Nudging (dis)trust in science: Exploring the interplay of social norms and scientific trust during public health crises

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Abstract
In times of public health crisis, such as the COVID-19 pandemic, there is a critical need for interventions that emphasize group unification. Such interventions may motivate individuals to adhere personally and collectively to health advice, enhance national solidarity, and reduce conspiratorial beliefs among members—particularly among those who may express skepticism or distrust towards science. Across three experimental studies (N_total = 1604) conducted online (Experiments 1 & 3) and in a real-world setting (Experiment 2) in Ireland and Kosovo, we assessed participants' trust in science (i.e., the extent to which they trust in science and scientists) and exposed them to one of three conditions regarding COVID-19 health advice: compliance (i.e., the majority of ingroup members comply with the health advice), non-compliance (i.e., a majority of ingroup members do not comply with the health advice), or no advice (i.e., control condition with no health advice information). Overall, the results showed that participants with low (vs. high) trust in science intended to adhere to health advice, expected ingroup members to do the same, experienced greater national solidarity, and reduced their conspiracy beliefs in the compliance condition compared to noncompliance or control conditions. Participants' feelings of national solidarity explained the observed effects. In sum, this set of experimental studies shows that compliance with health advice during a health crisis not only enhances national solidarity but also promotes adherence to health behaviors and reduces conspiracy beliefs, especially among those initially skeptical of science.

1 | INTRODUCTION

The COVID-19 pandemic has profoundly impacted people's personal and group/collective behavior. At a personal level, individuals have experienced significant changes in their daily routines, social interactions, and psychological well-being. At a group/collective level, the pandemic has prompted shifts in social dynamics and collective behavior as communities respond to the crisis (Van Bavel et al., 2020, 2022; Jetten et al., 2020; Marmarosh et al., 2020). However, the pandemic has motivated discussions and led to divergent views on public health measures. Some groups advocate for stricter restrictions to control the spread of the virus, while others resist such measures, viewing them with skepticism about their effectiveness and the scientific evidence behind them (Bloem & Salemi, 2021; Cowan et al., 2021; Hartmann & Müller, 2023). This divergence in opinions and approaches to managing the crisis has challenged national solidarity—that is, the unity, cohesion,
and mutual support among members of a nation or society (Federico et al., 2021; Foran et al., 2021; Kinsella et al., 2023). Such distrust or skepticism and weakened solidarity can lead to further fragmentation, creating fertile ground for individuals to disregard health advice and embrace conspiracy theories. Indeed, lower levels of trust in scientific evidence during the pandemic can diminish national solidarity, thereby reducing willingness to comply with health advice and increasing the likelihood of individuals endorsing conspiracy beliefs, as they seek explanations for the perceived disorder and lack of cohesion (Bicchieri et al., 2021; Chen et al., 2022). Research has indeed shown that some individuals resisted compliance with health advice and endorsed conspiracy theories during the pandemic, reflecting these dynamics (Henley & McIntyre, 2020; Jolley & Paterson, 2020; Jolley et al., 2022; Pummerer, 2022; Pummerer, Böhm, et al., 2022).

Given that public health crises such as the COVID-19 pandemic have the potential to destabilize trust in scientific authorities and national solidarity—leading to reduced adherence to crucial guidelines like mask-wearing and vaccination and creating opportunities for conspiracy theories to arise—it raises a crucial question: Can social psychological interventions, such as promoting ingroup norms, enhance national solidarity, improve adherence to health guidelines at both personal and collective levels, and mitigate support for COVID-19-related conspiracy beliefs, particularly within groups exhibiting skepticism towards science? First, understanding the interconnectedness between trust in science, solidarity, personal and collective health behaviors, and conspiracy beliefs is imperative for devising effective strategies to address these societal challenges. Second, by examining all these processes simultaneously and taking into account the prevailing social norms during the pandemic, we aim to unravel the complex dynamics at play and identify pathways for intervention that promote social cohesion among group members.

In this context, while also paying due attention to trust in science, we investigated whether exposure to an ingroup norm indicating compliance with COVID-19 health advice enhanced personal and perceived ingroup expected health behaviors, fostered national solidarity, and reduced conspiracy beliefs. Additionally, we investigated whether enhanced national solidarity was positively linked to personal and perceived ingroup expected behaviors concerning health advice and negatively linked to conspiracy beliefs.

2 | THE INFLUENCE OF INGROUP NORMS ON ADHERENCE TO COVID-19 HEALTH GUIDELINES

Social or normative influence encompasses the process through which individuals adhere to specific standards because they believe others share similar thoughts and behaviors (Cialdini & Trost, 1998). A pivotal aspect of social influence revolves around ingroup norms, which serve as a cohesive framework defining rules and expectations for social behaviors (Borinca et al., 2024a; Cialdini et al., 1990; Sherif, 1936; White et al., 2021). Therefore, ingroup norms play a crucial role in guiding individuals’ personal behaviors and shaping their expectations regarding ingroup members’ actions, by specifying what is deemed acceptable or unacceptable in particular situations (Borinca et al., 2024b; Cialdini & Trost, 1998; Valsecchi et al., 2024).

As an illustration, exposure to social norms indicating that others adhere to health advice (vs. not) enhanced individuals’ willingness to adhere to preventive measures, get vaccinated, and engage in prosocial behavior (Akfırat et al., 2023). Moreover, normative expectations—that other individuals might not participate in an event during the pandemic as they will respect social distancing—impact individuals’ belief that other group members would avoid that event (Martínez et al., 2021). Prior research has also demonstrated that fostering social unity—by encouraging individuals to perceive uniform behavior among all group members in a specific situation—effectively promoted solidarity among group members (Koudenburg et al., 2015). Likewise, research has shown that individuals provided with normative feedback, such as information indicating ingroup members’ support for vaccine uptake, integrate these normative beliefs into their own, resulting in a reduced likelihood of endorsing vaccine-related conspiracy beliefs compared to a control group that received no feedback (Cookson et al., 2021).

In brief, these findings indicate that ingroup norms possess the potential to influence COVID-19 personal behaviors, perceived ingroup behaviors, conspiracy beliefs, and national solidarity among group members. Nonetheless, the impact of normative compliance with COVID-19 health advice in enhancing personal and perceived collective compliance with health advice, fostering national solidarity, and reducing conspiracy theories among individuals with lower trust in science compared to those with higher trust remains unexplored. With the present research, we contribute to this effort by examining, for the first time, the impact of compliance with COVID-19 health advice (vs. noncompliance or a control condition) on individuals’ personal and perceived ingroup expected behaviors, national solidarity, and support for COVID-19-related conspiracy beliefs, particularly among individuals with low (vs. high) trust in science.

3 | TRUST IN SCIENCE, AND COMPLIANCE WITH HEALTH ADVICE

Trust in science implies trust in scholars and their conduct (Sztompka, 2007). Recent research has shown that lower trust in science can reduce individuals’ personal and collective adherence to health guidelines, diminish national solidarity, and enhance support for conspiracy beliefs during the pandemic (Algan et al., 2021; Bicchieri et al., 2021; Gutерres, 2020; Tonković et al., 2021). While individuals with high trust in science supported more health guidelines, diminished national solidarity, and endorsed fewer conspiracy beliefs related to COVID-19 (Algan et al., 2021; Bicchieri et al., 2021; Spannagel, 2021; Winter et al., 2021), this was not the case with individuals with low trust in science, as they tended to respect fewer health advice guidelines and negatively impacted national solidarity, a critical factor in endeavors to combat the pandemic (Algan et al., 2021; Muğaloğlu et al., 2022). Furthermore, research has shown that the less trust individuals had in science, the more likely they were to
endorse conspiracy beliefs about COVID-19 (van Mulukom, 2022; Tonković et al., 2021) and even spread such beliefs to others (Lobato et al., 2020). Simultaneously, exposure to conspiracy theories reduced trust in science (Pummerer, Böhm, et al., 2022; Rutjens & Večkalov, 2022). Therefore, scholars advocate for further research into interventions, particularly emphasizing the role of ingroup norms (Afkirat et al., 2023; Martínez et al., 2021; Neville et al., 2021), which hold the potential to enhance personal and collective respect for health advice, promote national solidarity, while concurrently diminishing support for conspiracy beliefs, especially among those characterized by heightened skepticism of science (Bicchieri et al., 2021; Tonković et al., 2021).

Taken together, prior research suggests that individuals with lower levels of trust in science, as opposed to those with higher levels, tend to respect health advice less, believe that ingroup members do so, perceive a diminished sense of national solidarity, and exhibit higher endorsement of COVID-19-related conspiracy beliefs (Algan et al., 2021; Bicchieri et al., 2021; van Mulukom, 2022). A potential reason might be that individuals with lower (vs. higher) levels of trust in science may indeed exhibit more “flexibility” in changing their beliefs and behaviors compared to those with higher trust in science. This is because individuals with low trust in science often start with lower default levels of personal behaviors, tend to believe that others should be or are behaving in the same manner, experience lower levels of national solidarity, and harbor higher conspiracy beliefs, making them more receptive to influence from social norms. Consequently, these individuals may be more susceptible to social influence. Since they already exhibit skepticism towards scientific information, they might be more receptive to alternative sources of information or social cues, such as ingroup norms, that could potentially sway their beliefs and behaviors. This increased susceptibility to social influence could amplify the impact of norm interventions among individuals with low trust in science, leading to a stronger effect compared to those with higher trust in science.

To address these gaps, the present research investigated how trust in science moderates the impact of exposure to compliance with COVID-19 public health guidelines (vs. noncompliance and/or the control) on personal and perceived ingroup expected health behaviors, national solidarity during the pandemic, and support for COVID-19 conspiracy beliefs. We hypothesized that exposure to compliance with COVID-19 health advice (as opposed to other conditions) would enhance personal perceived ingroup compliance with health advice, increase national solidarity, and decrease support for conspiracy beliefs, particularly among individuals with lower levels of trust in science compared to those with higher trust.

4 | THE MEDIATING ROLE OF NATIONAL SOLIDARITY

National solidarity has served as a crucial framework for encouraging adherence to public health guidelines throughout the COVID-19 pandemic (Maher et al., 2022; Muldoon et al., 2022; Muldoon, Bradshaw, et al., 2021). This is because it fosters a sense of collective identity and unity among group members, which may lead individuals to prioritize personal and collective well-being over personal beliefs or suspicions. In the context of the COVID-19 pandemic, there is evidence that national solidarity correlates with adherence to public health guidelines and the official narrative, as well as with expectations that others are similarly committed (Chang et al., 2022; Foran et al., 2021), suggesting a potential negative association with the inclination to entertain or endorse conspiracy beliefs (Cichocka et al., 2016).

However, the question arises as to whether national solidarity would be positively linked with personal and ingroup intended behaviors and negatively linked with reduced conspiracy beliefs among individuals with low (vs. high) trust in science. Indeed, for individuals with lower trust in science, who may already harbor greater skepticism towards official information and expert consensus, national solidarity could play a crucial role in shaping their beliefs and behaviors. By fostering a sense of belonging and shared identity within the national group, national solidarity may provide a social context that encourages conformity to group norms, and a sense of collective trust and cohesion within a community (Chen et al., 2022; Hogg, 2016; Lewicki & Bunker, 1995; Negură et al., 2021), potentially enhancing their compliance with health advice, enhancing their beliefs that other ingroup members will behave similarly, and reducing skepticism toward fringe theories like conspiracy beliefs. In this way, enhanced national solidarity may serve as a protective factor against noncompliance with health advice and the adoption or propagation of conspiracy beliefs, particularly among individuals who are more predisposed to distrust scientific information.

Accordingly, we expect that exposure to ingroup norm compliance with health advice (vs. other conditions) would increase feelings of national solidarity with ingroup members, which in turn should be linked to increased personal and perceived ingroup compliance with health advice and reduced support for conspiracy beliefs, particularly among individuals with lower trust in science compared to others.

5 | OVERVIEW AND HYPOTHESES

In the present research, we investigated the moderating role of trust in science on the impact of experimental manipulation—specifically, exposure to compliance with COVID-19 health advice compared to noncompliance and/or control conditions—on personal and perceived ingroup compliance with health advice, national solidarity, and support for COVID-19 conspiracy beliefs. We conducted three experiments involving two distinct cultural samples from Western and Southeastern Europe, with Experiments 1 and 3 conducted in Ireland and Experiment 2 in Kosovo.

Across all experiments, participants initially provided ratings for their trust in science. Subsequently, we manipulated exposure to ingroup norms regarding compliance with COVID-19 health advice, employing exposure to compliance versus noncompliance conditions in Experiments 1 and 2, and exposure to compliance versus noncompliance versus control conditions in Experiment 3. Following
that, we assessed participants’ personal and perceived ingroup compliance with health advice, their solidarity with ingroup members involved in the battle against COVID-19, and their endorsement of conspiracy beliefs related to COVID-19.

We hypothesized that trust in science would moderate the impact of ingroup norm compliance on personal and perceived ingroup compliance with health advice, national solidarity, and support for conspiracy beliefs (H1a). Specifically, we anticipated that exposure to the ingroup compliance condition (compared to the noncompliance condition in all experiments and vs. control conditions in Experiment 3) regarding COVID-19 health advice would enhance personal and perceived ingroup compliance with health advice, as well as national solidarity, while mitigating support for conspiracy beliefs, particularly among individuals with lower trust in science. Conversely, we did not expect these effects to emerge among individuals with high trust in science, as we presumed that they would exhibit enhanced personal compliance with health advice, perceive ingroup members as doing the same, and demonstrate enhanced levels of national solidarity, while exhibiting diminished support for conspiracy beliefs, irrespective of the ingroup norms related to COVID-19 health advice (i.e., the experimental manipulation).

Considering that some individuals lack trust in scientific institutions, the absence of normative compliance with health advice may result in various collective actions against recommendations related to the COVID-19 pandemic (Comfort, 2022; Harring et al., 2021). Therefore, in Experiment 3, we also investigated support for collective actions against COVID-19 health guidelines. We anticipated that exposure to ingroup norm compliance (compared to other conditions) would reduce collective actions against health advice recommendations concerning the COVID-19 pandemic among individuals with lower trust in science (H1b). However, we did not expect these effects to emerge among those with high trust in science, as we expected them to show low levels of support for anti-COVID-19 collective actions regardless of the conditions to which they were exposed.

Finally, we explored whether ingroup solidarity would mediate the anticipated interaction effect on personal and perceived ingroup compliance with health advice, and support for conspiracy beliefs in all experiments (H2a). Additionally, in Experiment 3, we investigated whether this mediation effect extends to collective actions (H2b). Recent research has indicated that solidarity leads to prosocial collective actions (Igwe et al., 2020; Mishra & Rath, 2020). Therefore, it will be important to explore whether exposure to normative compliance enhances national solidarity, which in turn might be negatively associated with anti-COVID-19 collective actions, particularly among individuals with lower trust in science compared to those with higher trust.

6 | EXPERIMENT 1

Experiment 1 was designed to test our hypotheses (i.e., H1a, H2a) using Irish participants. We measured trust in science as an individual difference and experimentally manipulated ingroup norm compliance (vs. noncompliance) with COVID-19 mitigation measures. The dependent variables included intended personal and ingroup behaviors concerning health advice, support for conspiracy beliefs, and national solidarity.

6.1 | Method

6.1.1 | Participants and design

The sample size in Experiment 1 was preregistered. Irish participants were recruited via university mailing lists and social media (i.e., through established Facebook or Twitter groups) and asked to participate in an online survey on “people’s perceptions of COVID-19.” A priori analysis conducted with G*Power (e.g., Faul et al., 2009) involving three predictors (i.e., two main effects and a two-way interaction), based on a small effect size of $f^2 = 0.02$, $\alpha = 0.05$, and a power estimate of 0.80, indicated that the study would require at least 550 participants. The online questionnaire was completed by 560 participants, and the data collection process was terminated once the required number had been reached. Ultimately, we had to exclude four participants who had not stated their nationality and two other participants who were neither Irish citizens nor residing in Ireland. Thus, the final sample included 554 participants (203 males, 340 females, nine nonbinary/third gender individuals, and two who preferred not to declare their gender; $M_{\text{age}} = 26.70, \text{SD}_{\text{age}} = 10.19$). Participants were randomly assigned to one of two experimental conditions (ingroup compliance with COVID-19 health advice [$n = 278$] or noncompliance [$n = 276$]). A sensitivity analysis conducted with G*Power (ver. 3.1.9.2; Faul et al., 2009) revealed that, assuming an $\alpha$ of 0.05 and a power estimate of 0.80, our final sample was sufficiently powered to detect an effect size of $f^2 = 0.01$, which conventionally indicates a small effect size (Faul et al., 2009).

6.1.2 | Procedure

The survey was presented as a study on perceptions of social issues concerning COVID-19. Participants completed a two-part online questionnaire. The first part asked them to provide demographic information (i.e., age and gender) and rate statements concerning their trust in science. The second part described the experimental manipulation and our primary dependent variables. Upon completion, participants were comprehensively debriefed on the study’s objectives and explicitly sought their consent for data utilization. Ethical approval for all studies was obtained from the ethics committee of the University of Limerick.

6.1.3 | Measures and experimental manipulation

Trust in science

Participants were asked to rate the extent to which they trusted in “Science” and “Scientists” (e.g., Nadelson et al., 2014). Responses
were provided on a 7-point scale, ranging from 1 (not at all) to 7 (completely). The mean of both items was calculated to obtain a global score of trust in science for each participant ($r = .80; M = 5.93, SD = 1.16$); higher scores indicated greater trust in science.

Experimental manipulation of compliance with health advice
Combining procedures from Borinca and colleagues’ prior research (such as Borinca, Andrighetto, et al., 2021 and Borinca, Iacoviello, et al., 2021), we experimentally manipulated perceived compliance with COVID-19 mitigation measures. This was implemented by exposing participants to a supposedly “real” scientific article on survey data concerning health advice allegedly conducted by researchers of an international university on a representative sample of Irish nationals about their behaviors during the COVID-19 pandemic. The manipulation presented “results” on the percentage of responses (i.e., “Yes,” “Not sure,” and “No”) to the following statements: (a) “I still respect social distancing”; (b) “I still wear a mask in a required situation”; (c) “I still avoid high-risk COVID-19 situations”; and (d) “I always keep proof of vaccination status in required situations.” In the compliance condition, the results indicated that the majority of Irish nationals (about 80% to 90%) were complying with the health advice. Conversely, in the noncompliance condition, participants were also exposed to a similar scientific article, but with altered results suggesting that the majority of Irish nationals were not complying with the health advice, also showing percentages ranging from almost 80% to 90%. That being said, our manipulation represents a descriptive ingroup norm prevalent among Irish nationals regarding compliance with COVID-19 health advice, thereby capturing a perceived collective behavior consistent with the overarching norms of the Irish (ingroup) population.

Manipulation checks
Two items assessed participants’ perception of ingroup compliance (1 = not at all, 7 = absolutely): “According to the results of this survey, most Irish citizens adhered to the health advice?” ($M = 4.22, SD = 2.14$) and “According to your own perception, most Irish citizens adhered to the health advice?” ($M = 4.27, SD = 1.55$; similar to; Borinca et al., 2021a).

6.1.4 | Dependent measures

Personal behaviors
Participants completed seven specially created items designed to measure their compliance intentions (e.g., “I intend to be vaccinated against the coronavirus”; “I intend to avoid public crowds by sitting outside the cafeteria, pub, etc.”; e.g., Brug et al., 2004; Cheng & Ng, 2006). Scale responses ranged from 1 (not at all) to 7 (absolutely). We computed an average score of personal compliance intentions ($\alpha = .86; M = 5.58, SD = 1.32$).

Ingroup’s behaviors
Participants also completed seven specially created items designed to measure their expectations regarding ingroup members’ behaviors (e.g., “I anticipate that Irish people will...” be vaccinated against the coronavirus; “avoid public crowds by sitting outside the cafeteria, pub, etc.”; e.g., Brug et al., 2004; Cheng & Ng, 2006). Scale responses ranged from 1 (not at all) to 7 (absolutely). We computed an average score of expected ingroup behaviors ($\alpha = .86; M = 4.26, SD = 1.15$).

National solidarity
We assessed national solidarity during COVID-19 using a single item adapted from Federico et al. (2021): “I have a feeling of solidarity with the Irish people in the fight against the spread of coronavirus” rated on a scale from 1 (not at all) to 7 (absolutely; $M = 4.95, SD = 1.93$).

Conspiracy beliefs
To assess participants’ support for conspiracy beliefs regarding COVID-19, we used a five-item scale (1 = strongly disagree, 7 = strongly agree) adapted from De Coninck et al. (2021; “I believe that the pharmaceutical industry is involved in the spread of the coronavirus”; “I believe the coronavirus was made intentionally in a laboratory”). We computed an average score of belief in conspiracy beliefs ($\alpha = .76; M = 2.53, SD = 1.23$).

7 | RESULTS

Trust in science (standardized values) and the experimental condition (i.e., compliance vs. noncompliance, coded -1 and +1, respectively), along with the interaction term between these factors, were entered as independent variables in a full factorial analysis of covariance (ANCOVA). Personal and perceived ingroup behaviors regarding health advice, support for conspiracy beliefs, and national solidarity were included as dependent variables (e.g., Borinca, Çelik, et al., 2022; Borinca, Falomir-Pichastor, et al., 2021; Valsecchi et al., 2024). Table 1 provides estimated means and standard errors for the primary dependent variables.

7.1 | Manipulation checks
Regarding the perceived compliance manipulation, our results indicated that the main effect of the manipulation was significant, $F(1, 550) = 645.99, p < .001, \eta_p^2 = 0.54$. In the compliance condition, participants perceived that the survey results showed that the majority of ingroup members complied more with COVID-19 mitigation measures ($M = 5.79, SD = 1.20$) compared to those in the noncompliance condition ($M = 2.64, SD = 1.67$). The main effect of trust, $F(1, 550) = 1.011, p = .315$, $\eta_p^2 = 0.002$, and the interaction of trust and the ingroup norm compliance, $F(1, 550) = 0.99, p = .320, \eta_p^2 = 0.000$, were not significant.

Concerning participants’ perception of ingroup members, results showed that the ingroup norm compliance manipulation had a significant main effect, $F(1, 550) = 44.92, p < .001, \eta_p^2 = 0.07$. Participants perceived that the majority of ingroup members complied more with COVID-19 mitigation measures in the compliance condition ($M = 4.69, SD = 1.49$) than in the noncompliance condition ($M = 3.84, SD = 1.49$). The main effect of trust, $F(1, 550) = 0.38, p = .537, \eta_p^2 = 0.001$, and the interaction
of trust and the ingroup norm compliance, $F(1, 550) = 2.46, p = .117$, $\eta^2_p = 0.004$, were not significant.

7.2 | Personal behaviors

The main effect of trust in science was significant, $F(1, 550) = 95.31, p < .001$, $\eta^2_p = 0.14$: Participants’ intentions to comply with COVID-19 guidelines increased as trust in science increased ($B = 0.49$). The main effect of perceived ingroup norm compliance was also significant, $F(1, 550) = 12.88, p < .001, \eta^2_p = 0.02$. Participants intended to adhere more with COVID-19 guidelines in the compliance condition ($M = 5.74, SD = 1.13$) than in the noncompliance condition ($M = 5.41, SD = 1.47$). Last, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance was significant, $F(1, 550) = 28.55, p < .001, \eta^2_p = 0.04$ (see Figure 1).

### TABLE 1  Dependent variables as a function of ingroup norms and trust in science.

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<thead>
<tr>
<th></th>
<th>Low (-1 SD)</th>
<th>High (+1 SD)</th>
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<tr>
<td></td>
<td>Ingroup norm</td>
<td>Ingroup norm</td>
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<td></td>
<td>Compliance</td>
<td>Noncompliance</td>
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<td><strong>Experiment 1 (N = 554)</strong></td>
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<tr>
<td>Personal behaviors</td>
<td>5.52 (0.09)</td>
<td>4.61 (0.10)</td>
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<tr>
<td>Ingroups behaviors</td>
<td>4.59 (0.09)</td>
<td>3.66 (0.09)</td>
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<tr>
<td>National solidarity</td>
<td>5.02 (0.15)</td>
<td>4.06 (0.16)</td>
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<tr>
<td>Conspiracy beliefs</td>
<td>2.79 (0.09)</td>
<td>3.30 (0.09)</td>
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<td><strong>Experiment 2 (N = 550)</strong></td>
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<tr>
<td>Personal behaviors</td>
<td>4.78 (0.12)</td>
<td>3.83 (0.11)</td>
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<tr>
<td>Ingroups behaviors</td>
<td>4.95 (0.12)</td>
<td>3.61 (0.11)</td>
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<tr>
<td>National solidarity</td>
<td>5.48 (0.15)</td>
<td>3.68 (0.14)</td>
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<tr>
<td>Conspiracy beliefs</td>
<td>3.31 (0.10)</td>
<td>4.12 (0.09)</td>
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<tr>
<td><strong>Experiment 3 (N = 500)</strong></td>
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<tr>
<td>Personal behaviors</td>
<td>5.60 (0.10)</td>
<td>4.79 (0.12)</td>
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<tr>
<td>Ingroups behaviors</td>
<td>4.54 (0.11)</td>
<td>3.55 (0.13)</td>
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<tr>
<td>National solidarity</td>
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<td>3.34 (0.23)</td>
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<tr>
<td>Conspiracy beliefs</td>
<td>3.06 (0.12)</td>
<td>3.68 (0.14)</td>
</tr>
<tr>
<td>Collective actions</td>
<td>2.36 (0.16)</td>
<td>3.21 (0.19)</td>
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Note: Means and standard errors (in parentheses) for ingroup norm at conditional levels of trust in science (i.e., distrust vs. trust).

**FIGURE 1** The interactive effect of ingroup norm (compliance vs. noncompliance) and trust in science (low vs. high) on intended personal behaviors (Experiment 1).
Simple effects analyses revealed that individuals with low trust in science (−1 SD) intended to adhere more to COVID-19 guidelines in the compliance condition than in the noncompliance condition, \( F(1, 550) = 39.86, p < .001, \eta^2_p = 0.06 \). However, the simple effect was not significant for individuals with high trust in science (+1 SD), \( F(1, 550) = 1.55, p = .213, \eta^2_p = 0.003 \).

7.3 | Ingroups’ behaviors

The main effect of trust in science was significant, \( F(1, 550) = 7.70, p = .006, \eta^2_p = 0.01 \): the perception that ingroup members will comply with COVID-19 guidelines increased as trust in science increased (\( \beta = 0.13 \)). The main effect of perceived ingroup norm compliance was also significant, \( F(1, 550) = 31.07, p < .001, \eta^2_p = 0.05 \). Participants expected that ingroup members would respect more COVID-19 guidelines in the compliance condition (\( M = 4.52, SD = 1.04 \)) than in the noncompliance condition (\( M = 4.00, SD = 1.20 \)). Last, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance was significant, \( F(1, 550) = 18.99, p < .001, \eta^2_p = 0.03 \).

Simple effects analyses revealed that individuals with low trust in science (−1 SD) expected that ingroup members would adhere more to COVID-19 guidelines in the compliance condition than in the noncompliance condition, \( F(1, 550) = 49.25, p < .001, \eta^2_p = 0.08 \). However, the simple effect was not significant for individuals with high trust in science (+1 SD), \( F(1, 550) = 0.73, p = .393, \eta^2_p = 0.001 \).

7.4 | National solidarity

The main effect of trust in science was significant, \( F(1, 550) = 23.99, p < .001, \eta^2_p = 0.04 \). Specifically, solidarity with ingroup members increased when trust in science was higher (\( \beta = 0.39 \)). The main effect of ingroup norm compliance was also significant, \( F(1, 550) = 7.60, p = .006, \eta^2_p = 0.01 \). Participants expressed more solidarity with ingroup members involved in the fight against COVID-19 in the compliance condition (\( M = 5.15, SD = 1.78 \)) than in the noncompliance condition (\( M = 4.74, SD = 2.05 \)). Last, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance manipulation was significant, \( F(1, 550) = 10.57, p = .001, \eta^2_p = 0.01 \).

Simple effects analyses revealed that individuals with low trust in science (−1 SD) expressed greater solidarity in the compliance condition than in the noncompliance condition, \( F(1, 550) = 18.03, p < .001, \eta^2_p = 0.03 \). However, the simple effect was not significant for individuals with high trust in science (+1 SD), \( F(1, 550) = 0.12, p = .729, \eta^2_p = 0.01 \).

7.4.1 | Conspiracy beliefs

The main effect of trust in science was significant, \( F(1, 550) = 117.37, p < .001, \eta^2_p = 0.17 \). Support for conspiracy beliefs about COVID-19 decreased, when trust in science was higher (\( \beta = -0.51 \)). But the main effect of the ingroup norm compliance was not significant, \( F(1, 550) = 0.27, p = .604, \eta^2_p = 0.000 \). Finally, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance manipulation was significant, \( F(1, 550) = 23.10, p < .001, \eta^2_p = 0.04 \).

Simple effects analyses revealed that participants with low trust in science (−1 SD) showed lower support for conspiracy beliefs about COVID-19 in the ingroup compliance condition than in the noncompliance condition, \( F(1, 550) = 14.18, p < .001, \eta^2_p = 0.02 \). However, the reverse effect was observed for participants with high trust in science (+1 SD) as they showed lower support for conspiracy beliefs in the noncompliance condition than in the compliance condition, \( F(1, 550) = 9.22, p = .003, \eta^2_p = 0.01 \).

7.5 | Mediation analyses

We tested H2a using Model 8 in PROCESS for SPSS (Hayes, 2018; 5000 bootstrapped samples) to run moderated mediation analyses for our main outcome measure: personal and perceived ingroup behaviors with health advice and support for conspiracy beliefs. We entered the ingroup norm compliance manipulation (−1 = the compliance condition, +1 = the noncompliance condition) as the independent variable and trust in science as the moderator. We then entered national solidarity as a mediator (see Figure 2).

![Diagram](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9000128/figures/figure2.png)

**Figure 2** The conceptual moderated mediation model tested in all Experiments.
Regarding personal behaviors, the analysis showed that the moderated mediation index (0.08) was significant, with an interval value that did not include zero in its 95% confidence interval [CI] [0.02, 0.13]. The indirect effect of perceived ingroup norm compliance was significant when trust in science was low, $B = -0.13$ (SE = 0.03), 95% CI [-0.20, -0.06], but not when it was high, $B = 0.005$ (SE = 0.03), 95% CI [-0.06, 0.07].

Regarding collective behaviors, the analysis showed that the moderated mediation index (0.05) was significant, with an interval value that did not include zero in its 95% CI [0.01, 0.09]. The indirect effect of perceived ingroup norm compliance was significant when trust in science was low, $B = -0.09$ (SE = 0.02), 95% CI [-0.14, -0.04], but not when it was high, $B = 0.004$ (SE = 0.02), 95% CI [-0.04, 0.04].

Regarding conspiracy beliefs, the analysis showed that the moderated mediation index (0.02) was significant, with an interval value that did not include zero in its 95% CI [-0.04, -0.004]. The indirect effect of the ingroup norm compliance manipulation was significant among individuals with low trust in science, $B = 0.03$ (SE = 0.01), 95% CI [0.01, 0.07], but not among those with high trust in science, $B = -0.001$ (SE = 0.01), 95% CI [-0.02, 0.02].

7.6 | Discussion

Consistent with H1a, the findings revealed that individuals with low trust in science intended to adhere to health advice and expected ingroup members to do so as well, experienced greater solidarity with ingroup members engaged in the fight against COVID-19 when exposed to the ingroup compliance condition compared to the noncompliance condition. Conversely, individuals with high trust in science exhibited consistent levels of intended behaviors, expected ingroup behaviors, and national solidarity irrespective of the experimental condition to which they were exposed.

However, regarding conspiracy beliefs, individuals with low trust in science exhibited reduced support for COVID-19 conspiracy beliefs when exposed to the compliance condition compared to the noncompliance condition. Unexpectedly, the results revealed that individuals with high trust in science decreased their support for conspiracy beliefs more in the noncompliance condition than in the compliance condition, thus challenging the anticipated norm (see means per conditions). A plausible explanation could be that individuals with high trust in science, upon observing noncompliance with health guidelines, may perceive a discrepancy between their expectations based on their trust in science and the observed behavior of others. This incongruence might prompt them to question the validity of their prior beliefs and reevaluate their stance on conspiracy beliefs. Additionally, the compliance condition, by highlighting widespread adherence to health guidelines within their ingroup, may reinforce their trust in science and reduce the perceived need for alternative explanations like conspiracy theories. Conversely, the noncompliance condition, by indicating a departure from expected norms, may challenge their trust in science and prompt them to seek alternative explanations for the observed behavior.

Ultimately, consistent with H2a, the results demonstrated that the predicted interaction effect between trust in science and ingroup norms concerning compliance with health advice on investigated outcomes was mediated by national solidarity. Given the far-reaching implications of the COVID-19 pandemic on both national and international scales, we sought to replicate this experiment in a distinct cultural context—specifically, the nation of Kosovo in Southeastern Europe.

8 | EXPERIMENT 2

In Experiment 2, we adopted a methodology akin to Experiment 1, assessing trust in science as an individual difference variable and experimentally manipulating compliance (vs. noncompliance) with COVID-19 health advice, this time involving participants from Kosovo–Albanian in Southeast Europe. Recognizing the widespread impact of the COVID-19 pandemic, our goal was to replicate our findings in a diverse cultural setting and thereby increase the ecological validity of our findings. Once again, intended personal and perceived ingroup behaviors with health advice, national solidarity, and support for conspiracy beliefs were the dependent variables for this experiment.

8.1 | Method

8.1.1 | Participants and procedure

The sample size in Experiment 2 was also preregistered, with a priori analysis conducted using G*Power (e.g., Faul et al., 2009), similar to Experiment 1, indicating that the study would require 550 participants. We recruited 550 Kosovar–Albanian participants (317 women; $M_{age} = 23.73$, $SD_{age} = 5.62$) from a large university campus in the city of Prizren in Kosovo; data collection was halted when the required number was reached. We randomly assigned participants to one of two conditions, as in Experiment 1 (compliance [$n = 275$], or noncompliance [$n = 275$]). A similar sensitivity analysis as in Experiment 1 revealed that our final sample was sufficiently powered to detect an effect size of $f^2 = 0.01$, which conventionally indicates a small effect size (Faul et al., 2009).

8.1.2 | Measures and experimental manipulation

Participants were asked to rate their level of trust in science ($r = .84; M = 4.34, SD = 1.99$) and were then exposed to the norm manipulation adapted for the Kosovan context and given the same manipulation check regarding their perception of the survey results ($M = 4.48, SD = 1.99$) and their opinion about it ($M = 4.39, SD = 1.93$). Participants subsequently completed the measures of personal intended behaviors ($\alpha = 88; M = 4.81, SD = 1.55$), ingroup members behaviors ($\alpha = 91; M = 4.65, SD = 1.71$), national solidarity ($M = 5.02,
8.2 | Results

Trust in science (standardized values) and the experimental condition (i.e., compliance vs. noncompliance, coded as −1 and +1, respectively), along with the interaction term between these factors, were entered as independent variables in a full factorial ANCOVA (e.g., Boinca, Moreno-Bella et al., 2022). Personal and perceived ingroup behaviors about health advice, support for conspiracy beliefs, and national solidarity were included as dependent variables. Table 1 provides estimated means and standard errors for the primary dependent variables.

8.2.1 | Manipulation checks

Regarding the perception of ingroup norms compliance, results indicated that the main effect of the experimental manipulation was significant, $F(1, 546) = 297.44, p < .001, \eta^2_p = 0.35$. Participants perceived that the survey results showed that the majority of ingroup members complied more with COVID-19 mitigation measures in the compliance condition ($M = 5.67, SD = 1.31$) than in the noncompliance condition ($M = 3.29, SD = 1.83$). The main effect of trust, $F(1, 546) = 38.11, p < .001, \eta^2_p = 0.07$, and the interaction of trust and the ingroup norm compliance, $F(1, 546) = 0.28, p = .596, \eta^2_p = 0.001$, were not significant.

Concerning participants’ perception of ingroup members, our results pointed out that the ingroup compliance norm manipulation had a significant main effect, $F(1, 546) = 269.81, p < .001, \eta^2_p = 0.33$. Participants perceived that the majority of ingroup members complied more with COVID-19 mitigation measures in the compliance condition ($M = 5.51, SD = 1.51$) than in the noncompliance condition ($M = 3.27, SD = 1.65$). The main effect of trust, $F(1, 546) = 1.92, p = .166, \eta^2_p = 0.004$, and the interaction of trust and the ingroup norm compliance, $F(1, 546) = 0.02, p = .881, \eta^2_p = 0.000$, were not significant.

8.2.2 | Personal behaviors

The main effect of trust in science was significant, $F(1, 546) = 74.86, p < .001, \eta^2_p = 0.12$: personal intentions to comply with COVID-19 guidelines increased as trust in science increased ($B = 0.52$). The main effect of perceived ingroup norm compliance was also significant, $F(1, 546) = 7.70, p < .006, \eta^2_p = 0.01$. Participants intended to respect more COVID-19 guidelines in the compliance condition ($M = 5.02, SD = 1.14$) than in the noncompliance condition ($M = 4.60, SD = 1.84$). Finally, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance was significant, $F(1, 546) = 25.03, p < .001, \eta^2_p = 0.04$.

Simple effects analyses revealed that participants with low trust in science (−1 SD) intended to respect more COVID-19 guidelines in the compliance condition than in the noncompliance condition, $F(1, 546) = 30.36, p < .001, \eta^2_p = 0.05$. However, the simple effect was not significant for individuals with strong trust in science (>+1 SD), $F(1, 546) = 2.48, p = .116, \eta^2_p = 0.005$.

8.2.3 | Ingroups’ behaviors

The main effect of trust in science was significant, $F(1, 546) = 72.95, p < .001, \eta^2_p = 0.11$: the perception that ingroup members will comply with COVID-19 guidelines increased as trust in science increased ($B = 0.50$). The main effect of ingroup norm compliance was also significant, $F(1, 546) = 46.92, p < .001, \eta^2_p = 0.07$. Participants expected that ingroup members would respect more COVID-19 guidelines in the compliance ($M = 5.20, SD = 1.13$) than in the noncompliance condition ($M = 4.32, SD = 1.76$). Last, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance was significant, $F(1, 546) = 19.03, p < .001, \eta^2_p = 0.03$.

Simple effects analyses revealed that participants with low trust in science (−1 SD) expected that ingroup members would respect COVID-19 guidelines more in the compliance condition than in the noncompliance condition, $F(1, 546) = 63.04, p < .001, \eta^2_p = 0.10$. However, the simple effect was not significant for individuals who trusted science (+1 SD), $F(1, 546) = 3.06, p = .081, \eta^2_p = 0.006$.

8.2.4 | National solidarity

The main effect of trust in science was significant, $F(1, 546) = 36.62, p < .001, \eta^2_p = 0.07$: when trust in science was higher, solidarity with ingroup members was greater ($B = 0.46$). The ingroup compliance also had a significant main effect, $F(1, 546) = 43.30, p < .001, \eta^2_p = 0.07$. Participants expressed more solidarity with ingroup members in the compliance condition ($M = 5.56, SD = 1.45$) than in the noncompliance condition ($M = 4.48, SD = 2.23$). Finally, as predicted by H1a, the interaction of trust in science and the ingroup norm compliance was significant, $F(1, 546) = 26.69, p < .001, \eta^2_p = 0.04$.

Simple effects analyses revealed that participants with low trust in science (−1 SD) experienced greater national solidarity in the compliance condition than in the noncompliance condition, $F(1, 546) = 69.19, p < .001, \eta^2_p = 0.11$. However, the simple effect was not significant for individuals with strong trust in science (>+1 SD), $F(1, 546) = 0.98, p = .322, \eta^2_p = 0.002$.

8.2.5 | Conspiracy beliefs

The main effect of trust in science on conspiracy beliefs was significant, $F(1, 546) = 20.76, p < .001, \eta^2_p = 0.03$: support for conspiracy beliefs about COVID-19 was lower among individuals with a greater trust in science ($B = -0.22$). The main effect of the
ingroup norm compliance was also significant, \(F(1, 546) = 5.65, p = .018, \eta^2_p = 0.01\). Participants showed lower support for conspiracy beliefs about COVID-19 in the compliance condition (\(M = 3.38, SD = 1.15\)) than in the noncompliance condition (\(M = 3.65, SD = 1.23\)). As predicted by H1a, the interaction of trust in science and ingroup norm compliance was significant, \(F(1, 546) = 34.66, p < .001, \eta^2_p = 0.06\).

Simple effects analyses revealed that participants with low trust in science (−1 SD) showed lower support for conspiracy beliefs about COVID-19 in the compliance condition than in the noncompliance condition, \(F(1, 546) = 34.28, p < .001, \eta^2_p = 0.05\). However, the reverse effect was observed for participants with high trust in science (+1 SD) as they showed lower support for conspiracy beliefs in the noncompliance condition than in the compliance condition, (+1 SD), \(F(1, 546) = 6.16, p = .013, \eta^2_p = 0.011\).

### 8.3 Mediation analyses

As in Experiment 1, we tested H2a using Model 8 in PROCESS for SPSS to run moderated mediation analyses for the outcome measures: personal and perceived ingroup behaviors and support for conspiracy beliefs. We entered the ingroup norm compliance manipulation (−1 = the compliance condition, +1 = the noncompliance condition) as the independent variable and trust in science as the moderator. Then, we entered national solidarity as a mediator.

Regarding personal behaviors, the analysis showed that the moderated mediation index (0.18) was significant, with an interval value that did not include zero in its 95% CI [0.10, 0.26]. The indirect effect of perceived ingroup norm compliance was significant when trust in science was low, \(B = -0.45 (SE = 0.06), 95\% CI [-0.59, -0.23]\), but not when it was high, \(B = -0.03 (SE = 0.04), 95\% CI [-0.13, 0.06]\).

Regarding ingroup behaviors, the analysis showed that the moderated mediation index (0.07) was significant, with an interval value that did not include zero in its 95% CI [0.10, 0.24]. The indirect effect of perceived ingroup norm compliance was significant when trust in science was low, \(B = -0.42 (SE = 0.06), 95\% CI [-0.55, -0.30]\), but not when it was high, \(B = -0.03 (SE = 0.04), 95\% CI [-0.11, 0.05]\).

Regarding conspiracy beliefs, the analysis showed that the moderated mediation index (−0.06) was significant, with an interval value that did not include zero in its 95% CI [−0.09, −0.03]. The indirect effect of the ingroup compliance manipulation was significant among individuals with low trust in science, \(B = 0.14 (SE = 0.03), 95\% CI [0.08, 0.22]\), but not among those with high trust in science, \(B = 0.01 (SE = 0.01), 95\% CI [-0.02, 0.04]\).

### 8.4 Discussion

The second experiment replicated our findings in a distinct cultural context, specifically in Kosovo, using real-life data collected through a paper-and-pencil methodology. Once more, individuals with low trust in science exhibited more intention to adhere to health advice and expected ingroup members to do so as well, experienced greater national solidarity while also displayed low levels of conspiracy beliefs. The only significant effect that emerged among individuals who strongly trust in science was when they were exposed to the noncompliance condition, expressing even fewer conspiracy beliefs compared to individuals with high trust in science in the compliance condition. To assess the default understanding of normative COVID-19 mitigation measures, particularly among those with low (vs. high) trust in science, we included a control condition in Experiment 3 where no COVID-19 health advice was provided. Furthermore, in Experiment 3, we also assessed individuals’ willingness for collective actions against COVID-19 health recommendations.

### 9 EXPERIMENT 3

We applied the same methodology used in the previous experiments to Experiment 3, in which we first assessed the degree of trust in science as an individual difference among Irish adult participants. We experimentally manipulated the ingroup compliance with COVID-19 health advice (compliance vs. noncompliance) as in previous experiments, but we added a control condition without information about COVID-19 health advice. In particular, we were interested in investigating the baseline understanding of ingroup norms related to COVID-19 health advice among people with low (vs. high) trust in science. Our dependent variables were similar to those of previous experiments with the addition of support for collective actions against COVID-19 health recommendations as a new outcome.

In addition to H1a and H2a, we hypothesized that exposure to ingroup norm compliance (compared to other conditions) would reduce collective actions against health advice recommendations concerning the COVID-19 pandemic among individuals with lower (vs. higher) trust in science (H1b). Furthermore, we hypothesized that ingroup solidarity would mediate the predicted interaction effect on willingness for collective actions among individuals with lower (vs. higher) trust in science (H2b).

### 9.1 Method

#### 9.1.1 Participants and procedure

The sample size in Experiment 3 was also preregistered. Irish participants were recruited via university mailing lists and social media (i.e., through established Facebook or Twitter groups) and asked to participate in an online survey on people’s perceptions of COVID-19. A priori analysis conducted with G*Power involving five predictors (i.e., three main effects and a two-way interaction; see below), based on a small effect size of \(F^2 = 0.03, \alpha = .05\) and a power estimate of 0.80, indicated that the study would require at least 434 participants. The online questionnaire was completed by 588 participants, and the data collection process was terminated when the required number had been reached. Ultimately, we had to...
exclude 20 participants who were not Irish citizens and who did not reside in Ireland, as well as 68 others who had previously participated in this study. Thus, the final sample included 500 participants (192 males, 299 females, six who were nonbinary/third gender, and three who preferred not to declare their gender; \( M_{\text{age}} = 26.51, SD_{\text{age}} = 10.67 \)) who were randomly assigned to one of three experimental conditions (compliance \( n = 156 \), noncompliance \( n = 156 \), or control \( n = 188 \)). The sensitivity analysis revealed that, assuming an \( \alpha \) of 0.05 and a power estimate of 0.80, our final sample was sufficiently powered to detect an effect size of \( f^2 = 0.02 \), which conventionally indicates a small effect size (Faul et al., 2009).

9.1.2 | Measures and the experimental manipulation

As in previous experiments, we assessed participants’ level of trust in science \( (r = .79; M = 4.34, SD = 1.99) \), and then they were randomly presented with one of the three conditions: ingroup norms concerning compliance with COVID-19 mitigation measures, ingroup norms concerning lack of compliance, or the control condition which did not provide any information about COVID-19 health advice. Because we included a control condition, we only used a single manipulation check to assess participants’ perceptions about Irish citizens’ compliance with health advice \( (M = 4.39, SD = 1.93) \). Following this, participants completed the same measures: personal intended behaviors \( (\alpha = 88; M = 4.81, SD = 1.55) \), expected ingroup behaviors \( (\alpha = 91; M = 4.65, SD = 1.71) \), national solidarity \( (M = 5.02, SD = 1.95) \), and support for conspiracy beliefs \( (\alpha = .78; M = 2.69, SD = 1.32) \) as in the previous experiments.

Finally, we assessed willingness for collective actions against COVID-19 health advice using a 7-point Likert scale ranging from 1 (not at all) to 7 (absolutely). Participants completed a four-item scale adapted from Van Zomeren et al. (2011), which included statements such as “I would like to participate in a protest against health advice recommendations concerning the COVID-19 pandemic” and “I would like to sign a petition to protest against the health advice recommendations concerning the COVID-19 pandemic” \( (\alpha = 91; M = 2.18, SD = 1.63) \).

9.2 | Results

To test our hypotheses, we computed two orthogonal contrasts, since contrast analysis, compared to analysis of variance, is a more precise and robust statistical test to analyze the effect of a variable with more than two modalities (Borinca et al., 2024; Brauer & McClelland, 2005; Furr & Rosenthal, 2003; Valsecchi et al., 2024). According to a linear hypothesis, the first contrast (C1) opposed the ingroup compliance condition (+2) to the noncompliance and control conditions \((-1 \text{ and } -1) \). The second critical contrast opposed the noncompliance \(+1 \text{ and } -1 \) conditions, while the compliance condition was coded 0 \((C2)\). A linear effect is denoted when the effect of C1 is significant, but not the effect of C2. These two orthogonal contrasts and trust in science (standardized values) and the interactions between these terms (except for the interaction between contrasts) were entered as independent variables in a full factorial ANCOVA.

9.2.1 | Manipulation check

Concerning participants’ perception of ingroup members’ compliance with COVID-19 mitigation measures, the results pointed out that the main effect of trust in science was significant, \( F(1, 494) = 20.9, p < .001, \eta^2_p = 0.04 \), as participants scoring higher in trust in science perceived ingroup members complied more with COVID-19 health advice \( (B = 0.29) \). Contrast 1 \((C1)\) was also significant, \( F(1, 494) = 49.2, p < .001, \eta^2_p = 0.09 \), as participants perceived that the majority of ingroup members complied more with COVID-19 health advice in the compliance condition \( (M = 4.89, SD = 1.32) \) than in the other two conditions \((M_{\text{non-compliance}} = 3.38, SD = 1.63; M_{\text{control}} = 4.12, SD = 1.26) \). C2, however, was not significant, \( F(1, 494) = 3.34, p = .068, \eta^2_p = 0.007 \). Finally, the \( C1 \times \text{trust in science} \) interaction was significant, \( F(1, 494) = 9.93, p = .002, \eta^2_p = 0.02 \), while the \( C2 \times \text{trust in science} \) interaction was not significant, \( F(1, 494) = 0.01, p = .920, \eta^2_p = 0.000 \).

Simple effects analyses revealed that participants with low trust in science \((-1 \text{ SD})\) perceived that the majority of ingroup members complied more with COVID-health advice in the compliance condition \((M = 4.89, SE = 0.14) \) than in the other two conditions \((M_{\text{non-compliance}} = 3.40, SE = 0.17; M_{\text{control}} = 3.70, SE = 0.15) \). \( F(1, 494) = 55.3, p < .001, \eta^2_p = 0.78 \). In addition, a similar effect emerged even for those with high trust in science, \((+1 \text{ SD})\), \( F(1, 494) = 7.49, p = .006, \eta^2_p = 0.01 \). Specifically, these individuals perceived that the majority of ingroup members complied more with COVID-19 health advice in the compliance condition \((M = 4.88, SE = 0.16) \) than in the other two conditions \((M_{\text{non-compliance}} = 4.21, SE = 0.16; M_{\text{control}} = 4.47, SE = 0.14) \).

9.2.2 | Personal behaviors

The main effect of trust in science was significant, \( F(1, 494) = 158, p < .001, \eta^2_p = 0.24 \): personal intentions to comply with COVID-19 guidelines increased as trust in science increased \( (B = 0.58) \). Both C1, \( F(1, 494) = 1.75, p = .186, \eta^2_p = 0.004 \) and C2, \( F(1, 494) = 3.18, p = .075, \eta^2_p = 0.006 \), were not significant. Finally, the predicted \( C1 \times \text{trust in science} \) interaction was significant, \( F(1, 494) = 35.57, p < .001, \eta^2_p = 0.06 \), while the \( C2 \times \text{trust in science} \) interaction was not significant, \( F(1, 494) = 0.53, p = .465, \eta^2_p = 0.001 \) (see Figure 3).

Simple effects analyses revealed that participants with low trust in science \((-1 \text{ SD})\) intended to respect COVID-19 guidelines more in the compliance condition than in the other two conditions, \( F(1, 494) = 26.7, p < .001, \eta^2_p = 0.24 \). However, the reverse effect was observed for participants who trusted science because they intended to respect more COVID-19 guidelines in noncompliance and control conditions than in the compliance condition, \((+1 \text{ SD})\), \( F(1, 494) = 9.71, p = .002, \eta^2_p = 0.01 \).
The main effect of trust in science was significant, F(1, 494) = 36.4, p < .001, $\eta^2_p = 0.06$: the perception that ingroup members will comply with COVID-19 guidelines increased as trust in science increased ($B = 0.31$). C1 was also significant, F(1, 494) = 10.6, p = .001, $\eta^2_p = 0.02$: participants expected that ingroup members will respect more COVID-19 guidelines in the compliance condition (M = 4.52, SD = 1.11) than in noncompliance condition (M = 4.06, SD = 1.22) or in the control condition (M = 4.32, SD = 1.11). The differences between control and noncompliance conditions were qualified by $\eta^2_p = 0.02: participants expected that ingroup members will respect more COVID-19 guidelines in the compliance condition than in the other two conditions, F(1, 494) = 32.1, p < .001, $\eta^2_p = 0.06$: showing that solidarity with ingroup members increased for those who reported a stronger trust in science ($+1$ SD) because they showed lower support for conspiracy beliefs about COVID-19 in the compliance condition than in the other two conditions, F(1, 494) = 29.6, p < .001, $\eta^2_p = 0.05$. However, the simple effect was not significant for individuals who trusted science ($-1$ SD), F(1, 494) = 0.46, p = .498, $\eta^2_p = 0.001$.

### 9.2.4 National solidarity

The main effect of trust in science on national solidarity was significant, F(1, 494) = 32.1, p < .001, $\eta^2_p = 0.06$, showing that solidarity with ingroup members increased for those who reported a stronger trust in science ($B = 0.52$). Both C1, F(1, 494) = 0.36, p = .548, $\eta^2_p = 0.001$, and C2, F(1, 494) = 0.40, p = .525, $\eta^2_p = 0.001$, were not significant. However, the predicted C1 x trust in science interaction was significant, F(1, 494) = 12.5, p < .001, $\eta^2_p = 0.02$, while the C2 x trust in science interaction was not significant, F(1, 494) = 0.51, p = .474, $\eta^2_p = 0.001$.

Simple effects analyses revealed that participants with low trust in science ($-1$ SD) expressed more solidarity in the compliance condition than in the other two conditions, F(1, 494) = 8.75, p = .003, $\eta^2_p = 0.01$. However, the simple effect was not significant for individuals with high trust in science ($+1$ SD), F(1, 494) = 3.83, p = .051, $\eta^2_p = 0.008$.

### 9.2.5 Conspiracy beliefs

The main effect of trust in science on support for conspiracy beliefs was significant, F(1, 494) = 209.64, p < .001, $\eta^2_p = 0.29$: support for conspiracy beliefs about COVID-19 was lower for those who had greater trust in science ($B = -0.75$). Both C1, F(1, 494) = 0.57, p = .450, $\eta^2_p = 0.001$, and C2, F(1, 494) = 0.90, p = .343, $\eta^2_p = 0.002$, were not significant. However, the predicted C1 x trust in science interaction was significant, F(1, 494) = 22.34, p < .001, $\eta^2_p = 0.04$, while the C2 x trust in science interaction was not significant, F(1, 494) = 0.49, p = .484, $\eta^2_p = 0.000$. Simple effects analyses revealed that participants with low in science ($-1$ SD) showed lower support for conspiracy beliefs about COVID-19 in the compliance condition than in the other two conditions, F(1, 494) = 14.23, p < .001, $\eta^2_p = 0.02$. However, the reverse effect was observed for participants with high trust in science ($+1$ SD) because they showed lower support for conspiracy beliefs about the COVID-19 in the noncompliance and control conditions than people in the compliance condition, F(1, 494) = 7.88, p = .005, $\eta^2_p = 0.01$.

### 9.2.6 Collective actions

The main effect of trust in science was significant, F(1, 494) = 111, p < .001, $\eta^2_p = 0.18$: collective actions intentions against COVID-19 regulations decreased as trust in science increased ($B = -0.72$). Both C1, F(1, 494) = 2.93, p = .087, $\eta^2_p = 0.006$, and C2, F(1, 494) = 1.14, p = .285, $\eta^2_p = 0.002$, were not significant. However, the predicted C1 x trust in science interaction was significant, F(1, 494) = 16.2, p < .001, $\eta^2_p = 0.03$, while the C2 x trust in science interaction was not significant, F(1, 494) = 0.21, p = .644, $\eta^2_p = 0.003$.

Simple effects analyses revealed that participants with low in science ($-1$ SD) were less willing to take actions against COVID-19 regulations in the compliance condition than in the other two conditions, F(1, 494) = 17.10, p < .001, $\eta^2_p = 0.03$. However, the simple effect was not significant for individuals who trusted science ($+1$ SD), F(1, 494) = 2.45, p = .118, $\eta^2_p = 0.005$.
9.3 | Mediation analyses

As in previous experiments, we conducted moderated mediation analyses on our main outcomes. We entered either C1 (i.e., the compliance condition against the noncompliance and control conditions) or C2 (i.e., the difference between noncompliance and control conditions) as the independent variable and trust in science as the moderator. Finally, we entered national solidarity as a mediator.

Regarding personal behaviors, the analysis showed that the moderated mediation index (−0.05) was significant, with an interval value that did not include zero in its 95% CI [−0.08, −0.02]. The indirect effect of C1 was significant when trust in science was low, $B = 0.01$ (SE = 0.01), 95% CI [0.005, 0.07], but not when it was high, $B = -0.01$ (SE = 0.02), 95% CI [−0.08, 0.001]. The moderated mediation index for C2 was not significant, CI [−0.04, 0.08].

Regarding ingroup behaviors, the analysis showed that the moderated mediation index (−0.02) was significant, with an interval value that did not include zero in its 95% CI [−0.04, −0.01].

The indirect effect of C1 was significant when trust in science was low, $B = 0.02$ (SE = 0.01), 95% CI [0.002, 0.04], but not when it was high, $B = -0.02$ (SE = 0.01), 95% CI [−0.05, 0.001]. The moderated mediation index for C2 was not significant, CI [−0.02, 0.05].

Regarding conspiracy beliefs, the analysis showed that the moderated mediation index (0.01) was significant, with an interval value that did not include zero in its 95% CI [0.002, 0.02]. The indirect effect of C1 was significant among individuals with low trust in science, $B = -0.009$ (SE = 0.005), 95% CI [−0.02, −0.006], but not among those with high trust in science, $B = 0.009$ (SE = 0.06), 95% CI [−0.006, 0.02]. The moderated mediation index (−0.005) for C2 was not significant, CI [−0.02, 0.01].

Regarding collective actions, the analysis showed that the moderated mediation index (0.03) was significant, with an interval value that did not include zero in its 95% CI [0.01, 0.06]. The indirect effect of C1 was significant when trust in science was low, $B = -0.02$ (SE = 0.01), 95% CI [−0.05, −0.003], but not when it was high, $B = 0.03$ (SE = 0.01), 95% CI [−0.001, 0.06]. The moderated mediation index for C2 was not significant, CI [−0.06, 0.03].

9.4 | Discussion

While the results of Experiment 3 were in line with the findings of Experiments 1 and 2 concerning H1a and H2a, there was one notable difference. In terms of personal behaviors, individuals who trusted in science showed a reverse effect: they tended to adhere more to COVID-19 guidelines in the noncompliance and control conditions than in the compliance condition, thus countering the absence of a compliance norm. Additionally, Experiment 3 provided novel support for H1b, indicating that participants with low (vs. high) trust in science were less willing to take action against COVID-19 regulations in the compliance condition compared to other conditions. Finally, it offered support for H2b, suggesting that the compliance condition, compared to other conditions, enhanced national solidarity among individuals with low (vs. high) trust in science, which was then associated with a reduced willingness to participate in collective actions against COVID-19 health advice.

10 | GENERAL DISCUSSION

Our research examined how exposing people to ingroup norms regarding health advice concerning COVID-19, while also considering trust in science (i.e., the moderating role of trust in science), impacts individuals’ behaviors, perceptions of ingroup members’ behaviors, national solidarity, and support for conspiracy beliefs related to the pandemic.

In all experiments, trust in science moderated the effect of group members’ compliance with COVID-19 health advice (vs. non-compliance in experiments 1–3, and the control condition in Experiment 3) on personal and perceived ingroup compliance with health advice, expectations for ingroup members’ behaviors, national solidarity, and support for conspiracy beliefs. Individuals with low trust in science intended to adhere to health advice, expected ingroup members to do the same, and experienced greater solidarity with other ingroup members when exposed to the ingroup compliance condition compared to the noncompliance condition (in all experiments) or its absence (Experiment 3). On the other hand, individuals with high trust in science consistently exhibited intended behaviors to comply with health advice, expected their ingroup members to do the same, and experienced feelings of national solidarity, regardless of the experimental condition to which they were exposed, except for Experiment 3 regarding personal behaviors.

Moreover, individuals with low trust in science exhibited reduced support for COVID-19 conspiracy beliefs when exposed to non-compliance conditions (in all experiments) or their absence (i.e., the control condition in Experiment 3). However, individuals with high trust in science decreased their support for conspiracy beliefs more in the noncompliance condition (in all experiments) and in the control condition (Experiment 3) than in the compliance condition. Indeed, for individuals with low trust in science, being exposed to the ingroup compliance condition led to lower support for conspiracy beliefs about COVID-19 compared to the noncompliance condition. This aligns with the expected direction, as adherence to the ingroup norm would likely reinforce trust in scientific information and decrease reliance on conspiracy beliefs. On the other hand, for individuals with high trust in science, the opposite effect was observed. They showed lower support for conspiracy beliefs in the noncompliance condition compared to the compliance condition. This unexpected finding suggests that the non-compliance condition had a counterintuitive effect on individuals who typically trust scientific information. One possible explanation could be that the non-compliance norm, which implied limited adherence to COVID-19 health advice within the ingroup, contradicted participants’ preconceived beliefs about societal attitudes towards such guidelines. As a result, they may have experienced cognitive dissonance, leading to a heightened endorsement of conspiracy beliefs as a means of reconciling the discrepancy between their beliefs and the presented norm (McKinnie, 2015).
This process highlights the complex interplay between trust in science, social norms, and cognitive processes in shaping individuals’ beliefs about health-related issues like COVID-19.

Last, in all experiments, national solidarity mediated the effect of the compliance norm condition (compared to other conditions) on personal compliance with health advice, expected ingroup behaviors, and conspiracy beliefs among individuals with low (vs. high) trust in science. These findings hold theoretical and societal relevance across various research domains. While prior research has shown that exposure to social norms can significantly influence individuals’ behavior and beliefs (Borinca et al., 2024a; Borinca, Andrighetto, et al., 2021; Cialdini et al., 1990), our findings provide theoretical insights into the complex interplay between social norms, trust in science on individual and collective behavior. By demonstrating the moderating role of trust in science, our research extends theories of social influence by highlighting how individuals’ trust in scientific information shapes their responses to ingroup norms regarding health behavior. This suggests that individuals’ susceptibility to social influence varies based on their level of trust in scientific authority, enriching our understanding of how social norms operate in different contexts. Moreover, the study elucidates the mechanisms through which ingroup norms influence behavior and belief systems, contributing to theoretical frameworks of normative behavior and group dynamics.

Our research also contributes to the literature on trust in science and information processing. Previous studies have indicated that trust in science is associated with greater acceptance of scientific information and adherence to health guidelines (Algan et al., 2021; Bicchieri et al., 2021). The current findings advance theories of trust formation and information processing by highlighting the differential effects of trust in science on individuals’ responses to health crises. By showing that trust moderates the impact of ingroup norms on behavior and belief systems, the study underscores the importance of considering individual differences in trust when designing public health interventions and communication strategies. This suggests that trust in science serves as a critical lens through which individuals interpret and respond to scientific information, influencing their willingness to adhere to health guidelines, susceptibility to conspiracy beliefs, and collective actions against authoritative health advice. These insights contribute to theoretical models of information processing, trust dynamics, and the spread of misinformation.

Our findings also contribute to research on national solidarity and collective behavior. Prior research has shown that national solidarity plays a crucial role in promoting collective action and resilience during crises (Kinsella et al., 2023; Maher et al., 2022; Muldoon, Bradshaw, et al., 2021). Our findings offer theoretical contributions to our understanding of national solidarity and collective behavior during health crises. By demonstrating the mediating role of national solidarity, the study extends theories of collective behavior by elucidating how societal factors influence individual responses to public health initiatives. The findings suggest that fostering national solidarity can enhance adherence to health guidelines and mitigate belief in conspiracy theories, particularly among individuals with lower trust in science. This underscores the importance of social cohesion in promoting collective well-being and resilience during times of crisis, enriching theoretical frameworks of identity formation, social cohesion, and collective action.

Finally, our findings contribute to research on conspiracy beliefs. Previous research has indicated that conspiracy beliefs are associated with lower trust in official narratives and scientific information (Lobato et al., 2020). The current study extends these findings by demonstrating that trust in science moderates the relationship between exposure to ingroup norms and support for conspiracy beliefs, suggesting that individuals’ trust in scientific authority influences their susceptibility to conspiracy theories during public health crises (Jolley & Paterson, 2020; Jolley et al., 2022; Tonković et al., 2021).

10.1 Limitations and directions for future research

Although our findings are important and novel, we acknowledge the limitations of our research and suggest directions for future studies. First, while we hypothesized that perceived compliance (vs. noncompliance) regarding COVID-19 guidelines would reduce support for conspiracy beliefs among individuals with low trust in science, we did not anticipate such effects for those with high trust in science. Indeed, we presumed they would show very similar reactions (e.g., less support for conspiracy beliefs) regardless of the experimental manipulation. Contrary to our expectations, however, the results across all experiments demonstrate that individuals who trusted science reported lower support for conspiracy beliefs when exposed to the noncompliance condition than those in the compliance condition. We contend that the reason for this effect is that when presented with information about others not complying with COVID-19 health advice, it contradicted their personal beliefs on this issue. However, we cannot be sure of the mechanisms leading to this observed effect. Thus, future research should seek to further explain the rationale for these reactions among individuals who trust science.

Second, we also conducted alternative moderated mediation analyses, with conspiracy beliefs acting as the mediator and personal and perceived ingroup behaviors, and national solidarity as outcomes for each experiment (see Supporting Information Material). Results showed that the index of moderated mediation via conspiracy theories was significant across all experiments (except Experiment 3 for ingroup behaviors). These results suggest that conspiracy theories could also be regarded as a mediator predicting not only personal and ingroup behaviors but also national solidarity. Therefore, it is important to approach conclusions cautiously regarding cross-sectional mediations, as there may be further explanations for the relationship between our investigated variables (Fiedler et al., 2011). Third, we assessed national
solidarity with a single item, which may not capture the multifaceted nature of this concept, potentially overlooking nuances and variability within it; therefore, future research should establish validated measures of national solidarity. Furthermore, while Study 2 demonstrated acceptable reliability for conspiracy beliefs ($\alpha = .61$), it is crucial to acknowledge that reliability estimates can vary across different studies due to various factors. Despite this limitation, the consistent and robust findings of conspiracy beliefs across Experiments 1 and 3, with higher reliability estimates ($\alpha = .76$ and $\alpha = .78$, respectively), contribute to the overall reliability and validity of our measure. The convergence of results across multiple studies strengthens our confidence in the reliability of the measure and underscores its consistency in capturing conspiracy beliefs.

Fourth, the results of Experiment 3 regarding the manipulation check showed that the manipulation had a stronger effect on norm perception among individuals with low trust in science compared to those with high trust in science. However, this pattern was not observed in Experiments 1 and 2. While trust in science was assessed in the same manner across all experiments, the discrepancy in the number of conditions between the first two experiments and Experiment 3 could have contributed to the observed variation in results. Nevertheless, future research should assess trust in science not only in the pretest but also in the posttest (before and after the manipulation) to gain a more holistic understanding of these differences and reactions.

Fifth, while our research focused on experimentally manipulating descriptive social norms regarding health advice, future research could enhance understanding by investigating the impact of prescriptive social norms on personal and collective behaviors, national solidarity, and conspiracy theories (e.g., Rupar et al., 2024; Valsecchi et al., 2024). Exploring these dimensions would provide a more comprehensive insight into the interplay between social norms, health behaviors, and broader societal dynamics. Finally, we acknowledge that our sample primarily consisted of university students, which may introduce a bias towards greater support for science, as our data overall showed that not many participants endorsed conspiracy theories. Indeed, our studies did not include people from minority groups or individuals with frontlines roles which could enrich perspectives regarding these issues (Kinsella et al., 2023; Muldoon, Liu, et al., 2021). Therefore, future research should aim to include a more representative sample.

10.2 Conclusion

Our research delved into the interplay between trust in science and social norms regarding individuals’ intended behaviors, expectations of ingroup members’ behaviors, national solidarity, and beliefs in conspiracy theories during public health crises such as the COVID-19 pandemic. By unveiling the moderating role of trust in science, we emphasize the importance of individual differences in shaping responses to ingroup norms, thereby guiding the design of interventions to promote adherence to health guidelines and counter conspiratorial beliefs. Moreover, our findings highlight the significant association between national solidarity and both personal and perceived collective compliance, as well as the reduction of conspiracy beliefs and collective actions against authoritative health advice.

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DATA AVAILABILITY STATEMENT

The data that support the findings will be available in OSF at https://osf.io/xtjfw following an embargo from the date of publication to allow for commercialization of research findings.

ETHICS STATEMENT

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. The authors declare that there are no potential conflicts of interest concerning the research, authorship, and/or publication of this article. All data is available on the open science platform (OSF; https://osf.io/xtjfw/).

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ENDNOTES

1 Experiments 1 and 2 took place between November 5 and November 20, 2021, while Experiment 3 took place between December 9 and December 20, 2021.
2 The pre-registration link for Experiments 1 & 2. https://osf.io/pgkwu
3 Additional Measures: For investigative purposes, we also included another scale at pretest: a two-item scale assessing trust in the government.
4 Note that we also had the item “I believe the medication already exists to prevent or treat coronavirus [in all experiments],” Because it may not be considered a conspiracy belief per se, it was not averaged along with the other conspiracy belief items averaged across our experiments. Nevertheless, it is worth noting that the results were virtually the same regardless of whether this item is included.
5 In our pre-registration, we initially outlined our plan to investigate whether conspiracy theories mediated the impact of predicted interactions on our outcomes. However, given the consistent findings in social psychology highlighting the substantial mediating role of empathy and solidarity on group-related outcomes (Borinca, Andrijighetto, et al., 2021), we opted to deviate from our pre-
registered hypothesis 2. In the spirit of transparency, we have decided to report the results that include conspiracy theories as a mediator and solidarity as an outcome in the Supporting Information Material. Notably, the indirect effect of predicted interactions on solidarity, as mediated by conspiracy theories, has proven to be statistically significant across all three studies. Please refer to the discussion or the Supporting Information Material for more information.

Additional Measures: As in Experiment 1, we also included another pretest measure (i.e., trust in government) for exploratory purposes. We report the analyses for these variables in the Supporting Information Material since their description is beyond the scope of this article.

The preregistration link for Experiment 3. https://osf.io/ehv36

Additional Measures: As in previous experiments, we also included another pretest (i.e., trust in government) for investigative purposes. Because their description is beyond the scope of this paper, we describe the analyses for these variables in the Supporting Information Material.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.


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