Psychology & Health

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/gpsh20

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To cite this article: Daniel Jolley, Lee Shepherd & Anna Maughan (25 Jul 2024): The fear factor: examining the impact of fear on vaccine hesitancy and anti-vaccine conspiracy beliefs, Psychology & Health, DOI: 10.1080/08870446.2024.2381235

To link to this article: https://doi.org/10.1080/08870446.2024.2381235

Published online: 25 Jul 2024.

PSYCHOLOGY & HEALTH
https://doi.org/10.1080/08870446.2024.2381235

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The fear factor: examining the impact of fear on vaccine hesitancy and anti-vaccine conspiracy beliefs

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ABSTRACT

Objectives: While anti-vaccine conspiracy beliefs can reduce vaccine intentions, longitudinal research shows that vaccine hesitancy can increase conspiracy beliefs. In three experiments ($N=949$), we examined the effect of fear about a vaccine on vaccine hesitancy and anti-vaccine conspiracy beliefs.

Method and Measures: In Studies 1a ($N=221$) and 1b ($N=508$), participants were exposed to high fear (*vs* low fear) about a (fictional) vaccine before reporting vaccine hesitancy and anti-vaccine conspiracy beliefs. In Study 2, all participants were exposed to high fear before being asked to think about *not* getting vaccinated (*vs* vaccinated) against the (fictional) disease. Participants then reported their vaccine hesitancy, anti-vaccine conspiracy beliefs, and closeness to others who distrust official narratives.

Results: In Studies 1a and 1b, exposure to high fear (*vs* low fear) increased vaccine hesitancy, which was positively correlated with anti-vaccine conspiracy beliefs. The reverse model's effect was either smaller (Study 1a) or non-significant (Study 1b). In Study 2, fear and not wanting to vaccinate resulted in vaccine hesitancy, which then predicted anti-vaccine conspiracy beliefs and feeling closer to those distrusting official narratives.

Conclusion: Therefore, fear creates a response not to get vaccinated. A conspiracy belief may then *justify* this response.

ARTICLE HISTORY
Received 10 October 2023
Accepted 10 July 2024

KEYWORDS
Anti-vaccine conspiracy theories; vaccine hesitancy; emotions; fear intentions

Introduction

Vaccines are important for tackling diseases and viruses, including COVID-19, measles, influenza, and human papillomavirus, with such immunization efforts being responsible for preventing approximately 3.5–5million deaths per year (World Health Organization, 2021). In many cases, vaccines not only protect the vaccinated individual but also reduce the likelihood of the viruses being passed on to vulnerable people within the population (Hurwitz et al., 2000). Despite the widespread acceptance that vaccinations are a powerful public health measure, a reluctance to vaccinate remains a problem worldwide. Indeed, the World Health Organization have described vaccine hesitancy as a growing challenge

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(World Health Organization, 2015). For example, large-scale research from across 23 countries has indicated that only 79% of people have accepted the COVID-19 vaccine (Lazarus et al., 2024). Similarly, the World Health Organization (2023) reported that in 2022 an initial measles vaccination was received by 83% of children. As such, there are a substantial number of people who are *hesitant* to receive vaccines for themselves or their children. Therefore, it is important to understand the factors contributing to vaccine hesitancy. One such factor is the belief in vaccine-related conspiracy theories.

Conspiracy theories are concerns that (perceived) powerful groups (e.g. governments, pharmaceutical companies, etc.) are engaging in secret plots for their own benefit (Douglas et al., 2017). In relation to vaccines, people may hold various conspiracy beliefs, including the belief that pharmaceutical companies are hiding information that vaccines are unsafe, vaccines are being used to control the population and that pharmaceutical companies are aware of the ineffectiveness of vaccines but hide this to make a profit (Jolley & Douglas, 2014). Holding conspiracy beliefs makes people reluctant to engage in beneficial health behaviours (for a review, see Jolley et al., 2022), including vaccination (e.g. Jolley & Douglas, 2014). Therefore, it is important to determine the factors that promote such vaccine conspiracy beliefs.

Emerging research has uncovered that our emotions can predict belief in conspiracy theories (Tomljenovic et al., 2020). For example, numerous studies have shown the effect of anxiety on conspiracy beliefs (Bowes et al., 2023). Indeed, research has found that trait anxiety positively predicts belief in conspiracy theories (Grzesiak-Feldman, 2013; Krüppel et al., 2023). Moreover, inducing anxiety increases the likelihood of people endorsing conspiracy theories (Radnitz & Underwood, 2017). However, much less research has been done to understand the influence of fear of vaccinations on vaccine hesitancy and vaccine-related conspiracy beliefs. This is despite many anti-vaccination messages containing strong fear appeals (Bradshaw et al., 2020; Scannell et al., 2021). Therefore, our research aimed to address this gap and has experimentally tested whether the fear of a vaccine may breed conspiracy beliefs about vaccines.

Fear and health behaviours

Fear is a negative emotion experienced when a stimulus is perceived as threatening or dangerous (Smith & Lazarus, 1993). Although fear is related to anxiety, these are distinct constructs (Frijda et al., 1989). Indeed, anxiety is experienced when people are concerned about an unpredictable and distal future outcome, whereas fear is experienced when there is an impending threat (Labar, 2016). For example, an individual may feel anxiety because they are unsure what will happen in the future (e.g. 'I am concerned that a new variant of COVID-19 may be problematic'). In contrast, they may feel fear when concerned about the situation's threat (i.e. 'This new vaccine has known severe side-effects'). Fear is also associated with a desire to protect oneself (Frijda et al., 1989). For example, feeling fear towards infection, in general, may motivate people to engage in protective behaviours, such as vaccination (Bendau et al., 2021; Caycho-Rodríguez et al., 2023). However, the relationship between fear and beneficial protective behaviours is complex, as fear may both promote protective and deter health behaviours, depending on the individual's interpretation of the threat (Witte, 1992). In line with this model, health psychology research has found that fear

may lead some people to engage in health behaviours but can potentially result in other individuals undertaking more defensive actions, such as derogating and denying the potential threat (Peters et al., 2013; for a review, see Ruiter et al., 2014). One strategy that may be used to deny a threat is conspiracy theories.

Fear and conspiracy theories

Conspiracy beliefs often stem from times of uncertainty and threat (Douglas et al., 2019). Importantly, researchers have argued that one motive for holding conspiracy beliefs may be to help them tackle existential threats (Douglas et al., 2017). For example, believing that COVID-19 is a hoax means there is no *reason* to fear this virus. Endorsing this conspiracy belief may alleviate the potential existential threat and people's related aversive emotions towards the virus. In line with this, research has found that feeling fear towards monkeypox increases the likelihood of people endorsing conspiracy beliefs towards monkeypox (Caycho-Rodríguez et al. et al., 2023). Similarly, fear towards COVID-19 increased the extent to which people held conspiracy beliefs towards this virus (Caycho-Rodríguez et al., 2023). Importantly, this relationship is mediated by perceived existential threats (Scrima et al., 2022).

This emerging research suggests that fear may promote conspiracy theories. However, it is important to note that some research suggests a lack of a relationship between fear of a medical condition (i.e. COVID-19) and conspiracy theories (Caycho-Rodríguez et al., 2022). This discrepancy may, in part, be due to a health condition being associated with numerous sources of threat. For example, people may be concerned by the threat of contracting a virus, dying from the virus, the long-term consequences on the individual's health, and the stigma associated with a virus. Alternatively, people may feel threatened by the consequences of treatment, such as whether they believe the treatment is safe and the potential long-term effects of the treatment on their bodies. Some of these fears may be more prone to conspiracy beliefs than others. A common threat in many conspiracy beliefs is that medical prevention for viruses may harm the individual. Indeed, this conspiracy has been found for childhood vaccinations (Jolley & Douglas, 2014), Pre-Exposure Prophylaxis (PrEP; Jolley & Jaspal, 2020), and COVID-19 vaccinations (Caycho-Rodríguez et al., 2023; Scrima et al., 2022).

Research has also suggested that feeling fear towards the side effects of vaccines is associated with vaccine-related conspiracy beliefs (Jovanović et al., 2023). However, it is important to consider the causal direction of this relationship. Some research has found that exposure to conspiracy beliefs increases the likelihood of people viewing vaccines as dangerous (Jolley & Douglas, 2014). As such, holding conspiracy beliefs is likely to result in people having a more negative appraisal of vaccines and, thus, increasing the likelihood of fear being experienced. However, given that research has suggested conspiracy beliefs may develop from feeling fear towards different medical conditions (i.e. COVID-19 and monkeypox; Caycho-Rodríguez et al., et al. 2023; Caycho-Rodríguez et al. et al., 2023), it is also likely that fear of medical prevention methods (e.g. vaccines) may promote medical conspiracy beliefs. Indeed, emotions are not simply affective responses to a cognitive process but act as a warning signal for issues that need to be acted upon in our environment (Keltner & Haidt, 1999).

As such, the emotions elicited towards an entity may influence the interpretation of the entity and subsequent behaviour.

The social intuitionist model argues that people base moral judgements on emotional gut reactions and then apply logical arguments to support the decision based on these gut reactions (Haidt, 2001). There is support for these ideas from research showing that eliciting feelings of disgust results in people interpreting a moral scenario more negatively (Schnall et al., 2008). Importantly, intuition predicts conspiracy theory beliefs (Tomljenovic et al., 2020). As such, the social intuitionist model likely applies to developing and maintaining conspiracy beliefs (Van Prooijen et al., 2020). Based on this, we argue that fear of a vaccine will likely promote conspiracy beliefs. Indeed, feeling fear towards a vaccine may signal to individuals that this vaccine may pose a threat to them. As such, people may then try to provide reasons to *justify* avoiding a vaccine. One such argument that may be applied is the endorsement of conspiracy beliefs (e.g. vaccines may be harmful, and pharmaceutical companies cannot be trusted). Therefore, fear of vaccines may cause people to have a greater endorsement of anti-vaccine conspiracy beliefs. As mentioned above, there is some initial cross-sectional evidence that feeling worried about the side effects of vaccines is associated with vaccine-related conspiracy theories (Jovanović et al., 2023). In this series of studies, we enhance this research by assessing the causal effect of fear towards a vaccine on vaccine-related conspiracy beliefs.

Present research

Across three experimental studies, we examined how fear of vaccines is linked with vaccine hesitancy and belief in anti-vaccine conspiracy theories. In Studies 1a and 1b, high fear was induced (*vs.* low fear) about a vaccine before participants reported their vaccination intention and anti-vaccine conspiracy beliefs. In both studies, we first examined how fear may provoke conspiracy beliefs and the subsequent association with vaccine hesitancy (*H1,* pre-registered). However, there is the possibility that the reverse pathway could also exist. Recent longitudinal work by van Prooijen and Böhm (2023) has found that vaccination hesitancy can shape increased conspiracy beliefs. It is plausible that when fearful, people may try to justify avoiding a vaccine. This avoidance (i.e. vaccine hesitancy) may provoke a conspiracy belief as a *justification*. In exploratory analyses inspired by van Prooijen and Böhm (2023), we also examined how fear may provoke vaccine hesitancy, which is subsequently associated with conspiracy beliefs (*H2,* exploratory).

As the exploratory findings of Studies 1a and 1b suggested that fear indeed provokes more vaccine hesitancy *then* conspiracy beliefs, Study 2 aimed to establish a causal effect between these variables. All participants were exposed to high vaccine fear before considering why they would *not* want to vaccinate (*vs.* get vaccinated). Participants then indicated their vaccination intention and anti-vaccine conspiracy beliefs. We predicted that participants who thought about *not* vaccinating would report higher anti-vaccine conspiracy beliefs when fearful of a vaccine (*H3,* pre-registered). In Study 2, participants also indicated how close they felt to people distrusting official narratives. We predicted that participants who thought about *not* vaccinating (*vs*. vaccinating) would feel closer to this group when fearful of a vaccine

(*H4*, pre-registered). All materials and data for each study (including pre-registrations) can be found on the Open Science Framework: https://osf.io/fqux7/.

Study 1a

Method

Participants and design

A between-participants design was used. The independent variable was fear (low *vs* high fear). The dependent variables were vaccine conspiracy beliefs and vaccine hesitancy. Preregistered a-priori power calculations suggested that a minimum sample of 200 participants would be required for this between-participants design with two conditions based on recommendations (see Brysbaert, 2019). Specifically, we used a small to medium effect size (Cohen's d of .40), an alpha of .05 and a power of .80. However, we over-recruited by 10% to ensure the minimum sample was obtained in case participants had to be removed (e.g. outliers if they bias the data). Therefore, we recruited 221 participants in October 2022 from *Prolific* (https://www.prolific.com/), a popular online crowd-sourcing platform (108 men (including trans men), 109 women (including trans women), one non-binary and three who would rather not say, *Mage* = 38.90, *SD* = 13.40). No participants were excluded. Eighty percent (178) were up to date with their COVID-19 vaccines, 89.6% (198) were up to date with their routine vaccines (e.g. Polio, Tetanus, MMR), and 33% (73) had received a flu vaccine within the last year. An experimental design was employed with 111 participants in low and 110 in high fear conditions. The study received ethical approval from the University of Nottingham's School of Psychology Ethics Committee (#F1383R).

Materials and procedure

Participants provided informed consent before being given information about a new virus called *Flebilis-Potentia* and a vaccine to treat it. *Flebilis-Potentia* is a fictional disease made for the purpose of the experiment, but participants were unaware of this. The researchers created this condition and vaccine to assess the factors influencing people's intention to get vaccinated without the ethical implications of altering people's willingness to obtain a real vaccination. The information included the associated *Flebilis-Potentia* symptoms and side effects of the vaccine. Participants were then randomly asked to read an expert opinion of the vaccine. In the low fear condition, the expert stated:

> People should not feel fear towards the Flebilis-Potentia vaccine. The vast majority of people will only experience mild side effects. Although the data suggests some people have experienced severe side effects, this has only happened in a small number of cases

In contrast, in the high fear condition, the expert stated:

> People should feel fear towards the Flebilis-Potentia vaccine. The vast majority of people will only experience mild side effects. However, the data suggests there have been a small number of cases where people have experienced severe side effects.

The full manipulation text is available on the Open Science Framework (https://osf.io/fqux7/).

Following this, participants completed a series of comprehension questions to test their knowledge of the information presented. There were four questions (e.g. 'What are the symptoms of Flebilis-Potentia') with four responses to each question (e.g. "a) Fatigue, difficulties in concentrating, muscle ache and dizziness'). Participants needed to get all questions correct to proceed with the survey; participants were allowed to amend any incorrect answers and then proceed. This ensured all participants were completing the remainder of the study with the same information made salient.

Next, participants completed a fear manipulation check, comprising of three questions (e.g. 'To what extent would you feel fear towards receiving the vaccine', α = .97) on a 5-point scale (1 = *not at all*, 5 = *very much so*). Participants then completed the Vaccine Conspiracy Beliefs Scale (Jolley & Douglas, 2014), where there are eleven questions (e.g. 'Vaccines are harmful, and this fact is covered up', α = .91) on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree)*. A vaccine intention item was then completed (Jolley & Douglas, 2014), where participants were asked, 'If you had the opportunity to vaccinate yourself against Flebilis-Potentia next week, what would you decide?' with responses being on a 7-point scale (1 = *definitely not vaccinate*, 7 = *definitely vaccinate*). Demographics were then taken before participants were debriefed.

Given the use of a fake medical condition and vaccine, we included an in-depth debriefing process. In this process, we first explained to participants that *Flebilis-Potentia* is not a real condition, that the vaccine information was false, and why we had used deception in the research (i.e. to avoid spreading incorrect information about an existing vaccine). Participants could not continue until they had answered two comprehension check questions correctly ('Flebilis-Potentia is not a real medical condition'; 'The information that I read about the vaccine was false'), with 'true' (rather than 'false'). Participants then received the full debrief, were thanked and paid for their time.

Results and discussion

Data checks

As pre-registered (https://osf.io/jyev5/?view_only=e50e8e096c264af88040990da83fa7d5), we first explored whether the manipulation successfully induced fear towards the vaccine. An Independent-Samples T-test demonstrated that participants who completed the high fear condition reported increased feelings of fear towards the vaccine ($M = 5.03$, $SD = 1.63$) than those in the low fear condition ($M = 3.53$, $SD = 1.65$), $t(219) = 6.801$, $p < .001$, $d = .92$. Next, we examined whether the manipulation was biased by condition-dependent attrition. We found that no participants had dropped out. Finally, we explored whether the manipulation conditions differed in demographics (i.e. age, gender, and a range of vaccine statuses [yes *vs*. no]). No significant differences were uncovered except for flu vaccination status, whereby there was a significant Chi-Squared Test for receiving a flu vaccination within the last year, χ^2 (1, $N = 210$) = 4.675, p =.031. As this highlighted that the experimental conditions differed on flu vaccine status, this variable was controlled for within the analyses.

We then performed two further Independent-Samples T-tests to examine the effect of the experimental condition (high fear *vs.* low fear) on anti-vaccine conspiracy beliefs

and vaccine intentions. As shown in Table 1, participants in the 'high fear' condition indicated significantly higher conspiracy beliefs and lower vaccine uptake than participants in the 'low fear' condition.

Fear, conspiracy beliefs and vaccine hesitancy (H1)

To examine *H1* that fear provokes conspiracy beliefs, which are then associated with vaccine hesitancy, we used PROCESS Model 4 with 5,000 bootstrapped samples and 95% bias-corrected confidence intervals (Hayes, 2013). The mediation was significant both before (-0.24, *ULCI* = −0.4298, *ULCI* = −0.0720) and after controlling for flu vaccine status (indirect effect *ab* = −0.24, *ULCI* = −0.4400, *ULCI* = −0.0684, see Figure 1). Fear (*vs.* low fear) increased conspiracy beliefs, which was then related to being less likely to want to get vaccinated, supporting *H1*.

Exploratory analyses - fear, vaccine hesitancy and conspiracy beliefs (H2)

Next, we tested the reverse mediation model in which fear manipulation indirectly affected conspiracy beliefs *via* vaccine hesitancy. We again used PROCESS Model 4, controlling for flu vaccine status. As shown in Figure 1, the mediation was significant both before (indirect effect *ab* = .32, *ULCI* = 0.1602, *ULCI* = 0.5256) and after controlling for flu vaccine status (indirect effect *ab* = .32, *ULCI* = 0.1549, *ULCI* = 0.5170). Fear (*vs.* low fear) reduced vaccine intentions, which was then related to higher anti-vaccine conspiracy beliefs supporting exploratory *H2*.

Discussion

The findings support the hypothesis that fear towards a vaccination would promote conspiracy beliefs. Indeed, fear directly increased anti-vaccine conspiracy beliefs, which then subsequently predicted vaccine hesitancy (*H1*). Interestingly, our exploratory analysis revealed that the fear manipulation indirectly affected conspiracy beliefs *via* vaccine hesitancy. When inspecting the size of the indirect effects, the effect size for (exploratory) *H2* was stronger (*ab* .32) than *H1* (*ab* .24), but both indirect effects were nonetheless significant. Importantly, these effects remained significant both before and after controlling for flu vaccination status. Additionally, some emerging evidence suggests vaccine hesitancy predicts conspiracy beliefs over time (van Prooijen & Böhm, 2023). This may have increased the likelihood of an indirect link from the fear manipulation to conspiracy beliefs *via* vaccine hesitancy being observed in this study. Also,

Table 1. T-test and descriptive statistics for the experimental conditions in Study 1a ($n = 221$) and 1b ($n = 508$).

Variable	High fear *M* (*SD*)	Low fear *M* (*SD*)	*t*	*p*	*d*
Study 1a					
Anti-vaccine conspiracy beliefs	3.34 (*1.35*)	2.90 (*1.07*)	2.791	.006	.38
Vaccine hesitancy	2.68 (*1.69*)	3.93 (*1.78*)	−5.330	< .001	.72
Study 1b					
Anti-vaccine conspiracy beliefs	3.07 (*1.34*)	3.15 (*1.44*)	0.648	.517	.01
Vaccine intention	2.82 (*1.65*)	3.40 (*1.87*)	−3.678	< .001	.33

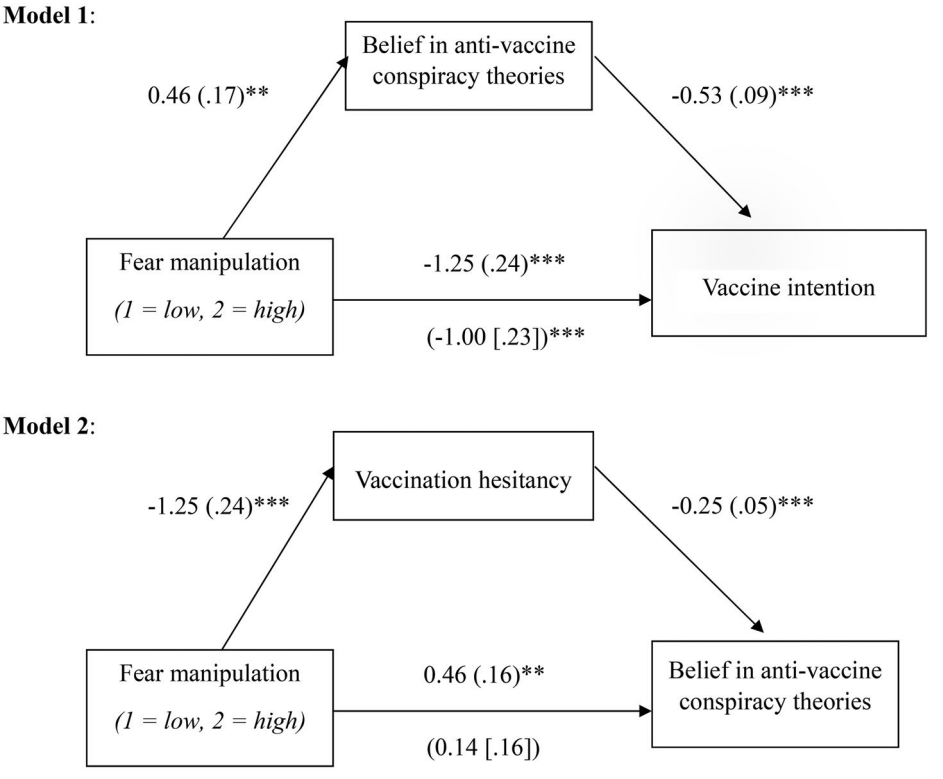

Figure 1. Mediation model of the relationship between fear (1 = *low fear*, 2 = *high fear*) on vaccination intention through conspiracy beliefs (Model 1) and on anti-vaccine conspiracy beliefs through vaccination intention (Model 2), respectively, in Study 1a, controlling for flu vaccine status ($n = 210$).

Note: All coefficients represent unstandardized regression coefficients. Standard Error (*SE*) is reported in parentheses. **$p < .05$, ** = $p < .01$ and ***$p < .001$.

on the note of effect sizes, we uncovered a small to medium effect for variables. Of course, there are various other factors playing a role in determining vaccination behaviours, but this work highlights that emotions and conspiracy beliefs play a role. Therefore, this correlational data suggests that a bi-directional relationship between conspiracy beliefs and vaccine hesitancy may exist when exposed to fear about a vaccine. In Study 1b, we sought to replicate the effect to enhance confidence in the results and improve the clinical utility of the fINDINGS (Tomljenovic et al., 2020)[1].

Study 1b

Method

Participants and design

Initially[1], Study 1b was powered as a 2*2 design to detect a small to medium effect as in Study 1a (i.e. $d = .04$ equivalent), $\alpha = .025$ (to account for Bonferroni corrections), and 80% power, with 5% dropouts accounted for. As such, 508 participants

were recruited in February 2023 from *Prolific* (191 men (including trans men), 312 women (including trans women), three non-binary and two who would rather not say, *Mage* = 38.92, *SD* = 13.02). All participants were based in the United Kingdom. Seventy-three percent (371) were up to date with their COVID-19 vaccines, 83.9% (426) were up to date with their routine vaccines (e.g. Polio, Tetanus, MMR), and 30.1% (153) had received a flu vaccine within the last year. As we focus on one factor in the main text (see footnote #1 for an explanation), a sensitivity analysis using G*Power was conducted. Based on $n = 508$, $\alpha = .05$, and 80% power for the two-group design, we can detect Cohen's $d \geq 0.25$. There were 253 participants in low and 255 in high fear experimental conditions. The study received ethical approval from Northumbria University's Department of Psychology Ethics Committee (#2722).

Materials and procedure

As in Study 1a, participants provided informed consent before being provided information about *Flebilis-Potentia* and before being randomly exposed to *low* or *high* fear information about the vaccine. Participants then completed comprehension check questions, a fear manipulation check ($\alpha = .97$), Vaccine Conspiracy Beliefs Scale ($\alpha = .91$), and an intention to get vaccinated. Finally, participants provided demographic information before being thoroughly debriefed as previously.

Results and discussion

Data checks

As pre-registered (https://osf.io/mf3ra/?view_only=f8ed0f8e79dd4faca14e7ac76748697d) and similar to Study 1a, an Independent-Samples T-test demonstrated that participants who completed the high fear condition reported increased feelings of fear toward the vaccine ($M = 4.81$, $SD = 1.48$) than those in the low fear condition ($M = 4.04$, $SD = 1.77$), $t(506) = -5.264$, $p < .001$, $d = -0.47$. Next, we then tested whether the manipulation is biased by condition-dependent attrition. We again found that no participants had dropped out. Finally, we explored whether the manipulation conditions differed in demographics. No significant differences were uncovered except for being up to date with COVID-19 vaccines, whereby there was a significant Chi-Squared Test, χ^2 (1, $N = 503$) = 6.311, $p = .012$. As this highlighted that the experimental conditions differed on COVID-19 vaccine status, this variable was controlled for within the mediation analyses.

We then performed two Independent-Samples T-tests to examine the effect of the experimental condition (high fear *vs.* low fear) on anti-vaccine conspiracy beliefs and vaccine hesitancy. Again, as shown in Table 1, participants in the 'high fear' condition indicated significantly lower vaccine uptake than participants in the 'low fear' condition. No significant differences were uncovered for conspiracy beliefs. We did not run the predicted mediation for *H1* since the fear manipulation did not directly affect anti-vaccine conspiracy beliefs. Thus, the findings do not support *H1* or replicate the findings of Study 1a.

Exploratory analyses - fear, vaccine hesitancy and conspiracy beliefs (H2)

To examine *H2* that fear may provoke vaccine hesitancy, which is associated with conspiracy beliefs, we again used PROCESS Model 4 controlling for COVID-19 vaccine status. As shown in Figure 2, the mediation was significant both before (indirect effect *ab* = .24, *ULCI* = 0.1017, *ULCI* = 0.3749) and after controlling for flu vaccine status (indirect effect *ab* = .23, *ULCI* = 0.1352, *ULCI* = 0.3208). High fear (*vs*. low fear) reduced vaccine intentions, which was then related to higher anti-vaccine conspiracy beliefs supporting exploratory *H2*.

Discussion

The findings in Study 1b provide support for only one (exploratory) hypothesis. We uncovered evidence that high fear (*vs*. low fear) directly increased vaccine hesitancy, which was then associated with ant-vaccine conspiracy beliefs (*H2,* exploratory). Fear did not directly increase conspiracy beliefs, rendering *H1* (pre-registered) not supported. This data suggests that a bi-directional relationship provoked by fear might *not* robustly exist. Instead, conspiracy beliefs may result from people seeking to rationalise their gut response to fear that provokes them not to want to get vaccinated. Such a finding builds on van Prooijen and Böhm (2023) work by suggesting that fear could drive vaccine hesitancy and conspiracy beliefs. In Study 2, we sought to explore this more precisely.

Study 2

Studies 1a and 1b have provided initial evidence that fear of a fictitious vaccine may provoke vaccine hesitancy, which, in turn, is associated with anti-vaccine conspiracy theories. Although we manipulated fear in both studies, the latter part of the mediation model was correlational (i.e. the link between vaccine hesitancy and

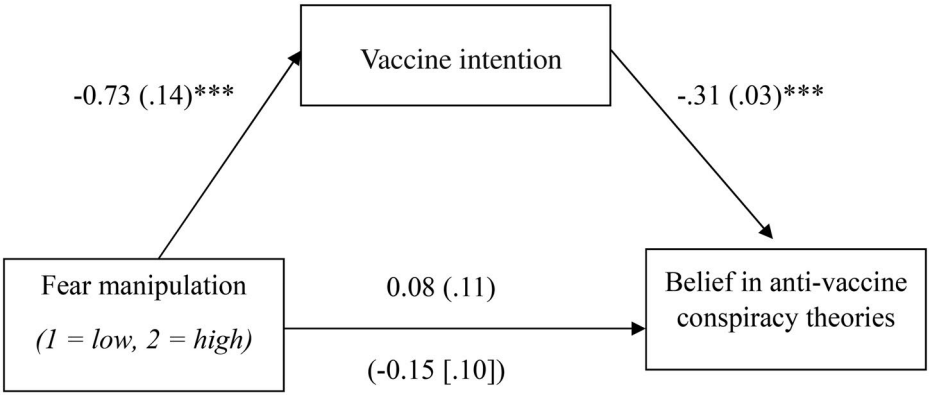

Figure 2. Mediation model of the relationship between fear (1 = *low fear*, 2 = *high fear*) on anti-vaccine conspiracy beliefs through vaccine intention in Study 1b, controlling for flu vaccine status ($n = 210$).

Note: All coefficients represent unstandardized regression coefficients. Standard Error (*SE*) is reported in parentheses. ***$p < .001$.

anti-vaccine conspiracy theories). Therefore, Study 2 sought to provide a direct, casual, pre-registered (https://osf.io/navt6/?view_only=5b3ae6c8b037436aac2556897dc5e286) test of the link between vaccine hesitancy and anti-vaccine conspiracy theories. To do so, all participants were exposed to high fear. We then manipulated participants' intentions to get vaccinated. Half of the participants were asked to think about *getting* vaccinated, whilst the other half thought about *not* getting vaccinated (see Pirlott & MacKinnon, 2016, for similar study designs to assess causal relationships from mediator to outcome variables). We argue that requiring participants to think about not getting vaccinated (low intention) creates an opportunity for participants to justify increased feelings of vaccine hesitancy based on the gut reaction created by high fear. As such, we predicted that under high fear, those who thought about not getting vaccinated (*vs* vaccinated) would report higher belief in anti-vaccine conspiracy theories to justify the gut fear decision not to vaccinate (*H3, pre-registered*).

Further, we also included an additional outcome variable: connection to people distrusting official narratives (Nera et al., 2022). Research has shown that people may feel a sense of community with others who share similar conspiratorial views (e.g. Phadke et al., 2021). Thus, it is reasonable to propose that by seeking to justify not wanting to vaccinate when fearful, individuals may also see themselves as more closely connected to others who support anti-vaccine conspiracy theories. Therefore, we predicted that those exposed to fear and thinking about not getting vaccinated (*vs* vaccinated) would report feeling closer to people who distrust official narratives (H4, pre-registered).

Method

Participants and design

This study used an experimental between-participants design. The independent variable was vaccine intention (low *vs* high). The dependent variables were vaccine conspiracy beliefs and connections to people distrusting official narratives. Given the use of a between-participants design with two experimental groups, preregistered a-priori power analyses indicated that a minimum sample of 200 participants was needed. This was based on a small to medium effect size as suggested by Brysbaert (2019) for two groups (d = .40), an alpha of .05 and a power of .80. We over-recruited to ensure we met this minimum sample size in case participants needed to be removed (e.g. outliers that influenced the results). Therefore, we recruited 220 British participants in July 2023 through *Prolific* (106 men (including trans men), 111 women (including trans women), two non-binary and one who would rather not say, M_{age} = 41.51, SD = 13.83). No participants were excluded. Eighty percent (176) were up to date with their COVID-19 vaccines, 84.1% (185) were up to date with their routine vaccines (e.g. Polio, Tetanus, MMR), and 37.3% (82) had received a flu vaccine within the last year. An experimental design was employed with 110 participants in low and 110 in high vaccinate conditions. All participants were exposed to a high vaccine fear condition. The study received ethical approval from the University of Nottingham's School of Psychology Ethics Committee (#F1460).

Materials and procedure

Participants first provided informed consent and demographic information. All participants were exposed to *high fear* and asked to complete comprehension questions, as in Studies 1a and 1b. Half of the participants were then asked to consider reasons that would *increase their willingness* to be vaccinated against *Flebilis-Potentia* (high vaccination intention). The other half were asked to consider reasons that would *decrease their willingness* (low vaccination intention); specifically, participants were provided with a list of four potential reasons and were asked to indicate all that applied (e.g. high: 'Only a small number of people have severe side effects'; low: 'The number of people having severe side effects'). Participants were then asked to think about the article and those reasons when completing the rest of the survey.

As in the previous studies, participants indicated their intentions to get vaccinated against *Flebilis-Potentia*, followed by completing the Vaccine Conspiracy Beliefs Scale (α = .90). Finally, participants indicated their connection to people distrusting official narratives (Nera et al., 2022). Participants were provided with the following: 'In general, a significant number of people in society believe that the official version of events given by the authorities and relayed by the media very often hides the truth' before being asked to complete four questions (e.g. 'I identity with this group', α = .95) on a 7-point scale (1 = *not at all,* 7 = *very much so*). Participants then received a thorough debrief as in the previous studies.

Results and discussion

Data checks

As pre-registered (https://osf.io/navt6/?view_only=5b3ae6c8b037436aac2556897dc5e286), we first explored whether the manipulation successfully induced lower vaccine hesitancy. An Independent-Samples T-test demonstrated that participants who completed the low vaccine intention condition reported decreased intentions to get vaccinated ($M = 2.43$, $SD = 1.51$) than those in the high vaccine intention condition ($M = 3.38$, $SD = 1.85$), $t(218) = -4.195$, $p < .001$, $d = -0.57$. Next, we then tested whether the manipulation was biased by condition-dependent attrition. We again found that no participants had dropped out. Finally, we explored whether the manipulation conditions differed in demographics and uncovered no significant differences ($p > .05$).

We then performed two Independent-Samples T-tests to examine the effect of the experimental condition (low vaccine intention *vs*. high vaccine intention) on anti-vaccine conspiracy beliefs (*H3*) and closeness with those who distrust official narratives (*H4*). As shown in Table 2, neither of the outcome variables was significant, not supporting *H3* or *H4*.

Exploratory analyses - fear, vaccine hesitancy and conspiracy beliefs (H3)

In our pre-registration, we predicted a direct effect of manipulation on conspiracy beliefs; however, the manipulation only impacted vaccination intentions (i.e. reduced them under fear *and* increased unwillingness to vaccinate). As vaccination hesitancy (our variable of interest to manipulate) varied by condition, we adjusted our analyses to run PROCESS Model 4. That is, we explored whether the experimental manipulation

Table 2. T-test and descriptive statistics for the experimental conditions in Study 2 (N = 220).

Variable	Not vaccinate *M* (*SD*)	Vaccinate *M* (*SD*)	*t*	*p*	*d*
Anti-vaccine conspiracy beliefs	3.21 (1.20)	3.26 (1.24)	.321	.748	.00
Closeness with those who distrust official narratives	2.90 (1.57)	2.90 (1.68)	.041	.967	.01

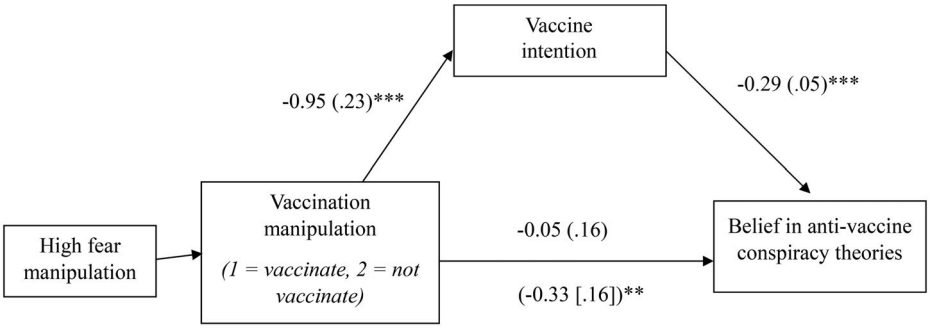

Figure 3. Mediation model of the relationship between vaccination (1 = *vaccinate*, 2 = *not vaccinate*) on anti-vaccine conspiracy beliefs through vaccination intentions in Study 2, under feelings of high fear about a vaccine ($n = 503$).
Note: All coefficients represent unstandardized regression coefficients. Standard Error (*SE*) is reported in parentheses. $^{**}p < .05$, $^{***}p < .001$.

(predictor) increased vaccine hesitancy (mediator), which, in turn, would be associated with increased anti-vaccine conspiracy beliefs (outcome). As shown in Figure 3, the mediation was significant (indirect effect *ab* = .28, *ULCI* = 0.1359, *ULCI* = 0.4588). Fear and thinking about *not* vaccinating (*vs*. vaccinating) reduced vaccine intentions, which was then related to higher anti-vaccine conspiracy beliefs. This finding only partly supports *H3,* as the predicted direct effect was not observed.

Exploratory analyses - fear, vaccine hesitancy and closeness with those who distrust (H4)

In our pre-registration, we also predicted a direct effect of manipulation on feeling close to those who distrust official narratives. Again, because the manipulation decreased vaccination intentions, we ran an exploratory PROCESS Model 4 to explore if the experimental manipulation (predictor) was linked to closeness (outcome) *via* vaccination intentions (mediation). As shown in Figure 4, the mediation was also significant (indirect effect *ab* = .21, *ULCI* = 0.0626, *ULCI* = 0.4019). Fear and thinking about *not* vaccinating (*vs*. vaccinating) reduced vaccine intentions, which was related to feeling closer to those distrusting official narratives. This also provides partial support for *H4*.

Discussion

In summary, Study 2 has extended the previous studies by manipulating fear of vaccination *and* vaccination hesitancy. We found that the manipulation did decrease vaccination intentions but had no direct effect on either conspiracy beliefs or close-

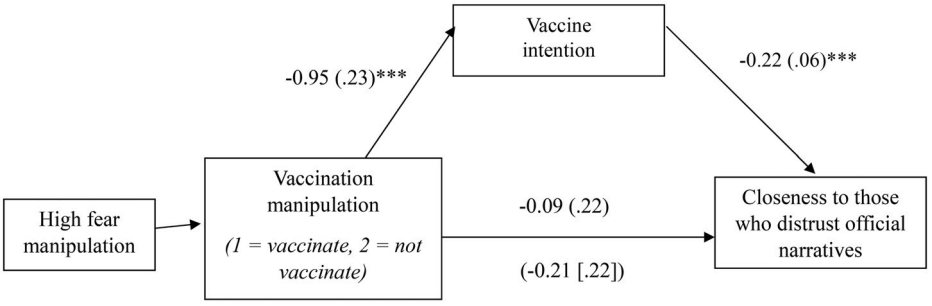

Figure 4. Mediation model of the relationship between vaccination (1 = *vaccinate*, 2 = *not vaccinate*) on closeness to those who distrust official narratives through vaccination intention in Study 2, under feelings of high fear about a vaccine ($N = 220$).
Note: All coefficients represent unstandardized regression coefficients. Standard Error (*SE*) is reported in parentheses. ***$p < .001$.

ness with those who distrust official narratives. However, in exploratory analyses, we uncovered that the experimental manipulation was linked with the outcomes *through* reduced vaccination intentions. Together, these findings provide further (correlational) evidence that conspiracy beliefs may be provoked when feeling fear *and* an unwillingness to get vaccinated. Anti-vaccine conspiracy beliefs seemingly can justify the fear gut response not to get vaccinated.

General discussion

Across three experimental studies, we explored the links between fear, vaccine hesitancy and anti-vaccine conspiracy beliefs. Initially, we predicted that as a response to fear, anti-vaccine conspiracy beliefs would be increased, which would then be associated with vaccine hesitancy. However, the results from Studies 1a and 1b demonstrated inconsistent evidence for this prediction—the effect was smaller than the alternative pathway in Study 1a and non-significant in Study 1b. Inspired by recent work by van Prooijen and Böhm (2023), we also explored an alternative pathway. That is, whether fear provokes vaccine hesitancy and conspiracy beliefs are born out of justifying this vaccine avoidance. Studies 1a and 1b provided consistent correlational evidence of this alternative. Study 2 then sought to provide causal evidence for this proposed pathway. All participants were exposed to high fear, and vaccination intention was manipulated (vaccinate *vs* not vaccinate). Results demonstrate that the manipulation reduced vaccine intentions, but no other direct effects were found. In an exploratory mediation test, however, we found that vaccine intentions were reduced under fear and not vaccinating (vs. vaccinate), which were then associated with conspiracy beliefs and feelings connected with those distrusting official narratives. Together, our research provides empirical evidence that fear could drive vaccine hesitancy and, in turn, increase the appeal of a conspiracy theory to justify one's emotional gut response.

Our work makes some important advances on previous research. First, alongside van Prooijen and Böhm (2023), we offer an alternative account to asserting that anti-vaccine conspiracy beliefs can reduce vaccine intentions. While conspiracy beliefs

can directly impact intentions (e.g. Jolley & Douglas, 2014), we support recent research (van Prooijen & Böhm, 2023) in providing evidence that conspiracy beliefs can *justify* not wanting to vaccinate. Importantly, we also explore the role of emotions and conspiracy beliefs. In the literature to date, there has been limited focus on exploring the role of emotions in conspiracy theory research, with even less attention on the role of fear and conspiracy beliefs (for exceptions, see Caycho-Rodríguez et al., 2023; Scrima et al., 2022). Therefore, we uniquely demonstrate that fear can provoke vaccine hesitancy and anti-vaccine conspiracy beliefs. Further, we uncover how such a fear response is associated with feeling closer to those distrusting official narratives. To our knowledge, this is the first time these concepts have been considered in the same experimental investigation and is thus a strength of our contribution.

Therefore, our work demonstrates the critical role that emotions may play in maintaining conspiracy theory beliefs and feeling connected with others who seek alternatives. It seeks to reason that one way to address conspiracy beliefs is to focus on their root causes. This could be based on addressing some people's psychological needs (such as disempowerment, Douglas et al., 2017). For other people, however, it could address how they respond to emotional stimuli, such as fear of a new vaccine. Emerging work has examined different emotional regulation strategies associated with conspiracy beliefs but with varying levels of success. Difficulties in emotion regulation, such as a tendency to catastrophise and ruminate, are associated with conspiracy beliefs (Green, 2022; Scandurra et al., 2022; Wabnegger et al., 2024). Similarly, there is evidence to indicate that priming the regulatory strategy avoidance coping subsequently increases conspiracy beliefs (Marchlewska et al., 2022). Therefore, there is indeed preliminary evidence linking maladaptive emotion regulation abilities with conspiracy beliefs.

However, to date, no published work has successfully utilised adaptive emotion regulation strategies to target the negative emotions associated with conspiracy beliefs. Whilst health communication messages addressing emotions have been efficacious in promoting certain health behaviours, this effect has not been explored for vaccination intentions when controlling for conspiracy beliefs. Future research should, therefore, seek to clarify the relationship between wider emotion regulation strategies to target fear and other negative emotions arising as a result of conspiracy theories before applying the findings to vaccine hesitancy. This, in turn, may inform future interventions and public health communication tactics. Therefore, our work showcases the importance of continuing to develop interventions that can target emotions, as seemingly being able to deal with fear may reduce the tendency to justify not wanting to vaccinate and, thus, safeguard against conspiracy beliefs emerging. It may also safeguard against feeling close to communities who distrust official narratives, as participants in our work might have been drawn to such communities to justify their fear gut response to the vaccine.

Whilst our work has many strengths, limitations must also be acknowledged. First, in each study, our key findings are all correlational in nature. Whilst each study employs experimental designs, particularly in Study 2 that manipulated the 'mediator', the empirical test between hesitancy *and* conspiracy beliefs ended up as correlational. As such, we must be careful with our conclusions regarding cause and effect. To

address this, future research could find alternative ways to manipulate vaccine hesitancy, which could give more support to our findings. For example, asking people in an experimental condition (but not a control condition) to rate their vaccine hesitancy may result in this construct being more salient in the person's mind and thus more likely to influence their future decisions, relative to a control condition who do not complete this scale (i.e. the mere measurement effect). This approach has been found to be effective for influencing other health-related constructs, such as anticipated regret related towards cervical screening non-attendance (Sandberg & Conner, 2009) and people's emotional beliefs towards organ donation (Doherty et al., 2017). As such, this may be an effective strategy for manipulating vaccine hesitancy.

Further, the measure of vaccine hesitancy was based on *intentions* to vaccinate, and we know that intentions do not always lead to actual behaviour (Sheeran, 2002). This point is underscored by the fact that the vaccine in our studies was based on a *fictional* disease, albeit unknown to the participants. On the one hand, this ensures that we can explore our hypotheses without any bias of prior knowledge about the vaccine, but it does mean that the vaccine is not *real*. Future research could use a behavioural measure alongside focusing on actual vaccination decisions for a natural vaccine. Although the latter must be examined within the realms of strict ethical protocols. In addition, it is important to carefully consider control variables. In the current research, we measured basic demographics and vaccination status (COVID-19 and flu). However, it would also be important to consider other demographics (such as education) and fear towards vaccine procedures (such as needles, hospitals or blood). Considering such variables would enable further confidence to be gained for our findings.

Also, our research only focused on one emotion (fear towards the vaccine). Other relevant emotions—such as disgust (e.g. Herani & Nadia, 2022) and anger (e.g. Featherstone & Zhang, 2020; Jolley & Paterson, 2020)—may also play a role in maintaining conspiracy beliefs. It is plausible that feeling disgust towards a vaccine that provokes vaccine hesitancy would also foster anti-vaccine conspiracy beliefs. Moreover, this research focused on fear towards a vaccine. As mentioned above, fear can both promote and deter health behaviours (Peters et al., 2013; Ruiter et al., 2014). For example, the fear of being infected has been found to promote vaccination (Bendau et al., 2021; Caycho-Rodríguez et al., 2023). Therefore, although the fear of the vaccine may have reduced people's willingness to get vaccinated in these studies, the fear of having the virus may have promoted vaccination. Given this, future research should also assess the role of different forms of fear.

In summary, our work has uncovered how fear can foster vaccine hesitancy, which is associated with anti-vaccine conspiracy beliefs. While it was once thought that conspiracy beliefs may only impact vaccine hesitancy, emerging work demonstrates that a bi-directional relationship likely exists. In the case of emotions, a gut response to explain not wanting to get vaccinated when feeling fearful over a vaccine may promote anti-vaccine conspiracy beliefs and lead people to feel more connected with those distrusting official narratives. Efforts focusing on improving vaccine uptake could be wise to focus on the emotional drivers of vaccine hesitancy. If people can emotionally regulate and respond better to fear, the fostering of vaccine hesitancy and anti-vaccine conspiracy beliefs could be alleviated. We call for future research to explore such an important possibility.

Note

1. Previous research has suggested that intuitive thinking is positively associated with beliefs in conspiracy theories (Tomljenovic et al., 2020). Given this, in Study 1b, we were interested in testing whether encouraging people away from intuitive thinking and towards more analytical thinking would weaken the effect of fear (see https://osf.io/mf3ra/?view_only=f8ed0f8e79dd4faca14e7ac76748697d). When running a two-way ANOVA, we uncovered no main effect of thinking style, a main effect of fear on vaccine hesitancy (similar to what was reported in the main text), but no interactions ($p > .05$). This non-significant effect of the thinking style manipulation may have been due to the fear being too strong to be overcome by analytical thinking. To streamline the paper, we have focused on fear in the main text and omitted thinking style. We have re-run all the main text analyses and controlled for 'thinking style', but as the effects were unchanged, we kept the controls to demographic variables in the main text.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

Data availability statement

All materials and data for each study (including pre-registrations) can be found on the Open Science Framework: https://osf.io/fqux7/

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