the pandemic.

Synthesizing the literature on humor, scientific consensus, conspiracy beliefs, and vaccine confidence, this study first proposes two hypotheses testing how conspiracy beliefs may modify the interplay of humor messaging and scientific consensus information in predicting COVID-19 vaccine confidence. Past studies have found that humor effects are not always positive but often produce small and unintended negative effects, especially in health contexts (Walter, Cody, Xu, & Murphy, 2018). When a message is paired with humor, it has been documented that both the message and humor processing must share the audience’s cognitive resources where humor can potentially distract careful consideration of the message content, leading to peripheral processing of the main message (Petty & Caccioppo, 1986; Yoon & Tinkham, 2013; Young, 2008). The affective processing of humor may also disrupt motivation for systematic processing, contributing to less effortful processing of the message arguments to maintain a positive mood (Bless et al., 1990). We argue that cognitive and affective humor processing can create either a positive or negative effect depending on one’s interaction with message properties and psychological background.

First, we can consider the case when the provaccine message lacks scientific consensus information and the individual holds higher conspiracy beliefs about the COVID-19 vaccine. As noted,

highlighting scientific consensus in the message may provide information about a descriptive norm or what is considered normal among the scientific community (van der Linden, Leiserowitz, et al., 2015). Given that individuals with higher conspiracy beliefs are less likely to trust and more likely to counterargue the actions of the government or scientific experts, exposure to a humorous PSA without consensus information is less likely to trigger their self-defensive reactions to the message (Madden & Weinberger, 1984). In this regard, humor can serve as a distractor in a *positive* way, potentially interrupting the chain of negative thoughts that a conspiracy-minded individual might have when he or she sees a COVID-19 vaccination PSA. Thus, the likelihood of forming the attitude the message advocates will increase. This is because the incongruity-resolution humor processing demands cognitive resources (Yoon & Tinkham, 2013), and in trying to resolve the incongruity humor, conspiracy individuals might likely be distracted from forming counterarguments (Nabi et al., 2007) and putting into practice their likely resistance (Moyer-Gusé et al., 2018). A similar prediction can be made based on the mood-maintenance hypothesis, where individuals are less likely to systematically scrutinize the message argument because a positive mood negatively affects their processing motivation (Bless et al., 1990). With humor as a distraction that opens a gateway for persuasion for conspiracy individuals when scientific consensus information is absent, it is expected that a humorous PSA will likely lead to greater persuasion of vaccine confidence than a nonhumorous PSA.

H1a: When scientific consensus information is absent, presenting humor elements in a PSA message promoting COVID-19 vaccination will increase vaccine confidence for participants with a higher level of COVID-19 vaccine conspiracy belief.

However, when scientific consensus information is present and endorsed by scientific experts, it may trigger defensive reactions from individuals with higher conspiracy beliefs because the message provides counterattitudinal information (e.g., van Prooijen et al., 2022). These defensive reactions can be cognitive, such as disputing vaccine safety claims, and affective, including animosity toward experts. In this case, rather than functioning as a positive distractor, humor might further fuel thoughts about message incredibility (Kim, Vraga, & Cook, 2021), distrust (Huntington, 2020), and discounting (Nabi et al., 2007). This is because, with scientific consensus information perceived as discrepant from their belief or attitude, they may perceive the inclusion of humor elements as a discounting cue or *just a joke*, leading to message discounting and counterargument toward the position advocated in the message (Nabi et al., 2007; Young, 2008).

In this regard, humor can be a distractor in a *negative* way, further helping to build resistance and negative emotion toward the argument presented in the message. With a humor-discounted PSA, the message's credibility could be further hurt, and the likelihood that the advocated actions will be processed positively will be lessened. Thus, for individuals with higher conspiracy beliefs, humor is likely to have a negative effect on vaccine confidence when scientific consensus information is present in the message.

H1b: When scientific consensus information is present, presenting humor elements in a PSA message promoting COVID-19 vaccination will decrease vaccine confidence for participants with a higher level of COVID-19 vaccine conspiracy belief.

Vaccine Confidence as a Mediator

Synthesizing our prior hypotheses about three-way moderating effects from humor, we propose a moderated moderated mediation model investigating the conditional indirect effect that explains the relationship between humor and vaccination intention, moderated by scientific consensus and conspiracy belief, and mediated through vaccine confidence (see Figure 1). As proposed in H1a and H1b, scientific consensus information and conspiracy beliefs might potentially act as boundary conditions, where a humorous PSA with or without scientific consensus information can exert either a positive or negative influence on vaccine confidence depending on individuals' levels of conspiracy beliefs. In the next set of hypotheses, we test their combined influence on the indirect effect of humor on vaccination intention through vaccine confidence. Previous studies acknowledge that vaccine confidence is a key mediating factor in one's intention to receive vaccinations. For example, Wismans and colleagues (2021) found that confidence was one of the two strongest antecedents linking perceived risk and effectiveness of vaccines to COVID-19 vaccination intention.

Based on the rationale we have elaborated for H1a, we expect that a humorous provaccine PSA without scientific consensus information will lead to greater vaccination intentions through its positive influence on vaccine confidence for individuals with higher conspiracy beliefs. However, when scientific consensus information is present in a humorous PSA, we expect it will lead to lower vaccination intentions through its negative influence on vaccine confidence, based on our rationale for H1b.

H2a: When scientific consensus information is absent, presenting humor elements in a PSA message promoting COVID-19 vaccination will result in greater intention to receive the COVID-19 vaccine via an increase in vaccine confidence for participants with a higher level of COVID-19 vaccine conspiracy belief.

H2b: When scientific consensus information is present, presenting humor elements in a PSA message promoting COVID-19 vaccination will result in lower intention to receive the COVID-19 vaccine via a decrease in vaccine confidence for participants with a higher level of COVID-19 vaccine conspiracy belief.

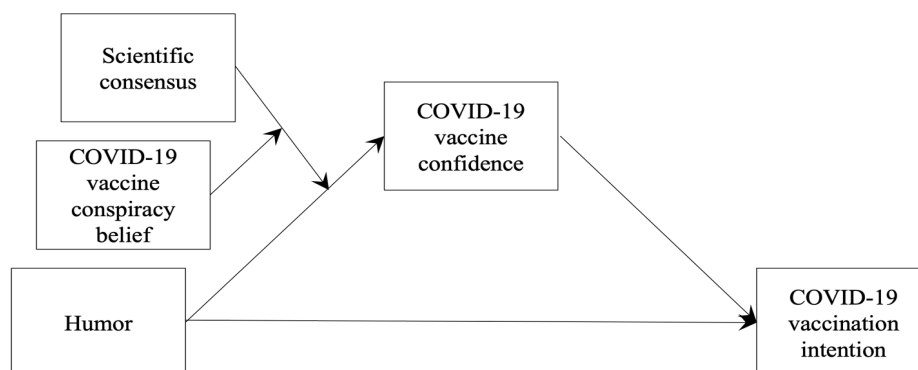


Figure 1. A conceptual model of the effect of humor, moderated by scientific consensus and COVID-19 vaccine conspiracy belief, and mediated by COVID-19 vaccine confidence, on COVID-19 vaccination intention.

Methods

Participants and Experimental Design

Participants were recruited from a research pool system at a large public university in the United States, with the incentive of extra credit for participation. Those interested in participating were directed to an online questionnaire via Qualtrics. Initially, 307 students expressed their interest in participating in the study. Among these individuals, 253 provided informed consent to participate. Ultimately, 237 participants completed the survey, constituting the final sample for the study. The study was conducted in November 2021. This was when the U.S. Centers for Disease Control and Prevention (CDC) expanded the eligibility for COVID-19 booster shots for all three available vaccines, including those aged 18+ who have underlying medical conditions, work or live in high-risk settings, or live in long-term care settings (CDC, 2021b). Most of the sample was female (72.6%) and Caucasian (76.8%). Participants ranged in age from 18 to 53 years ($M = 20.77$, $SD = 2.69$) and varied in their COVID-19 vaccination status (unvaccinated [19.4%], first dose of Pfizer-BioNTech or Moderna [4.2%], primary dose(s) [70.5%], and booster dose(s) [5.9%]). More than 50% (53.2%) of participants have had COVID-19 before.

The study was a 2 (humor: present [$n = 116$] versus absent [$n = 121$]) \times 2 (scientific consensus: present [$n = 121$] versus absent [$n = 116$]) between-subjects online experiment with COVID-19 vaccine confidence as a measured mediator and vaccine conspiracy beliefs as a measured moderator. Once informed consent was obtained, participants reported their COVID-19 vaccination status. Then, participants were randomly assigned to one of the four experimental conditions where they were shown PSAs promoting COVID-19 vaccinations. Afterward, participants were instructed to answer questions about the manipulation check, COVID-19 vaccine confidence, vaccine conspiracy beliefs, vaccination intention, and demographic information. The survey took approximately 15–20 minutes to complete.

Stimuli

Fictitious PSAs from the CDC encouraging vaccination against COVID-19 were created for the stimuli. There were two common elements included in all four experimental stimuli: (a) behavioral recommendation, "Travel wherever you want and with ease of mind in 2022" and "Get your COVID-19 vaccination, including primary and booster doses," and (b) a CDC logo and a website link (cdc.gov/coronavirus) at the bottom right corner. Humor was manipulated using verbal copy and an image. The nonhumor PSA read, "Travel wherever you want and with ease of mind in 2022," and showed a woman looking at the Eiffel Tower through an airplane window. The humor PSA read, "Don't let this be you again in this year," and presented an image of a woman looking at laundry through a washing machine door glass placed next to the same image and verbal copy used in the nonhumor PSA. The juxtaposition of these two images created incongruent arousal or surprise. Then, incongruity resolution occurs when the participant realizes that the woman wants to be on the plane to Paris but can only stare at laundry because of the pandemic. This arousal of incongruent and following resolution can generate mirth and perceived humor (Speck, 1991).

Furthermore, the scientific consensus was manipulated by stating, "97% of scientists agree that even young and healthy people need a COVID-19 vaccine." The nonscientific consensus stimuli did not

present this statement. Communicating 97% consensus has been reported to be an effective strategy for delivering mainstream scientists' understanding to the public (van der Linden, Leiserowitz, et al., 2015). Many studies used the 97% consensus figure to convey the standpoint generally agreed on by most scientists in areas such as climate change and the safety of genetically modified food (e.g., Chinn & Hart, 2021; Kerr & Wilson, 2018; Lewandowski, Gignac, & Vaughan, 2013; Maertens, Anseel, & van der Linden, 2020; see Appendix for all stimuli used in the study).

Measures

A 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to measure each variable.

COVID-19 Vaccine Conspiracy Belief

Participants' COVID-19 vaccine conspiracy belief was assessed using seven items from Shapiro, Holding, Perez, Amsel, and Rosberger (2016). Sample items include "COVID-19 vaccine effectiveness data are often fabricated" and "people are deceived about COVID-19 vaccine safety" ($M = 2.90$, $SD = 1.56$, Cronbach's $\alpha = 0.95$).

COVID-19 Vaccine Confidence

COVID-19 vaccine confidence was measured using three items from Betsch and colleagues (2018), "I am completely confident that COVID-19 vaccines are safe"; "COVID-19 vaccinations are effective"; and "Regarding COVID-19 vaccines, I am confident that public authorities decide in the best interest of the community" ($M = 4.82$, $SD = 1.65$, Cronbach's $\alpha = 0.89$).

Vaccination Intention

Intention to obtain COVID-19 vaccines was measured using two items, "I intend to get a COVID-19 vaccination (primary or booster doses) when available" and "I will try to get a COVID-19 vaccination (primary or booster doses) when available" ($M = 4.96$, $SD = 1.92$, $r = 0.97$; Hendriks & Janssen, 2018).

Results

Manipulation Check

For the humor manipulation, perceived humor was measured. Specifically, participants assessed the question, "The ad that I just saw was:" on a seven-point semantic differential scale anchored by not funny/funny, not amusing/amusing, and not humorous/humorous ($M = 2.72$, $SD = 1.62$, Cronbach's $\alpha = 0.95$; Cline, Altsech, & Kellaris, 2003). An independent sample t -test indicated that perceived humor was higher in the humor condition ($M = 3.48$, $SD = 1.65$) compared with the nonhumor condition ($M = 2.00$, $SD = 1.21$), $t(235) = 7.91$, $p < .001$. For scientific consensus manipulation, the presence or absence of scientific

consensus information in the message does not need a manipulation check because the variation was defined in terms of an intrinsic feature of the message property itself (O'Keefe, 2003).

Hypothesis Testing

PROCESS macro Model 11 permits testing a three-way interaction and if this interaction occurs through a mediator (Hayes, 2018), thus allowing us to address the proposed hypotheses simultaneously. Using Model 11, we established a moderated, moderated mediation model with a dummy-coded humor condition as an independent variable (X ; 0 = absent vs. 1 = present), vaccination intention as a dependent variable (Y), vaccine confidence as a mediator (M), and a dummy-coded scientific consensus condition (W ; 0 = absent vs. 1 = present) and vaccine conspiracy belief (Z) as two moderators. We used 5,000 bootstrap estimates to construct 95% bias-corrected confidence intervals (CIs) for conditional indirect effects. Unstandardized coefficients are reported below.

H1a and H1b examined a three-way interaction effect of humor, scientific consensus, and vaccine conspiracy belief on vaccine confidence. H1a anticipated that when scientific consensus information is absent, humor elements in PSAs will increase vaccine confidence when participants' COVID-19 vaccine conspiracy belief is higher. On the other hand, under the condition where scientific consensus information is present, H1b expected decreased vaccine confidence would result from presenting humor in PSAs when participants' vaccine conspiracy belief is higher. The results revealed a significant three-way interaction effect of humor, scientific consensus, and conspiracy belief on vaccine confidence, $b = -0.65$, $SE = 0.19$, $t(229) = -3.44$, $p < .001$. To probe H1a and H1b, the effect of humor on vaccine confidence was further assessed at values of the mean (2.90), one standard deviation below (1.35), and one standard deviation above the mean (4.46) of conspiracy belief within each scientific consensus condition. Under the condition in which scientific consensus was not present, humor had a significant and positive impact on COVID-19 vaccine confidence when a level of conspiracy belief was high and moderate: high (+1SD), effect = 1.15, $SE = 0.30$, $p < .001$, moderate (mean), effect = 0.50, $SE = 0.20$, $p < .05$, and low (-1 SD), effect = -0.15, $SE = 0.29$, $p = ns$, confirming H1a (see Figure 2). When scientific consensus information was present, humor exhibited a significant and negative impact on vaccine confidence only when a level of conspiracy belief was high: high (+1SD), effect = -0.63, $SE = 0.28$, $p < .05$, moderate (mean), effect = -0.27, $SE = 0.20$, $p = ns$, and low (-1 SD), effect = 0.10, $SE = 0.29$, $p = ns$. Therefore, H1b was supported (see Figure 3).

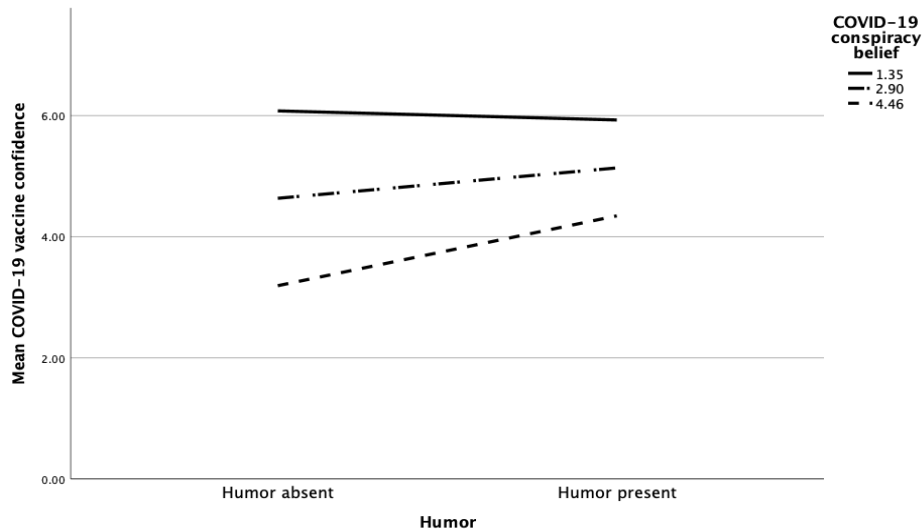


Figure 2. Interaction effect between humor and COVID-19 vaccine conspiracy belief on COVID-19 vaccine confidence under the condition in which scientific consensus information is absent.

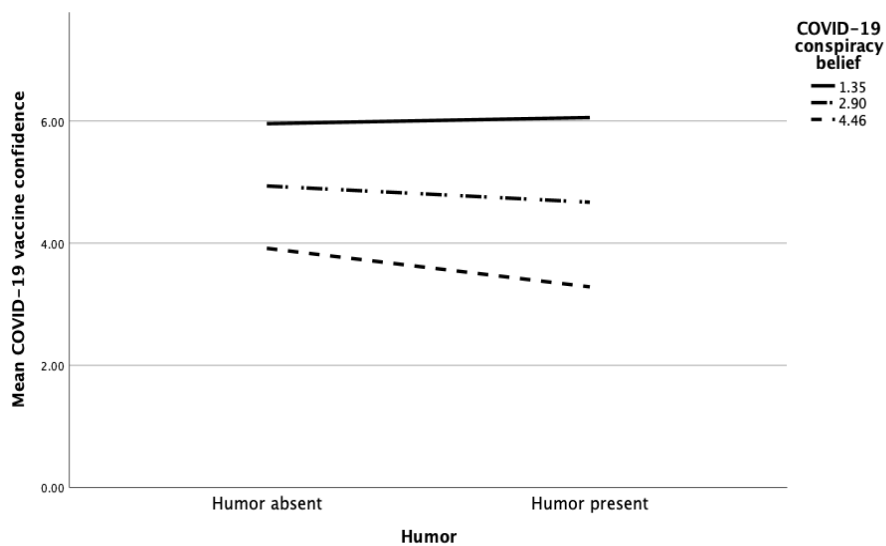
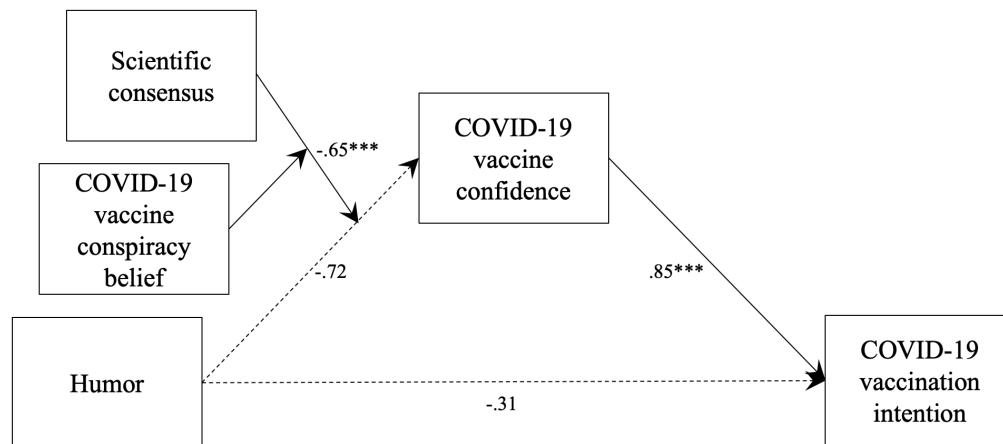


Figure 3. Interaction effect between humor and COVID-19 vaccine conspiracy belief on COVID-19 vaccine confidence under the condition in which scientific consensus information is present.

H2a and H2b concern the effect of humor on vaccination intention, moderated by scientific consensus and conspiracy belief and mediated by vaccine confidence. Specifically, H2a predicted that when scientific consensus information is absent, presenting humor elements in a PSA promoting COVID-19 vaccination will result in greater intention to receive the COVID-19 vaccine via an increase in vaccine confidence when participants' level of COVID-19 vaccine conspiracy belief is higher. On the contrary, H2b expected that when scientific consensus information is present, presenting humor elements in a PSA

message promoting COVID-19 vaccination will lead to lower intention to receive the COVID-19 vaccine via a decrease in vaccine confidence when participants' level of COVID-19 vaccine conspiracy belief is higher.

The results exhibited a significant moderated moderated mediation index, index = -0.56 , $SE = 0.17$, 95% CI $(-0.89, -0.24)$. The indirect effect of humor was explored at values of mean, one standard deviation below, and one standard deviation above the mean of conspiracy belief within each scientific consensus condition. When scientific consensus was not present, the indirect effect of humor on vaccination intention was significant and positive through increased vaccine confidence when a level of vaccine conspiracy belief was high and moderate: high (+1SD), indirect effect = 0.98 , $SE = 0.28$, 95% CI $(0.46, 1.53)$, moderate (mean), indirect effect = 0.43 , $SE = 0.16$, 95% CI $(0.12, 0.75)$, and low (-1 SD), indirect effect = -0.13 , $SE = 0.22$, 95% CI $(-0.58, 0.29)$. Therefore, H2a was confirmed. When consensus information was present, the indirect effect of humor was significant and negative on intention through decreased vaccine confidence only when a level of vaccine conspiracy belief was high: high (+1SD), indirect effect = -0.54 , $SE = 0.28$, 95% CI $(-1.12, -0.02)$, moderate (mean), indirect effect = -0.23 , $SE = 0.18$, 95% CI $(-0.60, 0.12)$, and low (-1 SD), indirect effect = 0.09 , $SE = 0.22$, 95% CI $(-0.33, 0.53)$. Thus, H2b received support. Figure 4 depicts these relationships in a graphical form.



Conditional indirect effects of humor on COVID-19 vaccination intention

When scientific consensus is absent

Conspiracy belief 1.35 (-1 SD): $b = -.13$, $SE = .22$, 95% CI = $[-.5802, .2893]$

Conspiracy belief 2.90 (mean): $b = .43$, $SE = .16$, 95% CI = $[.1173, .7503]$

Conspiracy belief 4.46 (+1 SD): $b = .98$, $SE = .28$, 95% CI = $[.4623, 1.5250]$

When scientific consensus is present

Conspiracy belief 1.35 (-1 SD): $b = .09$, $SE = .22$, 95% CI = $[-.3304, .5271]$

Conspiracy belief 2.90 (mean): $b = -.23$, $SE = .18$, 95% CI = $[-.5973, .1218]$

Conspiracy belief 4.46 (+1 SD): $b = -.54$, $SE = .28$, 95% CI = $[-1.1208, -.0185]$

Figure 4. Path coefficients for moderated moderated mediation analysis on vaccination intention.

Note. All coefficients are unstandardized; the dotted line indicates a nonsignificant pathway.

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

Discussion

Given the pressing need for developing and testing effective provaccine messaging strategies in the target individuals with COVID conspiracy beliefs, the current research sought to address the effectiveness of humorous PSA messages and whether the inclusion of scientific consensus information about the necessity of COVID vaccination matters for the outcomes of vaccine confidence and vaccination intention. For individuals with high and moderate conspiracy beliefs, the finding suggests that humor had a significant and positive impact on COVID-19 vaccine confidence when the scientific consensus information endorsed by the scientists is absent. Further, their vaccination intention was significantly improved through higher vaccine confidence. However, when the scientific consensus was present, humor significantly and negatively impacted vaccine confidence only for individuals with high conspiracy beliefs. The same individuals showed a lower vaccination intention through lower vaccine confidence.

The current study provides unique contributions to the humor literature and vaccination research. This research extends humor theory in the context of COVID-19 vaccination by considering two key moderators: one's conspiracy beliefs, a key determinant for vaccine hesitancy (Bierwaczek, Gundersen, & Kunst, 2022), and the scientific consensus information, a strong predictor of one's certainty about the scientific issue (Dunwoody & Kohl, 2017; Koehler, 2016; Kohl et al., 2016). Although the influence of humor, scientific consensus, and conspiracy beliefs on attitudes and intentions toward vaccination have been *independently* documented (e.g., Clarke et al., 2015; Moyer-Gusé et al., 2018; van Prooijen et al., 2022), little is known about whether and how humor exerts an influence on vaccination confidence and vaccination intention in conjunction with these moderators. This inquiry represents a theoretical advancement in health-messaging and vaccine research. Whereas previous studies mainly focused on the *direct* persuasive impact of humorous messaging that often produced inconsistent results (English et al., 2011; Martin, 2007; Weinberger & Gulas, 1992), we have advanced scholarship by redirecting our focus to two key moderators, providing a more nuanced understanding of humor messaging's role in the context of COVID vaccines. Our research aims to fill the gap by identifying the conditions in which humor is either a positive or negative persuasive factor for individuals with higher conspiracy beliefs.

Notably, the moderating role of conspiracy beliefs adds complexity to humor messaging research in the context of vaccines. For high- and moderate-conspiracy-beliefs individuals who are challenging for government organizations to engage and persuade, this study showed that using humor could have an immediate persuasive impact when the message is not paired with the scientific consensus information, which is in line with the counterargument distraction hypothesis and the mood-maintenance hypothesis (Martin, 2007; Weinberger & Gulas, 1992; Young, 2008). However, the effects were reversed when scientific consensus information was paired with humor for individuals with high conspiracy beliefs. In this case, they may feel threatened and attacked as the message challenges their preexisting beliefs about the scientific experts (for example, Dillard & Shen, 2005). Although the message itself may be perceived as humorous, humor may not be able to reduce their motivation to counterargue, and the provaccine message presented with scientific consensus information may be discounted, resulting in adverse persuasive effects (Nabi et al., 2007). This finding informs us that humor may not be an ideal persuasive strategy in counterattitudinal contexts. This demonstrates the promise and peril of using

humor as a communication tool for individuals most resistant to provaccination messaging. Overall, the current study supports the idea that the message recipient's preexisting attitudes and beliefs and the message characteristics should continue to be examined *together* for humor theory development and provaccine message effectiveness.

Although this study further supports past findings that vaccine confidence is a key driving factor for favorable COVID-19 vaccination intentions (Wismans et al., 2021), it establishes an important theoretical link between humor and vaccination intentions. We proposed and tested two conditional mediational routes through which PSAs with humor and scientific consensus elements lead to persuasion outcomes. Given that the main effects of humor on vaccine confidence and intention were not statistically significant in our analysis (see Figure 4), these two conditional mediation routes play an essential role in humor effectiveness. This study is one of the first to link the effect of humor to vaccination intention through vaccine confidence. The interplay between humor and two key moderators offers new insights into the theoretical pathways explaining humor's persuasive effect in the context of COVID-19 vaccines.

These findings provide initial empirical support for the hypotheses drawn from humor processing theory and existing literature. We seek to advance the current literature by investigating the differential effects of humorous PSAs and their interplay with two key moderators on the outcome of vaccination intention. However, this study does not provide a critical test to unravel the underlying cognitive and affective mechanisms operating while processing humorous PSAs. Treating humor processing as a "black box" is common in humor messaging studies, often because of difficulties in manipulating its cognitive and affective elements and their relative effects (Walter et al., 2018). Despite the encouraging initial evidence, follow-up studies are needed to establish the causal mechanism by directly manipulating cognitive effort and affective response during the processing of humorous messages. Assessing cognitive effort and distraction through more comprehensive thought-listing measurements and exploring the use of psychophysiological responses to confirm the affective elements would be a promising step toward understanding the mechanism behind humor processing.

Nonetheless, the findings from the current study provide valuable insights into how public health officials and practitioners can effectively use humor-framed provaccine messages in their vaccination initiatives. Conspiracy beliefs have eroded people's trust in public health authorities and experts holding power or knowledge (Imhoff et al., 2018). Thus, individuals with higher conspiracy beliefs can be the campaign's target demographic to combat vaccine hesitancy and avoidance of the recommendation endorsed by scientists and public health institutions. Given public health organizations have also increasingly employed humor and memes in their vaccination campaigns in recent years, it is essential to tailor humor messaging to the target demographic by presenting provaccine messages without scientific consensus information. If delivering the scientific consensus element is one essential goal of the vaccination campaign, it is recommended that a humor frame may not be used for the target of high conspiracy beliefs individuals as it will lower vaccination intention through a decrease in vaccine confidence. Thus, target audience analysis in the precampaign stage is crucial to understanding the target's vaccine-related attitudes and beliefs, which will inform effective messaging strategies such as humor. Notably, the current study was conducted when CDC expanded the eligibility for COVID-19 booster shots for all three available vaccines. However, vaccine hesitancy among younger generations

has limited the effectiveness of vaccination initiatives (CDC, 2021a; Geng et al., 2022). The findings from the current study provide evidence for government and public health institutions to help prepare relevant messaging strategies for future vaccination initiatives aimed at the younger generation.

There are some caveats. First, the current study did not measure how higher conspiracy individuals might respond to the message source of the message, which was the CDC. Although it is plausible that the source effect might influence vaccine confidence and vaccination intention, there is no reason to believe that it would bias our interpretation of findings given the random assignment of study participants. Second, this study assessed the single exposure effect of humorous provaccine PSAs. The outcome variables, COVID-19 vaccine confidence and vaccination intention, are measured immediately after exposure. Although the research design is commonly used in various message testing studies, future research should use a longitudinal research design with repeated exposures to the stimuli to enhance the ecological validity of the study findings and assess long-term effects on the outcome variables. Third, the current study tested the humor-framed provaccine messaging strategy using a sample of college students, a population with reported lower COVID-19 vaccine uptake and intention to get vaccinated (CDC, 2021a). Thus, the degree of generalization to other populations (such as populations with a lower education level or the general public) remains to be tested. Additionally, this study focused on one specific type of conspiracy belief and its moderating effects. However, conspiracy theories differ widely in their forms depending on topics, ranging from vaccines to climate change to nonscientific contexts (e.g., politics). Research has shown that belief in one conspiracy theory is often the best predictor of belief in another, suggesting that a general conspiracy mindset drives consistent psychological processes across different domains (Lewandowski et al., 2013; Sutton & Douglas, 2014; Swami et al., 2011). However, measuring conspiracy beliefs in various contexts is nuanced and complicated, and there needs to be more empirical evidence, especially about their varying moderating effects on persuasion outcomes.

Last, current research practice has largely employed the perceived humor measure to confirm the successful manipulation of humor in the message (Alden et al., 2000). As O'Keefe (2003) argued, "the adequacy of the manipulation of the message property is not appropriately assessed by inquiring about participant perceptions of the message" (p. 257). This is particularly true for manipulating humor, which involves cognitive and affective elements. Sometimes, a person's experience of humor (affective element) may not align with his or her cognitive recognition of incongruity and context in the humor message (cognitive element). For example, one can report that the message was funny without experiencing genuine mirth simply because they recognized the incongruity and intended humor in the message. Future studies need to explore an alternative method for confirming humor manipulation, particularly for the affective element, through moment-to-moment analysis of surprise and perceived humor (Woltman Elpers, Mukherjee, & Hoyer, 2004) or psychophysiological responses such as fluctuations in physiological arousal (Fiacconi & Owen, 2015).

Despite these limitations, the findings carry important implications for health campaign message strategies for vaccine-hesitant conspiracy-minded individuals. Our findings underscore the important role of the scientific consensus element in promoting COVID-19 vaccine confidence during humor message processing. The current study also explored the underlying mechanisms that strengthen vaccination

intention by linking humor processing to vaccine confidence as a mediator. The mediating role of vaccine confidence offers insights into the importance of designing humorous PSAs that engender trust in vaccines' safety, effectiveness, and public health authorities, especially when communicating with young adults who tend to show lower vaccination rates.

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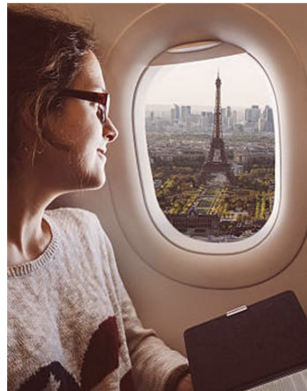
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Appendix: Stimuli

Travel wherever you want and with ease of mind in 2022.



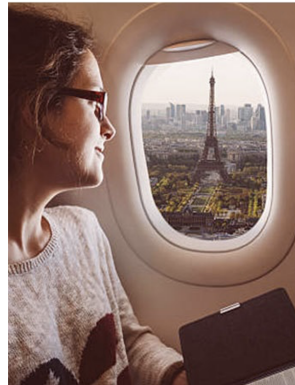
Get your COVID-19 vaccination,
including primary and booster doses.



Find out more at
cdc.gov/coronavirus

Figure 1. Nonhumor + no scientific consensus PSA.

Travel wherever you want and with ease of mind in 2022.



97% of scientists agree that even young and healthy people
need a COVID-19 vaccine.

Get your COVID-19 vaccination,
including primary and booster doses.



Find out more at
cdc.gov/coronavirus

Figure 2. Nonhumor + scientific consensus PSA.

Don't let this be you again in the new year.



Travel wherever you want and with ease of mind in 2022.



Get your COVID-19 vaccination, including primary and booster doses.



Find out more at cdc.gov/coronavirus

Figure 3. Humor + no scientific consensus PSA.

Don't let this be you again in the new year.



Travel wherever you want and with ease of mind in 2022.



97% of scientists agree that even young and healthy people need a COVID-19 vaccine.

Get your COVID-19 vaccination, including primary and booster doses.



Find out more at cdc.gov/coronavirus

Figure 4. Humor + scientific consensus PSA.