The dark side of belief in Covid-19 scientists and scientific evidence

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ABSTRACT

We draw from an interdisciplinary literature on convictions to examine the manifestations and consequences of firmly held beliefs in Covid-19 (C19) science. Across three studies ($N = 743$), we assess participants' beliefs in C19 experts, and beliefs in supported and unsupported empirical evidence. Study 1 establishes the basic theoretical links and we show that an individual's belief in science on C19 is associated with dispositional belief in science and moralization of C19 mitigation measures. Our subsequent two studies show how stronger belief in C19 science influences distrust in unmasked individuals past the mandates, and greater endorsement of pandemic mitigation authoritarianism. We document the dark side that emerges when belief in C19 science extends beyond the generally desirable scientific literacy and manifests as a conviction that public health experts are the only ones who can handle the pandemic, and that even unsupported claims about C19 are supported by scientific evidence (e.g., risk of outdoor transmission is high). We also highlight our political ideology findings showing that both liberals and conservatives mis-calibrate C19 risks in different ways, and we conclude with discussing how examining the darker side of scientific beliefs can inform our understanding of people's reactions to the pandemic.

Human beings face numerous threats to their survival and well-being. Some of them are visible, definitive, and immediate. Others, such as infections by pathogens, are harder to detect and their dangers can take longer to materialize. The C19 global pandemic is an example of the latter. As a virus, C19 is invisible to the naked eye and in the absence of observable symptoms like coughing or runny nose, it is impossible to know whether a person is infected by it. Even visible symptoms can be inconclusive because they manifest in other illnesses (e.g., allergies which are not contagious). Nonetheless, C19 mitigation requires large-scale, coordinated action through practices like masking, social distancing, vaccinating, and adhering to various restrictions of movement.

If C19 is an invisible enemy, what makes ordinary people commit to actions that are presumed to minimize a threat they cannot see by applying solutions they cannot test? One explanation is that they *believe* in the wisdom, integrity, and authority of scientists. For many people, C19 is a problem best understood and ameliorated through the application of the scientific method (as opposed to, for instance, turning to religious guidance or folk remedies). Thus, millions have conceded to

the demands made by authorities to alter their lives in significant ways. We submit that for such large scale compliance to occur, sufficient numbers of people must believe the scientific evidence that C19 is indeed a significant threat and that mitigation measures, even if they are restrictive and harmful in other ways (Lewis & Hsu, 2020), are proportional to its severity and worth the cost.

Showing deference to scientific expertise – trusting those more skilled to provide guidance on matters one might not understand – is functional in complex, technologically advanced societies because it increases collective adaptability and responsiveness in the face of uncertainty and other destabilizing forces (Ray et al., 2011). A widespread belief in the competence and honesty of scientists during C19 has proven to be an adaptive force. For instance, trusting the major health institutes and experts (e.g., those associated with WHO, CDC, or SAGE) is associated with greater compliance with health-minded recommendations and lower belief in non-scientific theories that discourage vaccine use and derail public health efforts to control the virus (Agley & Xiao, 2021; Calvillo et al., 2020; Hughes & Machan, 2021; Islam et al., 2021; Lammers et al., 2020; Leibovitz et al., 2021). These beliefs have also been

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useful for regulating everyday social interactions. In the absence of perpetual surveillance backed by coercive force, factors like shared beliefs, values, and mutual trust are essential for commitment to common goals (Axelrod, 1986; Fehr et al., 2002; Sunstein, 1996) and voluntarily adherence to health-minded recommendations.

In this research we investigate the implications of holding strong beliefs about the validity of C19 science that approach the realm of convictions. Our work has two objectives. First, we constructively replicate previous research documenting the positive effects of having a strong belief in C19 science on general compliance with health-minded mandates, and the negative effects of rejecting scientific expertise and dismissing currently accepted scientific facts about C19. Second, we extend this work by simultaneously addressing an understudied question: What are the implications when people place an excessive or exclusive belief in C19 science and scientists' pronouncements related to the pandemic mitigation?

We focus on the latter question because it is under-studied (relative to the stream that focuses on failing to trust scientists on C9 matters), and because the beliefs about the facts of the world can transform themselves into an uncompromising faith in science as a source of knowledge and even moral instruction (Skitka et al., 2021; Sorell, 1991). Left unexamined and uncriticized, we maintain that people whose belief in various claims about C19 science approaches the realm of convictions or faith – that is, where they assent to propositions without having complete evidence and commit themselves to acting on the basis of these propositions – will display attitudes and make demands upon others that are typical of what happens when people adopt any unyielding position about the infallibility and moral supremacy of their particular belief system. We draw from an interdisciplinary literature on beliefs to examine the implications that an excessive belief or conviction in C19 science might have on social cohesion and interpersonal trust. Our model is presented in Fig. 1.

1. Theory and hypotheses

Beliefs involve accepting that something exists or is true without definitive proof,[1] and have been shown to have numerous psychological benefits. For example, beliefs can minimize uncertainty and provide a sense of meaning, both of which alleviate anxiety and stress by orienting people towards certain ends (Heine et al., 2006; Proulx & Heine, 2006). When such beliefs – particularly those based on religion or ideology – are shared by others, they can align peoples' commitment to common goals, increase trust among strangers, and help unify a group to combat external threats (Haidt, 2013). However, secular beliefs in humanism, human progress, and science have also been shown to possess quasi-religious properties about ultimately unverifiable claims that provide the same anxiety-reducing and socially binding benefits as religion (Farias et al., 2013). For example, Farias et al. (2013) showed that when people are faced with a threatening situation (e.g., athletes competing in a race), those who more strongly believe in science showed less stress in light of their competition.

The benefits of placing one's trust in science have become particularly evident during the global responses to C19. The general invisibility of C19 virus and efficacy of the responses create uncertainty which could be reduced with trust in authorities and compliance (Dolan & Henwood, 2021). One study showed that people who have greater faith in science and the scientific process were more likely to comply with health mandates, wear masks, and get vaccinated (Stosic et al., 2021). Other

studies showed that people who trust C19 scientists were less likely to believe non-scientific information, such as conspiracy theories and a range of inaccurate information that generally discount the severity of the virus and question the effectiveness of treatments (Agley & Xiao, 2021; Islam et al., 2021; Leibovitz et al., 2021). High trust in science is also related to respect for health-minded and preventative measures (Plohl & Musil, 2021), with relationship emerging in different cultures (Algan et al., 2021; Bicchieri et al., 2021). In contrast, beliefs in conspiracy theories like the C19 pandemic having been planned by global powers or placing faith in unproven treatments (WHO, 2020b), are linked with lower compliance with numerous health-minded measures (Leibovitz et al., 2021; Romer & Jamieson, 2020). To preview some of our results, we also observe these pro-social benefits of trust in science. Yet, while beliefs can be a source of motivation, courage, and positive change, their more extreme manifestations have a darker side, as convictions remain "one of the surest ways to make a fool of [oneself]" (Abelson, 1988, p. 274).

1.1. The dark side of unassailable beliefs and convictions

Philosophers and scholars have long cautioned the public about the dangers of adopting beliefs that are immune to refutation, critique, or revision (Abelson, 1988). Deeply held beliefs underlie moral convictions (Skitka et al., 2021), religious extremism (Iannaccone & Berman, 2006), censorship efforts (Kuran & Sunstein, 1999; Sunstein, 2002), the punishment of dissenters (Haidt, 2013; Hoffer, 1951/2010), and are broadly associated with authoritarian (Applebaum, 2021) and even totalitarian (Arendt, 1951) proclivities. In his critique of such rigid beliefs, Hoffer (1951/2010) cautions that "the opposite of the religious fanatic is not the fanatical atheist but the gentle cynic who cares not whether there is a God or not. The atheist is a religious person. He believes in atheism as though it were a new religion."

Not even science is immune from extremist beliefs. When beliefs in science among lay people, scientists, and politicians move from a desirable state of general scientific literacy coupled with a healthy skepticism, to ontological rigidity and moral certainty, they lapse into *scientism*. Scientism is defined as a "matter of putting too high a value on natural science in comparison with other branches of learning or culture" (Sorell, 1991), viewing science as the only real source of knowledge for educated people (Hutchinson, 2011), and turning to science to justify the regulation of social affairs because one assumes that it is less fallible than other ways of knowing.

One of the possible consequences of holding extreme beliefs about science is the moralization of scientific pronouncements and claims generated by presumably objective scientists. When empirical evidence and scientifically-derived conclusions, which are by definition always provisional and subject to disconfirmation, become moralized, following them can become an inflexible demand required of persons for demonstrating both their rationality and commitment to the common good. In contrast, disputing or acting against these claims can incite charges of ignorance and atavistic thinking that can elicit moral outrage, condemnation, social distrust, ostracism, or punishment of the non-believers by those who think otherwise (Skitka et al., 2021).

Throughout the pandemic, evidence of the moralization of scientific claims can be seen in how C19 efforts that promote elimination and containment are often cast as moral imperatives or duties, while those that promote focused prevention are condemned as immoral or unethical (Davidson et al., 2020; Graso et al., 2021; Prosser et al., 2020). Moralization of facts that are open to dispute and refutation can lead people to reject alternative ways of dealing with complex problems or the questioning of scientists' claims which, by the principles of the scientific method, should be treated as subject to revision. For example, when evaluating C19 research proposals, laypeople viewed research that sought to investigate harm resulting from restrictions (vs. from abandoning restrictions) as being methodologically inferior, despite containing the same amount of information (Graso et al., 2021). Graso et al.

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[1] Oxford Dictionary defines *beliefs* as: 1) "an acceptance that something exists or is true, especially without proof, something one accepts as true or real; a firmly held opinion; a religious conviction" or as 2) "trust, faith, or confidence in (someone or something)". Accordingly, we use terms *trust* and *beliefs* interchangeably, mindful that such use is inappropriate in contexts that rely on interpersonal interactions.
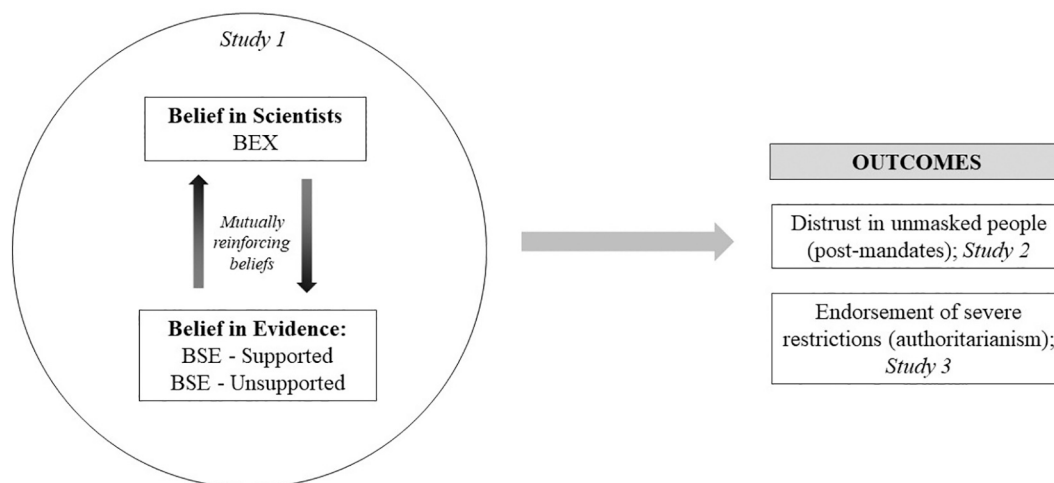
Fig. 1. Summary of studies.

(2021) argue that this kind of response is what one might expect when quasi-religious or *sacred* values are questioned (Tetlock et al., 2000).

Kuran and Sunstein (1999) used a risk-assessment perspective to study the adoption of unquestioned belief. Central to their analysis is the *availability cascade* which they defined as a chain reaction in the social milieu propelled by the *availability heuristic*, a mental shortcut where the perceived likelihood of any event or risk is dependent on how easily this event can be brought to mind. Left unchallenged, new information is disseminated within the existing cascade of one-sided information and beliefs systems which then perpetuates itself (Brannon et al., 2007). Experts who introduce information that disputes orthodox ways of thinking can therefore become the target of reputational attacks and censorship (Sunstein, 2021).

Scientific claims are not impervious to moralization or the distorting effects of availability cascades and narratives (Dolan & Henwood, 2021). O'Brien et al. (2021) showed that an extreme belief in science can lead to undesirable consequences like being unwilling and unable to evaluate information critically, and to increased susceptibility to pseudoscience and misinformation. Moreover, the process of reporting scientific information itself can become highly politicized. This can direct scholars' attention towards asking certain questions and steering them away from others, all while making it difficult for scientists to publish uncomfortable findings (Clark & Winegard, 2020).

As summarized in our Fig. 1, we theorize that these forces lead to belief extremity or convictions about science, the facts it generates, and the validity of scientific evidence. These processes become mutually reinforcing such that convictions lead to the retention of belief-congruent information and the dismissal or censorship of belief-incongruent information (Kuran & Sunstein, 1999; Skitka & Mullen, 2002). In turn, the retention of belief-congruent information reinforces one's beliefs about science and scientific authority. People who place overly high beliefs in C19 science and evidence will adopt similarly strong and inflexible views about what should be *said*, what should be *done*, and how others should *behave* in response to C19.

1.2. Present study: overview, measurement issues, and open practice statement

We draw from the literature on convictions to investigate how the extremity of a belief in science can explain different ways that individuals perceive threats associated with C19. We first examine the prosocial benefits, as we test whether stronger beliefs in C19 science are associated with increased self-report compliance with mandates and a rejection of conspiracy theories that are anthetical to science, and we then turn to other unstudied consequences of beliefs about C19 on social distrust and endorsement of authoritarianism.

1.2.1. Note on beliefs measurement

In line with the broader literature on personal convictions as a function of attitude strength (Abelson, 1988; Holbrook et al., 2005; Krosnick & Petty, 1995; Skitka et al., 2021; Stancato & Keltner, 2021), we treat beliefs about science and scientific facts as lying on a continuum, with convictions representing belief extremity. We do not (and cannot) specify a definitive point after which reasonable deference to scientific expertise ends and dogmatic, quasi-religious conviction begins. We account for this challenge by operationalizing belief in C19 science in two related ways: 1) *belief in experts or scientists* (BEX) and 2) *belief that scientific evidence* (BSE) backs C19 claims. We measured the latter as perceptions of *supported* and *unsupported* claims (abbreviated as BSE-S and BSE—U, respectively). We hypothesize that placing greater faith in C19 science extends beyond the generally desirable deference to expertise and scientific literacy (i.e., BSE—S), and manifests as: 1) a stronger belief that C19 scientists are the *only ones* who are fully qualified to handle the pandemic (BEX in Study 3), and 2) beliefs that even unsupported claims about C19 are supported by scientific evidence (BSE—U). We assess all three sets in slightly different ways across our studies to demonstrate the generalizability of our basic prediction.

As we will show below, we rely on well-established individual differences measures, but we also assess participants' perceptions of multiple Covid-19 claims and policies. We observed that the latter assessments are reliable ($\alpha > 0.75$), but the factor structure could be improved by eliminating 2–4 items. To reduce the chances that our conclusions are driven by measurement challenges, we analyze our data using multiple indicators of certain sets of items (i.e., aggregate and single-factor structure emerged by eliminating two or three items). We provide results based on reduced, single-factor structures here and results based on 12-item aggregations in Supplementary Online Materials (SOM). We highlight that our conclusions remain unchanged.

1.2.2. Open practice statement

We pre-registered Studies 2 and 3 and we provide links below. We rely extensively on our SOM for additional analyses, exploratory items used to deepen our understanding of C19 beliefs (e.g., estimation of C19 risks), and references for our BSE-S and —U items. We make our data and syntax codes available here: https://osf.io/fxeqs/?view_only=2632802eb660489bb616d733219dc6b1

2. Study 1: preliminary assessment of belief in science variables

In Study 1 we test whether beliefs in C19 science are predicted by

other kinds of deeply held beliefs. Specifically, we hypothesize that beliefs about C19 science are positively related to a *dispositional belief in science* (Farias et al., 2013) and *moral mandates* (Skitka et al., 2021) that elevate trusting C19 science (i.e., "trust the science") to the status of a moral imperative. We operationalize beliefs in C19 science as beliefs in C19 experts and scientists (BEX; Dr. Fauci and institutes such as WHO and CDC) and beliefs in evidence pertaining to C19 (BSE). We divided BSE into 12 items drawn directly from public health messages (e.g., WHO or CDC) to assess participants' belief in claims that are actually supported by evidence (BSE—S), and 12 items representing normative or propositional claims that lie outside the purview of science or that are unsettled by the scientific community. For these reasons, we expect BSE-U to be judged by participants as being relatively lower in the strength of evidence about their veracity than BSE—S, although demonstrating this pattern is not a requirement for testing our primary hypothesis that all three C19 related beliefs will be predicted by belief in science and moral mandates to trust the science.

We also assessed several variables based on their potential to provide alternative explanation for our findings or that may inform participants' belief in C19 science: 1) *ideology* because liberals are more concerned with C19 than conservatives (Calvillo et al., 2020; Conway et al., 2021), 2) *religiosity* because lower religiosity is associated with greater beliefs in science in general (Farias et al., 2013), 3) *general concern over C19* because concern is associated with C19 moralization (Graso et al., 2021), and 4) *conspiracy beliefs* because of their association with a host of attitudes towards C19 (Leibovitz et al., 2021). Finally, we asked participants about their compliance with mandates in order to replicate past research.

2.1. Participants and procedures

In mid-July 2021, we invited 230 USA users from Amazon Mechanical Turk (Mturk) to take part in a study on C19 perceptions. Upon eliminating failed attention checks, the final sample size was 220 (52.1% male, $M_{age} = 40.49$, $SD_{age} = 11.77$).

2.2. Measures

2.2.1. Belief in C19 science measures

2.2.1.1. BEX (belief in C19 experts and scientists). We asked participants to "Consider the scientists and health institutes who are providing suggestions on ways of managing C19 pandemic" and to indicate "In general, I trust the expertise of": 1) scientists who are typically featured on mainstream media outlets, 2) Health organizations (e.g., WHO, CDC, or SAGE), 3) government health secretary, and 4) Dr. Fauci. Participants noted their agreement on a scale from 1 = *strongly disagree* to 7 = *strongly agree*, α = 0.92.

2.2.1.2. BSE-S and —U (belief in scientific evidence and consensus). We simultaneously assessed both sets of beliefs by asking people to read 24 items about C19 (i.e., 12 BSE-Supported and 12 BSE-Unsupported statements; see Appendix A for a complete list and SOM for references). We asked participants to indicate the extent to which they believe that each claim is supported with clear evidence and scientific (expert) consensus. Responses ranged from 1 (*No evidence and no scientific consensus*) to 7 (*Clear evidence and high scientific consensus*). Middle points were labelled as *Mixed evidence and some scientific consensus*. Upon examining the factor structure, we concluded that the assessment can be improved by eliminating three items from each set (marked with * in the Appendix A). For parsimony, we report results from reduced, 1-factor BSE-S and —U scales (α coefficients are 0.82 and 0.86, respectively). We direct our readers to SOM for results based on the aggregate assessments. Our results remain largely unchanged.

2.2.1.3. Personal moralization of scientific authority. We adapted Mullen and Skitka's (Skitka et al., 2005) measure of issue-specific moral mandates to examine the extent to which people moralize the issue privately. Participants indicated the extent of their agreement (1 = *strongly disagree* to 7 = *strongly disagree*) with the following five statements: 1) My attitude about following C19 science-based recommendations is closely related to my core moral values and convictions, 2) My feelings about following C19 science recommendations are deeply connected to my beliefs about 'right' and 'wrong', 3) I feel that following what C19 science tells us we should do is a moral issue (an issue where my attitude is based on moral values), and 4) Overall, I believe that *not* following C19 science based recommendations is immoral, and 5) I "just know" it is wrong *not* to follow the recommendations that are based on C19 science. Cronbach's α = 0.86.

2.2.1.4. Belief in science (BIS; dispositional). Participants completed the 10-item BIS scale (Farias et al., 2013) where they indicated the extent of their agreement with statements such as "Science provides us with a better understanding of the universe than does religion" (1 = *strongly disagree* to 6 = *strongly agree*; Cronbach's α = 0.94).

2.2.2. Potential control and exploratory variables

2.2.2.1. Concern over contracting C19. Participants were asked: "How concerned or worried would you be if you or somebody close to you got C19?" (0 = *not at all concerned* to 100 = *extremely concerned*).

2.2.2.2. Religiosity. We asked participants to note: "How religious do you consider yourself to be?" (0 = *not at all religious* to 6 = *deeply religious*).

2.2.2.3. Political ideology. Participants indicated their political ideology on a scale from 1 = *very liberal or left-wing* to 9 = *very conservative or right-wing*.

2.2.2.4. Conspiracy beliefs. We used the following items: 1) C19 (the virus) does not exist, 2) C19 is a hoax, 3) C19 pandemic was deliberately planned by the global powers. Participants indicated their agreement on a scale from 1 = *strongly disagree* to 6 = *strongly agree* (Cronbach's α = 0.86).

2.2.2.5. Compliance. We asked participants to indicate how strongly they agree with the following statements (1 = *strongly disagree* to 6 = *strongly agree*): "In general, I have been complying with the following C19 mandates in my region:" 1) masks, 2) physical distancing, and 3) contact-tracing. We report results with each compliance indicator separately.

2.3. Results and discussion

Descriptive statistics and intercorrelations are provided in Table 1.

A paired sample *t*-test showed that participants perceived BSE-S to be more supported with scientific evidence than BSE—U, $t(220) = 19.42$, 95% CI [1.01, 1.24], $p < .001$. Next, using Mplus 7, we regressed BSE—S, BSE—U, and BEX on moralization and belief in science, and we presented findings in Fig. 2.

We observed a strong and positive relationship between all three beliefs-based variables (BSE—S, BSE-U, and BEX). Greater beliefs in scientific evidence (BSE-S and U, BEX) are predicted by higher moralization of mitigation measures and BIS. In addition, we observed that dispositional belief in science (BIS) has positive properties, leading people to recognize that valid C19 statements are supported by scientific evidence (i.e., score high on BSE-S) and to show increased trust scientists (i.e., score high on BEX). However, we observed that people who score high on BIS and who moralize scientific authority also assume that

Table 1
Study 1: descriptive statistics and intercorrelations.

Variables	Mean	SD	2	3	4	5	6	7	8	9	10	11	12	13	14
1. BSE - S (1 Factor)	5.93	0.94	0.70**	0.66**	0.49**	0.48**	0.06	0.13*	0.47**	−0.48**	−0.29**	−0.73**	0.61**	0.61**	0.40**
2. BSE - U (1 Factor)	4.80	1.21		0.76**	0.57**	0.59**	0.01	0.03	0.58**	−0.61**	−0.26**	−0.55**	0.67**	0.69**	0.52**
3. BEX	4.67	1.59			0.60**	0.59**	0.08	0.02	0.47**	−0.61**	−0.34**	−0.59**	0.67**	0.62**	0.52**
4. BIS	4.17	1.18				0.51**	0.09	−0.14*	0.35**	−0.51**	−0.57**	−0.43**	0.43**	0.43**	0.36**
5. Moralization	5.03	1.39					0.04	−0.04	0.44**	−0.54**	−0.23**	−0.35**	0.54**	0.49**	0.37**
6. Gender (1 = Male)	0.52	0.50						−0.11	0.02	0.01	−0.08	−0.10	0.03	0.01	0.03
7. Age	40.49	11.77							0.12	0.14*	0.03	−0.12	0.02	0.10	−0.03
8. C19 Concern	59.46	32.21								−0.37**	−0.08	−0.33**	0.55**	0.55**	0.49**
9. Ideology (Conservatism)	4.18	2.29									0.47**	0.46**	−0.49**	−0.44**	−0.33**
10. Religiosity	1.89	2.08										0.36**	−0.19**	−0.18**	−0.06
11. Conspiracy	1.49	0.86											−0.57**	−0.56**	−0.32**
12. Compliance (Masks)	6.19	1.44												0.85**	0.52**
13. Compliance (Distance)	5.99	1.52													0.52**
14. Compliance (Tracing)	4.53	2.05													

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

claims about C19 are backed by a scientific consensus even when they are not supported or are unsettled (i.e., score high on BSE—U). Reported in SOM, results hold even while controlling for religiosity, ideology, conspiracy beliefs, and concern over C19. Of note, BEX was more strongly correlated with BSE—U, than BSE—S, $z = -4.157$, $p < .001$.

Finally, we observed that lower concern over C19, conservative ideology, higher religiosity, and greater belief in conspiracy theories are all associated with less belief in science and lower compliance with mandates. We did not find significant or consistent relationship between gender, age, and C19 beliefs variables.

3. Study 2: belief in scientific evidence and distrusting the unmasked (past masking mandates)

We examine the relationship between BSE and distrust. We focused on trust because the possibility of its erosion (Lo Iacono et al., 2021) raises important questions about how people might start to view one another in societies that have progressed to the colloquial *new normal*: a commonly used term to describe general long-term adjustments to life with C19 (Cohen, 2021). Trust is also a fundamental part of social cohesion and can protect from increasing polarization which is a phenomenon associated with many detrimental social consequences (Rapp, 2016). In these societies, certain behaviors could be seen as either conforming to, or deviating from the *new normal*. As we stated earlier, one result of convictions is that they can lead people to distrust fellow citizens who may not *appear* to be accepting the dictates of authorities that were presumably informed by scientific evidence.

At the time of data collection (June 2021; before mandates in the USA were re-imposed due to the Delta variant), if an individual is not wearing a mask, it would indicate they are either fully vaccinated and they therefore do not need to wear a mask, or are unwilling to comply with any mandates, and may be seen as a potential threat. In such cases, masks can be worn to protect one's self from contamination, but they can also can be a demonstration of one's concern for the welfare of others and a respect for collective authority, regardless of one's vaccination status. While it is natural that people may be hesitant to engage with unmasked individuals given the emphasis on benefits of mask-wearing, we also anticipate some individual differences in people's perceptions of unmasked people.

Therefore, in line with our theoretical foundation that posits a relationship between convictions and distrust, we expect people who score high on BSE-U will distrust those who do not wear masks. We expect this relationship to persist even after we control for people's belief in actual C19 science (i.e., BSE—S) and BIS. We do not expect BSE-S to positively relate to distrust since it reflects one's belief in supported claims, which in this case, do not involve mask-wearing.

These predictions, data collection, sample size, variables, and exclusion tactics were pre-registered and available here: https://as predicted.org/blind.php?x=ki8b6m.

3.1. Participants and procedures

In mid-July 2021, we invited 230 individuals from Mturk to participate in this study and we followed the same quality-assurance steps as noted in Study 1 with one exception. Per our pre-registration plan, participants who have failed more than one out of four attention check questions were removed from analyses. The final sample size was 223 (49.8% male, $M_{age} = 37.97$, $SD_{age} = 12.25$).

3.2. Measures

3.2.1. BSE-S and U

We used the same assessments as in Study 1 (see Appendix A for items, and SOM for references). Cronbach's α coefficients were 0.83 and 0.77 for BSE-U and —S respectively. As in Study 1, here we report the results with assessments reduced to 1 factor (explaining 36.02%
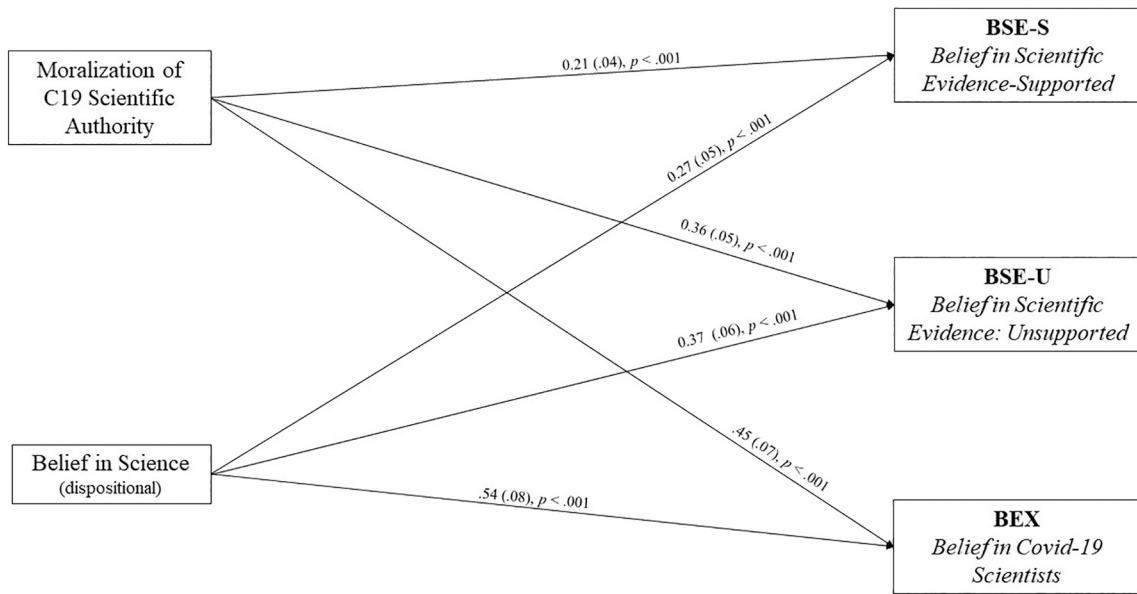
Fig. 2. Study 1 results: unstandardized coefficients, standard errors, and *P*-values.

(BSE—U) and 32.87% (BSE—S) of variance), and we direct our readers to SOM for results based on 12-item aggregations. All our conclusions remain the same.

3.2.2. Distrust in unmasked individuals

We adapted 10 items based on Evans and Revelle (2008) to assess distrust in unmasked individuals. Participants considered the CDC rule change allowing fully unvaccinated people to resume activities without masking or physically distancing and they noted: "People who are NOT wearing a face mask at this time make me (1 = *strongly disagree* to 7 = *strongly agree*):" *avoid contact with them, not want to interact with them, suspicious, uncomfortable, uneasy, not want to trust them, not trust them, feel safe, assume they are fully vaccinated, and respect them* (the last three items were reverse coded). Higher numbers indicate greater distrust in unmasked individuals. Cronbach's α was 0.90.

3.2.3. Potential control and exploratory variables

We asked participants to provide the same demographic and personal attributes questions as in Study 1 using the same items. Those are ideology, age, gender, concern over contracting C19, conspiracy beliefs (Cronbach's α = 0.75), and belief in science (Cronbach's α = 94; Farias et al., 2013). In addition, SOM reports additional exploratory variables including state openness, basic statistic literacy, and C19 risk estimation questions.

3.3. Results and discussion

Descriptive statistics and correlations are presented in Table 2.

Participants perceived BSE-S to be more supported by scientific evidence than BSE—U, $t(222) = 19.61$, 95% CI [1.12, 1.36], $p < .001$.

Next, we regressed trust on BSE-S and BSE-U simultaneously. The model's ability to predict distrust was significant, adjusted $R^2 = 0.25$, $F(2,220) = 16.34$, $p < .001$, and was driven by BSE—U, $b = 0.58$, $SE = 0.08$, $t = 7.07$, $p < .001$. BSE-S emerged as a non-significant predictor, $p = .687$ after controlling for the effect of BSE-U (see Model 1 in Table 3). As the final robustness check, we examined whether BSE-U incrementally predicts distrust over and above variables that could provide

Table 3
Incremental predictive validity of BSE on distrust.

DV: Distrust:	Model 1			Model 2		
	b	SE	p	b	SE	p
Intercept	1.73	0.51	0.001	2.74	0.81	0.001
Predictors						
BSE-S	−0.04	0.11	0.687	−0.16	0.12	0.166
BSE-U	0.58	0.08	<0.001	0.33	0.09	0.000
C19 Concern				0.02	0.01	< 0.001
BIS				0.04	0.08	0.565
Conspiracy beliefs				−0.81	0.13	0.541
Ideology (Conservatism)				−0.04	0.04	0.324
Model R²	0.25			0.38		

Table 2
Study 2: descriptive statistics and intercorrelations.

Variables	Mean	SD	2	3	4	5	6	7	8	9
1. Distrust	4.16	1.31	0.18**	0.51**	0.30**	−0.02	0.06	0.54**	−0.33**	−0.25**
2. BSE - S (1-factor)	5.83	0.88		0.53**	0.38**	0.02	0.12	0.36**	−0.42**	−0.62**
3. BSE - U (1-factor)	4.59	1.15			0.44**	0.04	0.00	0.52**	−0.52**	−0.44**
4. BIS	4.16	1.10				0.16*	−0.21**	0.31**	−0.39**	−0.31**
5. Gender (1 = Male)	0.50	0.50					−0.24**	−0.10	0.03	−0.06
6. Age	37.97	12.25						0.18**	0.09	0.00
7. C19 Concern	60.37	32.81							−0.32**	−0.27**
8. Ideology (Conservatism)	4.03	2.27								0.40**
9. Conspiracy	1.41	0.70								

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

alternative explanation of our findings based on their positive association with distrust. Those variables are entered under the Model 2 of Table 3. As indicated in Table 3, BSE-U predicted distrust over and above other variables.

In summary, Study 2 showed that people who more strongly believe that C19 claims are supported with evidence – even when they are not (BSE—U) – show greater distrust towards people who are not wearing masks, when masks are not required. Importantly, the predictive power of BSE-U on distrust remained significant even after controlling for BSE-S and alternative predictors (beliefs in conspiracy theories, concern over C19, political ideology, and BIS). Like in Study 1, we observed that lower concern over C19, conservative ideology, and greater belief in conspiracy theories are all associated with less belief in science. We did not find significant or consistent relationship between gender, age, and C19 beliefs variables.

4. Study 3: constructive replication and predicting pandemic mitigation authoritarianism

With Study 3 we broaden our outcome to interest to include people's demands that *others* engage in certain pandemic mitigation practices, so we focus on pandemic mitigation authoritarianism (PMA; Manson, 2020). We selected PMA because as noted in the introduction, people who have strong beliefs tend to support authoritarian or coercive practices, and through their coercion, ensure that others comply and contribute to collective action necessary to reduce C19 spread. However, we use the term *authoritarianism* with caveats. Whether a behavior or practice is considered authoritarian (versus, for instance, a dire necessity with unfortunate collateral consequences) is determined by one's ideology and convictions (Manson, 2020). We followed the existing definitions of authoritarianism as a general set of attitudes that includes dogmatism, support for conformity, willingness to coerce others into behavioral compliance, punitive stances towards those who are perceived to be threats, and censorships (Bostyn et al., 2016; Costello et al., 2021; Manson, 2020). We hypothesize that stronger endorsement of BEX and BSE-U will be associated with stronger PMA.

To ameliorate the possibility of our previous results being a measurement artifact, we also refine our assessments by including different items in BEX (we focus on *exclusive* beliefs), and for BSE we use response anchors that do not conflate evidence and consensus. Like in Study 2, we expect that BEX and BSE-U would both predict PMA. We measure BSE—S, but we do not expect it to correlate significantly with PMA because knowledge of supported C19 propositions may be incompatible with certain PMA measures or elimination approach to C19 (Phillips, 2021).

Our predictions, data collection, sample size, variables, and exclusion tactics were pre-registered and available here: https://aspredicted. org/QMV_HHL.

4.1. Participants and procedures

In August of 2021, we recruited 310 participants from Prolific Academic to take part in a study about C19 perceptions. The final sample size following removal of failed attention checks was 300 (42.7% male, $M_{age} = 25.26$, $SD_{age} = 7.70$).

4.2. Measures

4.2.1. Pandemic mitigation authoritarianism

We used two complementary assessments of PMA: a general assessment (PMA General) and evaluation of Australian practices (PMA Australia).

4.2.1.1. PMA General. Thirteen items assessed participants' support for PMA (see Appendix A). We based items on Manson (2020) and we

complemented them with issues such as vaccine passports, which became more pressing since the article's publication in 2020. We asked participants to indicate what policies should countries continue to implement in order to deal with C19 and to note their response on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Upon removing two items (marked with * in Appendix A), EFA yielded 1-factor solution explaining 50.10% of the variance, and α remained 0.92. We provide results based on 1-factor here and results based on 13-item aggregation in SOM; they remained consistent.

4.2.1.2. PMA: Australia. As a complement to generalized PMA based on Manson (2020), we asked participants to assess Australian policies because multiple outlets labelled them as authoritarian (e.g., Friedersdorf, 2021; Lee, 2021). We presented participants with two graphs depicting Australia's C19 situation at the time of data collection (late August 2021). Graphs were copy-pasted directly from John Hopkins database and suggested that for the past 7 days, Australia averaged 974 cases and 2 deaths from C19 every day. We provided the participants with the following prompt:

> "Australia is currently undergoing severe restrictions to reduce the spread of Covid. Consider whether you would want your own region to adopt Australian methods to control the spread of C19. Indicate the extent to which you would support each of the following restrictions."

We selected the five items provided in Appendix A because they are actual rules used across Australian territories at the time of data collection (NSW.gove, 2021). Participants indicated the extent to which they would support those policies on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach's α was 0.88.

4.2.2. BSE-S and —U

We administered 10 adjusted items for each BSE assessment (see Appendix A for items and SOM for references). We revised our BSE-U items to contain seemingly factual statements only. In addition, instead of conflating evidence and consensus, participants indicated the extent to which they believe that each claim is supported with evidence on a scale from 1 (*NO scientific evidence*) to 7 (*clear scientific evidence*). Midpoints were labelled as *mixed evidence* (α for BSE-S and —U were 0.74 and 0.76). We report 1-factor structures here (without items marked with * in the Appendix A), and 10-item aggregates in SOM; they remained consistent.

4.2.3. BEX: exclusive belief in C19 experts and scientists

We asked participants to consider the global health institutes (e.g., WHO, CDC, and SAGE), leading scientists, health experts, and epidemiologists who are guiding the government response, and to indicate the extent to which those health experts are the ONLY ones who are FULLY qualified to: 1) consider all citizens' health and well-being; 2) effectively manage the C19 pandemic; 3) have the final say on how C19 should be handled; 4) anticipate the costs of the restrictions; 5) decide what is the moral response to C19; 6) decide whether restrictions are worth the costs; 7) generate the optimal C19 response (one that will benefit most members of society); 8) provide complete information about C19; 9) provide accurate information about C19. Participants noted their agreement on a scale from 1 = *strongly disagree* to 7 = *strongly agree*, α = 0.89.

4.2.4. Potential control and exploratory variables

Like in our previous studies, participants provided individual attributes questions including compliance with C19 mandates ("Overall, I have been complying with C19 mandates (e.g., masks)", political ideology, gender, and age. New to this study, we also asked participants to indicate whether they have or have had healthcare experience (1 = *yes*; 0 = *no*). In addition, we made our concern over C19 variable more

pointed by asking them to indicate whether they would be concerned if they got C19, or if they already had C19, if they are concerned about the long-term consequences of C19 (1 = *not at all concerned*; 100 = *extremely concerned*). We combined the responses to reflect generalized concern over C19.

4.3. Results and discussion

Table 4 shows correlations and descriptive statistics.

Participants perceived BSE-S to be more supported with scientific evidence than BSE—U, $t(299) = -33.07$, 95% CI [−2.45, −2.18], $p < .001$. Next, we regressed two PMA variables (General and Australia) on BEX, BSE-S and —U. Results are presented in Fig. 3.

All three belief in science variables (BEX, BSE—S, and BSE—U) positively predicted PMA (Global). BSE-U and BEX positively predicted participants' PMA endorsement. BSE-S positively predicted PMA (global) but not PMA (Australia), suggesting scoring high on BSE-S does not necessarily lead one to endorse stricter measures. In addition, people who identified as liberal and as women also expressed stronger support for PMA. Continuing to explore pro-social compliance behaviors, we observed similar results as in our previous two studies; conservative ideology was negatively related to compliance, while belief in science variables were positively related to compliance.

5. General discussion

Just as convictions pertaining to religion or politics lead to extremist views, censorships, and punitive reactions, we reasoned that placing excessive or uncompromising faith in the validity of C19 science may have similar implications. As a consequence, people might distrust fellow citizens who do not visibly comply with recommendations of scientific authorities, and they might endorse extreme measures to contain the virus. We tested this premise across three studies and we showed that beliefs in C19 science are associated with a dispositional belief in science and a belief that following C19 science is a moral mandate. We showed that these beliefs (operationalized as BEX, BSE—S, and BSE—U) relate to the distrust of unmasked individuals even during the period of no mandates (Study 2), and the endorsement of authoritarian mitigation restrictions (Study 3).

Our results showed that distrust and the endorsement of strict measures are predicted by stronger beliefs in C19 scientists (e.g., Dr. Fauci and institutes such as CDC, WHO, and SAGE) and stronger (correct) beliefs that certain claims about C19 are supported by evidence (e. g., C19 vaccines are effective at reducing hospital admissions and deaths from C19, symptoms of 'long Covid' include psychological and neurological disorders, and other BSE-S items). Of particular interest, however, is our finding pertaining to *un*supported claims about C19. Those include endorsing BSE-U statements such as "C19 could have been

eliminated if everybody complied with health mandates" or "In case of community outbreaks, outdoor spaces (beaches, parks) should be closed". Rating these *un*supported claims about C19 as supported most consistently predicted our dependent variables, over and above other competing explanations (e.g., ideology). We observed these results using different, but complementary assessments of beliefs and outcomes.

Finally, our results replicated the past research on compliance. We showed that people who believe in science (regardless of whether it was captured as dispositional BIS, BEX, or BSE) are more likely to engage in pro-social compliance behaviors (e.g., wear masks), and less likely to place trust in unfounded claims and conspiracy theories.

5.1. Theoretical and practical contributions

Our work makes several contributions. First, we build on the existing literature on individual's belief in science (Farias et al., 2013). In tandem with recent findings (Leibovitz et al., 2021; Stosic et al., 2021), we show that belief in science has positive and pro-social features that include embracing the health-minded measures, distrusting conspiracy theories, and believing scientific statements that are supported with C19 science (BSE—S). We also show, however, the darker side of such beliefs. Just as trusting science is associated with greater support for pseudoscience (O'Brien et al., 2021), we observed that people who believe in science are also more likely to believe in C19 statements that are unsupported with science (BSE—U). Recall that it was BSE-U predicted distrust in unmasked individuals over and above BIS (Study 2), attesting to the importance of capturing multiple manifestations of C19 beliefs in science.

Second, our findings comport with a large body of literature on firmly held convictions and its consequences, as they show how strongly held beliefs about C19 matters yield maladaptive responses related to distrust of unmasked individuals (past mandates), and pandemic authoritarianism (Manson, 2020). Such outcomes can undermine social cohesion and create a more polarized culture whereby disagreeing others are more likely to be penalised. For instance, previous work has identified strong links between distrust and opinion polarization in relation to morally charged issues such as abortion and euthenasia, demonstrating their negative impact on social cohesion (Haidt, 2013; Rapp, 2016).

Third, our findings inform the extant literature on political ideology and its role in C19 responses. Liberals showed greater belief in science as demonstrated by their higher endorsement of BIS (Farias et al., 2013) and BSE—S, but they also showed greater belief that science provides answers even when it does not (they scored higher in BSE—U). They were more likely to mistrust unmasked individuals and endorse authoritarian practices to combat C19. In contrast, conservatives showed greater resistance to believing matters that are unsupported by science (score lower in BSE—U), but they also place less faith in science

Table 4
Study 3 correlations and descriptive statistics.

Variables	Mean	SD	2	3	4	5	6	7	8	9	10	11	12
1. PMA	4.32	1.38	0.56**	0.39**	0.51**	0.59**	−0.15**	−0.02	0.10	−0.36**	−0.02	−0.05	0.29**
2. PMA - AUS	3.73	1.63		0.19**	0.41**	0.39**	−0.02	0.09	0.06	−0.23**	−0.04	0.01	0.21**
3. BSE-S	5.24	0.86			0.35**	0.37**	−0.10	0.04	0.12*	−0.22**	0.11	0.14*	0.35**
4. BSE-U	3.53	1.01				0.45**	−0.08	0.06	0.16**	−0.18**	−0.01	−0.03	0.20**
5. BEX	5.02	1.19					−0.08	−0.06	0.14*	−0.21**	0.11	−0.09	0.26**
6. Gender (1 = male)	0.43	0.50						0.07	−0.09	0.27**	−0.03	−0.08	−0.15*
7. Age	25.22	7.73							−0.03	0.06	−0.06	0.09	0.00
8. Concern	44.72	40.66								−0.09	0.21**	0.01	0.15*
9. Ideology (Conservatism)	3.68	2.04									−0.01	0.04	−0.20**
10. Covid History	0.16	0.37										−0.03	0.00
11. Healthcare Exp.	0.11	0.31											−0.06
12. Compliance	6.21	1.27											

Binary variables; 1 = participant had C19 (C19 history), has or had healthcare experience.
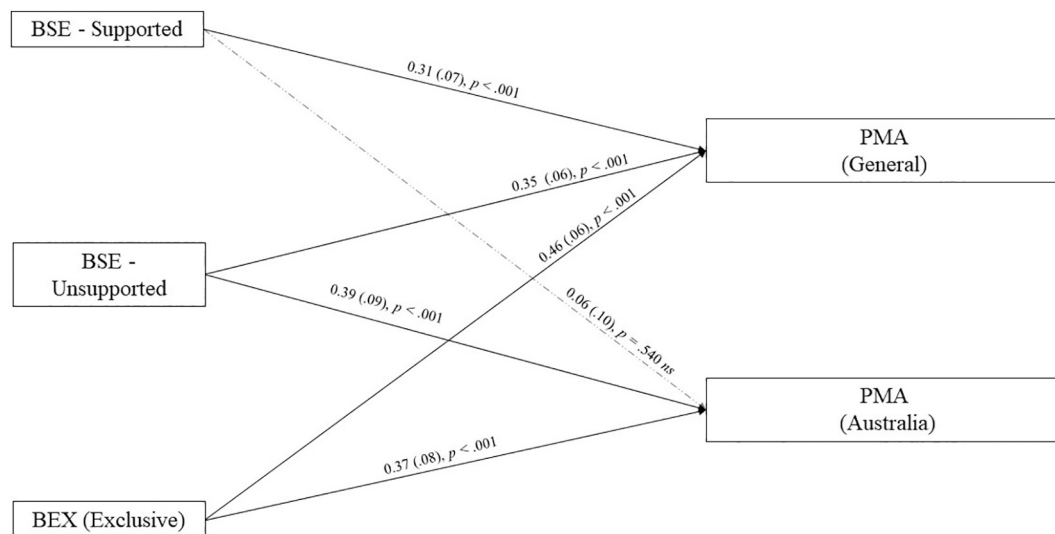
** $p < .01$.

* $p < .05$.

Fig. 3. Study 3 results with unstandardized coefficients, standard errors, and *P*-values.

in general (BIS), and they believe less in statements that are actually supported by science (also score lower in BSE—S). We view this as a major challenge for public health communicators and decision-makers, as it suggests that both liberals and conservatives need to recalibrate their perceptions of the C19 health threat if divisions are to be reduced. Accordingly, we invite future research to direct efforts to breaking the 'availability cascades' of one-sided information (Kuran & Sunstein, 1999), and recognize that de-escalation of existing tensions will be possible only with more accurate and shared perceptions of C19.

5.2. Limitations and future directions

Our study has several limitations. First, all of our statements, particularly BSE-S and —U, should be interpreted within the time context in which the data were collected (i.e., June – September 2021). We do not anticipate that this evolving information will significantly alter the nature and strength of our underlying relationships, as we based on expectations on robust literature linking convictions to maladaptive consequences. Nonetheless, any new research on laypeople's beliefs should be executed in tandem with new evidence.

Second, our findings are also limited by the BSE-S and – U claims we used. One's knowledge of C19 scientific evidence may range from low (e. g., a disinterested lay person) to high (e.g., an expert holding dual doctorate degrees in medicine and economics). We anticipated the challenge of quantifying a lay person's expertise, which is why we used exploratory risk-estimation items in Studies 1 and 2 (reported in SOM), different BSE items, and why we used claims drawn from legitimate sources (BSE—S) and those that are not (BSE—U). Nonetheless, our set still represents a rather small list of possible C19 claims that may be familiar to any lay person. Therefore, we strongly caution future researchers to incorporate new information as it becomes available.

Third, in our assessments of BSE-U we introduced a number of statements that are currently unsupported by empirical evidence. However, we did not distinguish between statements that are false and those for which there is insufficient evidence, and these are clearly not interchangeable. Furthermore, some items we used are limited by some degree of imprecision; for instance, when asking participants to indicate whether this item is supported (Young children should wear masks until they are vaccinated), we did not indicate the age of children which might influence their response (WHO, 2020a). Similarly, EU countries recognize recovery from C19 as a valid condition for a health pass, while USA does not (Block, 2021), thus challenging the interpretation of our item "People who have already had C19 still need to get the vaccine to

be protected". These definitional challenges are also evident in other domains of Covid-19 misinformation; for instance, some claims that were once labelled as conspiracies (e.g., lab leak hypothesis) are now being investigated (Maxmen & Mallapaty, 2021). We encourage researchers to differentiate between statements that are factually false (e. g., children are considered to be 'at risk' category of getting seriously ill from Covid), and those that do not enjoy overwhelming evidence at this time (e.g., new variants spread faster AND are also far deadlier than the original variant).

Fourth, we recognize certain limitations of our BSE measures more broadly. Because these items assess participants' perceptions of scientific consensus, they are arguably more closely linked to knowledge- rather than attitude-based indicators, which is why we complemented them with BEX. While the knowledge-based items should be analyzed with tools such as item response theory, this approach was not appropriate because there is no single right answer and certain statements are normative in nature.

Finally, we did not untangle the causal effects between general (BEX) and information-based beliefs in evidence (BSE-S and —U). As suggested by the large body of literature on beliefs and convictions, the two forces (information and beliefs) are mutually reinforcing. One way to slow the cycle of information-beliefs narrative is to introduce information that may be cognitively unavailable. In the context of C19, this could include informing the public that certain issues are not uniformly backed by scientific evidence. However, triggering such 'unavailability cascades' (Kuran & Sunstein, 1999) may potentially have competing consequences. It may either cast doubt on people's convictions and lead them to rethink their rigidly held beliefs, or it may inadvertently reinforce them.

Regardless of researchers' objectives and approaches to handling C19 pandemic, we invite all to recognize the deeply intertwined nature between pro-social behavior and highly desireable scientific literacy (manifested loosely as BSE—S), and highly rigid beliefs and perceptions that unsupported claims enjoy scientific evidence (BSE-U or BEX in Study 3). Researchers seeking to tackle the BSE-U should be mindful that as they do so, they might risk reducing generally pro-social beliefs, too. We offer no definitive answer about whether risks of untangling these effects and excising the maladaptive beliefs are worth the costs. Nonetheless, there is extant focus on negative Covid-19 information (Sacerdote et al., 2020; Stolow et al., 2020) and the misinformation presented through media channels (Jamieson & Albarracin, 2020), but this information is disseminated because the consumers seek and reward it with their viewership. Disseminating negative or misleading information

(without also disseminating more positive information) will have consequences as lack of transparency – while effective in short-term – may compromise long-term trust in authorities and scientists (Petersen et al., 2021).

5.3. Conclusion

Placing trust in scientists on matters we do not understand increases adaptability in the face of uncertainty. We invited people to consider when and whether trusting science *too much* may have unintended and negative consequences for social cohesion during C19. Our results show that belief in science is adaptive and well-meaning, but left unchecked, it can be disruptive. Divisions arising from miscalibrated convictions must be de-escalated and corrected, regardless of whether they come from de-valuing or over-valuing the threat. Without recognition of these mis-calibrations, society is prone to continue a destructive cycle of distrust and authoritarianism. Close attention to these factors, in this crisis and beyond, is crucial if we are to mitigate the dangers associated with an increasingly polarized society. Moreover, our post-pandemic resilience may depend on it.

CRediT authorship contribution statement

Maja Graso: Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Formal analysis, Investigation, Funding acquisition. **Amanda Henwood:** Writing – original draft, Writing – review & editing. **Karl Aquino:** Conceptualization, Writing – original draft, Writing – review & editing. **Paul Dolan:** Conceptualization, Writing – original draft, Writing – review & editing. **Fan Xuan Chen:** Data curation, Software, Formal analysis.

Appendix A

Notes. * indicates items that were excluded from our 1-factor analyses (we evaluate data with all items and with those that form 1-factor structure). We report aggregate-based data in SOM. SOM also provides complete descriptive statistics and references for each item. References suggest why we labeled BSE-S as generally supported and BSE-U as unclear/unsupported. See our General Discussion and SOM references section for crucial caveats, limitations, and boundaries of our labels.

A.1. Studies 1 and 2

A.1.1. BSE-Supported items in Studies 1 and 2

1. Getting a C19 vaccine helps from getting seriously ill even if a person gets C19.
2. * Fully vaccinated people don't need to wear face masks in most settings. (JULY 2021)
3. People in retirement homes are at high risk of getting seriously ill from C19.
4. C19 vaccines are effective at reducing hospital admissions and deaths from C19.
5. * Being overweight or obese puts one at a higher risk of getting seriously ill from C19.
6. * Direct sunlight helps neutralize C19 virus.
7. Face masks provide protection from the possibility of transmitting C19.
8. Symptoms of 'long Covid' include psychological and neurological disorders.
9. Washing hands and not touching your face are good ways to prevent the spread of C19.
10. Unvented N95 masks are more effective at protecting people against C19 than cloth masks.
11. C19 vaccines cannot give you C19.

12. Risk of C19 surface transmission is low (i.e., contracting C19 from surfaces such as tables or counters).

A.1.2. BSE-Unclear/unsupported items in Studies 1 and 2

1. Benefits of lock-downs are GREATER than the costs of failing to contain C19.
2. * Unvaccinated people should wear masks ANY time they are outside, even if they are alone (e.g., driving or hiking alone).
3. If a person is reported as C19 death, it is clear that C19 was the MAIN cause of, death (i.e., they would be alive if it weren't for Covid).
4. New variants spread faster AND are also far deadlier than the original variant.
5. In case of community outbreaks, outdoor spaces (beaches, parks) should be closed.
6. Young children should wear masks until they are vaccinated.
7. Elimination (Zero-Covid) is the best global strategy to handle C19.
8. * Young children are considered to be at high risk of getting seriously ill from C19.
9. * A third or more of all positive C19 patients suffer from lung scarring and heart inflammation, up to 6 months after their infection.
10. Asymptomatic people (who have C19 but have no symptoms such as coughing) are responsible for majority of all infections.
11. C19 could have been eliminated if everybody complied with health mandates.
12. People who have already had C19 still need to get the vaccine to be protected.

A.2. Study 3

A.2.1. Pandemic mitigation authoritarianism: general

1. Require C19 vaccine passport to travel (e.g., busses, trains, or airplanes).
2. Require C19 vaccine passports to access institutions and businesses (e.g., schools, restaurants, or workplaces).
3. As soon children under 12 are able to get vaccinated, require schools to institute vaccination requirement for attendance.
4. Make it difficult for unvaccinated individuals to participate in life activities.
5. Impose restrictions any time there are rising cases of C19.
6. Make indoor face mask requirements permanent regardless of vaccinations.
7. *Restrict the constitutional right to protest against government restrictions to contain C19.
8. *Illegal activities that increase the spread of the virus need to be punished directly by government officials, without the right to trial by jury.
9. Heads of national, state, and local governments should be able to order new restrictions on activities that could spread the virus, without needing to consult legislative bodies (such as Congress or state legislatures).
10. Restrict the freedom of sharing certain ideas about C19 (e.g., questioning restrictions or mass vaccinations).
11. Do not give air time to scientists who are questioning the need for children to get vaccinated.
12. Revoke license of health practitioners who are publicly questioning the need for children to get vaccinated.
13. Give government health experts the power to decide what constitutes 'misinformation' about C19 that could endanger people if it were widely believed.

A.2.2. Endorsement of PMA (Australian policies; August 2021)

1. Only permit leaving home for five reasons (medical treatment, essential shopping, essential work, 1 h of exercise, family emergency).
2. Limit outdoor exercise to one hour a day within 3 miles of one's home.
3. Permit vaccinated people to spend 1 additional hour outside their homes.
4. Prohibit residents from moving beyond 3 miles of their house.
5. Require people to carry proof of their address any time when outside.

A.2.3. BSE-Supported items in Study 3

1. *Blood clot risk is greater after C19 infection than after vaccination.
2. People in aged care homes are at high risk of getting seriously ill from C19.
3. C19 vaccines are effective at reducing hospital admissions and deaths from C19.
4. *Being overweight or obese puts one at a higher risk of getting seriously ill from C19.
5. *Direct sunlight helps neutralize C19 virus.
6. Face masks are effective at reducing transmission of C19.
7. C19 can damage the lungs, heart, and brain, which increases the risk of long-term health problems.
8. Washing hands and not touching your face are good ways to prevent the spread of C19.
9. Unvented N95 masks are more effective at protecting people against C19 than blue surgical masks.
10. Being fully vaccinated provides a high degree of protection against severe illness, hospitalization and death due to Delta variant.

A.2.4. BSE-Unsupported/unclear items in Study 3

1. Cloth face coverings (e.g., scarfs, home-made cloth masks, or bandanas) are highly effective at preventing the spread of C19 Delta variant.
2. To reduce chance of transmitting C19 significantly, people need to wear masks if they are alone (e.g., they are driving or walking outside alone).
3. "Long Covid" symptoms are unique to C19 (i.e., flu or other viral illnesses do not have such long-term consequences).
4. A third or more of all people who had C19 are no longer able to work due to 'Long Covid' (symptoms that persist after recovery).
5. Young children (under 12) are considered to be at high risk of getting seriously ill from Delta variant of C19.
6. Excess deaths are unreported C19 deaths. (Excess deaths are defined as the difference between the observed and expected numbers of deaths in the same time period).
7. *Risks of outdoor transmission of C19 are high.
8. The mortality rate for the Delta variant is at least 1% (for every 100 positive C19 cases, at least 1 person dies).
9. For a healthy child under 12, C19 is at least three times deadlier than the flu.
10. Most (more than 50%) of people who have Delta variant will never fully recover.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2022.111594.

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