Seeing COVID-19 Is Believing: Direct and Indirect Experiences With COVID-19 Predict Health Behaviours Through Conspiracy Beliefs and Risk Perception

Nicholas D. Evans[1] and Adam K. Fetterman[2]

[1]University of Manitoba

[2]University of Houston

Corresponding author: Nicholas D. Evans, Department of Psychology, University of Manitoba, Room P404 Duff Roblin Building, 190 Dysart Road, Winnipeg, MB, R3T 2N2, Canada; Email: nicholas.evans@umanitoba.ca

All analyses are preregistered and can be accessed at: https://osf.io/jp2m6. The analysis code is available at: https://osf.io/jtyw5/. Since this paper involves the analysis a secondary dataset, an ethics and consent statement is not applicable to this research. Information about the data collected by Azevedo et al. (2022), which were used in this study, as well as their ethics and materials are available at: https://osf.io/tfsza/.

Abstract

When people are confronted with research that contradicts their own personal experiences, they tend to deny the science. Using a secondary multinational dataset collected during the early stages of the COVID-19 pandemic (*N* = 46,490; Azevedo et al. 2023), we tested this “seeing is believing” effect as it relates to the link between direct and indirect personal experience with COVID-19 and public health behaviours (PHBs) through COVID-19 conspiracy beliefs and perceived risk of infection. Indirect experience with COVID-19 was associated with lower endorsement of COVID-19 conspiracy beliefs, which negatively predicted risk perception of infection, and in turn, positively predicted PHBs. However, direct experience positively predicted COVID-19 conspiracy beliefs, while it negatively predicted perceived risk. Moreover, while indirect experience positively predicted PHBs, direct experience largely negatively predicted PHBs. Implications of these findings as it relates to the “seeing is believing” effect are discussed.

Keywords: COVID-19 health behaviours, COVID-19 risk perception, cognitive dissonance, science denial, conspiracy beliefs

Seeing COVID-19 Is Believing: Direct and Indirect Experiences With COVID-19 Predict Health Behaviours Through Conspiracy Beliefs and Risk Perception

Scientific information on the COVID-19 pandemic and the efficacy of the common means of slowing the spread of the virus was, and is, readily available at most people's fingertips. This information has been clear that the disease is, without a doubt, serious and that behaviours and policies designed to slow the spread (e.g., spatial distancing and mask wearing) have been effective (Wang et al., 2021; Zhang et al., 2020). Yet, even with the availability and certainty of this scientific information, a non-trivial number of people were hesitant to adopt behaviours and support policies designed to mitigate against the spread of the disease. Along with scientific illiteracy and misinformation campaigns, several psychological biases likely contribute to this hesitancy. The current study focuses on a phenomenon that potentially contributed to lowered perceived risk as an important factor leading to reduced public health support for fighting the spread of COVID-19. Specifically, we tested the idea that people are less likely to accept scientific evidence when it conflicts with their personal experience (Evans & Fetterman, 2022). That is, because the COVID-19 disease and its effects were relatively invisible, those without personal experience with the disease's severity could easily downplay its seriousness, their perceived risk, and the need to support public health initiatives to slow the spread of COVID-19. Seeing is believing.

Predictors of COVID-19 Public Health Behaviours

Prior work has identified many factors linked to a lack of support of behaviours that help slow the spread of COVID-19—henceforth referred to as COVID-19 public health behaviours (PHBs). First, different socio-political and psychological factors contribute to COVID-19 PHB (non)compliance. Namely, people who identify as more liberal had a greater tendency to support

COVID-19 PHBs (Gadarian et al., 2021). Additionally, researchers have identified psychological entitlement as a predictor of COVID-19 PHB noncompliance (Zitek & Schlund, 2021), whereas holding social-oriented values and believing that these values are shared with others are associated with greater compliance (Wolf et al., 2020).

Beyond these psychological determinants, much of the research highlights two psychological factors associated with both enhanced and reduced support for COVID-19 PHBs: perceived risk and COVID-19 conspiracy beliefs. First, perceiving that COVID-19 poses a serious risk to one's health and well-being and the likelihood that one can become infected with the disease was consistently shown to be positively associated with COVID-19 PHB support (Abdelrahman, 2022; Bruine de Bruin & Bennett, 2020; Hughes et al., 2022; Schumpe et al., 2022; Wise et al., 2020). In essence, if people think they are at risk of infection and the corresponding potentially dire symptoms of COVID-19, they are more likely to follow recommended procedures to reduce this risk.

In addition to risk perception, much of the work within the psychological literature on predictors and correlates of COVID-19 PHBs demonstrates that noncompliance is also linked to conspiracy beliefs surrounding the COVID-19 pandemic. Imhoff and Lamberty (2020) noted a mixed relationship between COVID-19 conspiracy beliefs and PHBs. They found that COVID-19 conspiracy beliefs that diminish the legitimacy the virus (e.g., that the virus is a hoax) were negatively associated with COVID-19 PHBs, whereas conspiracy beliefs that exacerbate the danger of the virus (e.g., that it was manufactured in a laboratory) were positively associated with "self-centered prepping" behaviors (e.g., hoarding goods; Imhoff & Lamberty, 2020). Moreover, Imhoff and Lamberty (2020), as well as Šrol et al. (2020), found a direct link between COVID-19 conspiracy beliefs and perceived risk, such that, conspiracy beliefs that diminish the legitimacy of the pandemic were negatively associated with perceived risk of infection, whereas the beliefs that exacerbate the danger of the virus were not associated with threat perception.

However, overall, the research demonstrates a negative relationship between COVID-19 conspiracy beliefs and COVID-19 PHB compliance (e.g., spatial distancing and policy support; Earnshaw et al., 2020; Pummerer et al., 2022). Further, in line with this negative link between conspiracy beliefs and perceived risk and COVID-19 PHBs, Hughes et al. (2022) found conspiracy beliefs (both general and COVID-19-specific) to be negatively linked to risk perception, which in turn, was positively linked to PHBs. Not only that, but perceived risk was also shown to mediate the negative association between conspiracy beliefs and PHBs (Hughes et al., 2022). Therefore, when people hold COVID-19 conspiracy beliefs, specifically beliefs that diminish the legitimacy of the disease, they tend to perceive the disease as not posing a substantial risk or threat to their health, and in turn, are less likely to abide by PHBs.

There are likely many factors that influence conspiracy beliefs, perceived risk and, ultimately, PHB (non)compliance. Of course, given the global proliferation of the spread of misinformation via social media (Barua et al., 2020; Pian et al., 2021) and political polarization (Jiang et al., 2020; Kerr et al., 2021) within the United States, it is tempting to focus on these as contributors to people's perceived risk of COVID-19 infection and PHB (non)compliance. However, a factor that appears to be overlooked is personal experience. Prior work investigating noncompliance of COVID-19 PHBs provides initial evidence of the role personal experience plays. Both direct and indirect experience have been shown to be positively associated with PHBs. Dryhurst et al. (2020) found direct experience to be a significant positive correlate of both perceived risk of infection as well as PHBs. Moreover, they found that learning more about the virus from family and friends—and likely their personal experiences with the virus—was also associated with perceived risk. This hints at indirect experience possibly playing a key role in enhancing perceived risk. Yet, more direct evidence further illuminates the role of indirect experience. Jasielska et al. (2022) measured participants' indirect experiences (e.g., having a loved one who was infected by COVID-19) as a correlate of PHBs, and in line with the findings from Dryhurst et al. (2020), found these experiences to be positively associated with PHB compliance. Simply experiencing the virus—or knowing someone who has experienced the virus—firsthand seems to be an important factor in predicting both risk perception and, consequently, PHBs.

Building on this line of reasoning, the current study focuses on personal experience with COVID-19 and how it contributes to holding COVID-19-specific conspiracy beliefs, perceived risk, and PHB (non)compliance. Specifically, while most available scientific information indicates that the risk of COVID-19 is much higher than any risks of following recommended public health protocols (e.g., mask wearing; He et al., 2021; Liao et al., 2021), people's personal experience with COVID-19 might contradict this information. This, then, could lead to cognitive biases and processes that lead to lowered perceived risk of infection and noncompliance with PHBs.

A Model for COVID-19 PHB Hesitancy Based on Personal Experience

Classic research in psychological science suggests that people tend to pay more attention to case-specific information than group tendencies, a phenomenon called "base rate ignorance" (Kahneman & Tversky, 1973). This is where anecdotal evidence and personal experience hold their power. It is much easier for a person to draw upon their past experiences to judge something as real or not, than to rely on statistical averages. Indeed, when scientific information does not match a person's lived experience, it takes less cognitive effort to just reject it, rather than incorporating this new information. In this sense, average tendencies that contradict case-specific information hinders fluent processing, which can lead to negative attitudes towards the presented information (Schwarz, 2004; Schwarz et al., 2007). For example, we often hear skepticism regarding climate change on unseasonably cold days. Here, people's case-specific information, or personal experience (cold weather), contradicts the idea that the globe is getting warmer on average. This requires the person to reconcile their personal experience with average tendencies to incorporate the new scientific information.

The reconciliation of discrepancies between scientific information (group or average tendencies) and personal experience (case-specific information) reflects another classic psychological process: cognitive dissonance (Festinger, 1962). When people experience dissonance – a form of psychological discomfort—they are motivated to reduce it as quickly as possible (Elliot & Devine, 1994). The most common dissonance reduction strategy is adding new beliefs (Festinger, 1962), especially when the contradicting information is strong (Goldberg et al., 2020). For example, upon hearing that the earth is warming on an unseasonably cold day, a person might reduce their dissonance by adding a belief that climate change is a conspiracy made up by scientists and evil politicians or that the risk is exaggerated. In the same vein, when applied to the COVID-19 pandemic, if an individual has not personally experienced the adverse health-related symptoms after testing positive for the disease or does not know someone who has been afflicted by the disease, they may reduce their dissonance by adding the belief that the COVID-19 is no worse than a common cold. Of most importance for the current project, these added beliefs typically end with people rejecting or ignoring the dissonance-inducing information (Goldberg et al., 2020; Kaplan et al., 2016).

Recently, in relation to scientific information from personality psychology, Evans and Fetterman (2022) tested the idea that if scientific findings do not match one's personal experience, people are likely to deny the science (i.e., that "seeing is believing"). Specifically, they found that when participants' self-reported scores on two personality or individual difference variables contradicted research that demonstrates a robust and consistent relationship between the two variables, the participants not only perceived this discrepancy with their personal experience, but ultimately reported greater psychological discomfort and were more likely to deny the research. Importantly, it was this perceived discrepancy with their personal experience that directly led to the discomfort more so than the actual discrepancy between their scores on the measures and the science. This investigation supports the idea that people are skeptical of scientific information that does not match their personal experiences.

Of course, skepticism or the rejection of established correlations in personality science is low stakes compared to COVID-19 PHB noncompliance. Furthermore, COVID-19 and behaviours that slow the spread of the disease are not directly relevant to people's identity, like the personality variables investigated by Evans and Fetterman (2022). Yet, it is likely that the "seeing is believing" effect might have been even more insidious for the COVID-19 pandemic and its PHBs. Unlike personality variables, in which people have direct personal experience, and some other pandemics (e.g., smallpox) or epidemics (e.g., polio), the effects and severity of COVID-19 are relatively invisible for many people. That is, while millions have been infected by COVID-19 and many have suffered or even died, people rarely saw these impacts first-hand, especially in the earlier parts of the pandemic due to quarantine requirements. The information regarding the effects of the COVID-19 pandemic were often statistical in nature and disseminated in the form of scientific infographics on news broadcasts or websites. Furthermore, a large portion of people who had contracted the disease experienced mild-to-no symptoms. Therefore, reports about the severity of COVID-19, individual risk, and the need for PHBs from the scientific community may have struck some as discrepant with their personal experiences, leading to cognitive dissonance, skepticism, and COVID-19 PHB noncompliance.

Overall, then, we should expect that those who had relatively little direct experience with COVID-19 in the early parts of the pandemic to be more likely to experience dissonance, believe false narratives about COVID-19, perceive their personal risk as lower, and thus, be more skeptical about the need to follow PHBs. This is what the current project is designed to test.

Current Investigation

We tested whether experiencing COVID-19 both directly (testing positive for the coronavirus) and indirectly (knowing someone who tested positive for the coronavirus) positively predicts PHBs through a negative association with conspiracy beliefs surrounding COVID-19 and a positive association with perceived risk of COVID-19 infection. Using a publicly available multinational dataset collected by Azevedo et al. (2023) during the early stages of the pandemic (specifically from April 22 to June 3, 2020), we tested seven pre-registered hypotheses[1]:

Hypothesis 1: Direct and indirect experience with COVID-19 will positively predict COVID-19 PHBs.

Hypothesis 2: Direct and indirect experience with COVID-19 will positively predict perceived risk of COVID-19 infection.

[1] The dataset, materials, and other information regarding the Azevedo et al. (2023) study is available at https://osf.io/tfsza/. Our pre-registered hypotheses are available at https://osf.io/jp2m6, and our analysis code is available at https://osf.io/jtyw5/.

Hypothesis 3: Direct and indirect experience with COVID-19 will negatively predict COVID-19 conspiracy beliefs.

Hypothesis 4: COVID-19 conspiracy beliefs will negatively predict COVID-19 PHBs.

Hypothesis 5: COVID-19 conspiracy beliefs will negatively predict perceived risk.

Hypothesis 6: Perceived risk will positively predict COVID-19 PHBs.

Hypothesis 7: Direct and indirect experience with COVID-19 will positively predict COVID-19 PHBs indirectly through reduced conspiracy beliefs and enhanced risk perception.

Method

We conducted a secondary analysis from data reported by Azevedo et al. (2023), who collected these data to provide social and moral psychologists a comprehensive dataset of potential psychological predictors of COVID-19 behaviours from a representative sample. Therefore, the original study did not test any hypotheses regarding the variables collected. We used the dataset that was cleaned by the original authors, removing participants who provided inattentive responses and who failed to complete at least half of the items of the survey (i.e., the "no bots" dataset; Azevedo et al., 2023). This dataset can be accessed through the Open Science Framework: osf.io/98fex. We only report sample characteristics and descriptive statistics for variables relevant to our hypotheses. For an in-depth discussion of the sample characteristics, data collection procedures, and descriptive statistics for all variables collected for this study, see Azevedo et al. (2023).

Participants

The dataset consisted of 46,490 participants from 75 unique samples among 68 countries (age: M = 43.13, SD = 16.07, 107 undisclosed; gender: 22,148 men, 24,152 women, 159 "other", 31 undisclosed)[2]. Participants completed a battery of demographic questionnaires and measures assessing several personality characteristics, social psychological constructs, and attitudes and behaviours regarding in line with the procedures outlined by Azevedo et al. (2023).

Materials

Direct and Indirect Experience with COVID-19

To assess the first of our two key predictor variables, participants responded to one binary (yes/no) question assessing their direct experience with COVID-19—whether they tested positive for COVID-19 (n_{yes} = 2,678; n_{no} = 43,749; 63 undisclosed). To assess our second key predictor, participants responded to one binary (yes/no) question assessing their indirect experience with COVID-19—whether they know someone who tested positive for COVID-19 (n_{yes} = 9,652; n_{no} = 36,790; 48 undisclosed).[3] Among the participants who indicated they have tested positive for COVID-19 and those who knew someone who tested positive, 1,790 indicated that they both tested positive themselves and knew someone who tested positive.

COVID-19 Conspiracy Theory Beliefs

Participants responded to a four-item measure along an 11-point scale (0 = *strongly disagree*, 10 = *strongly agree*) to assess their conspiracy beliefs surrounding the COVID-19 pandemic (e.g., "The coronavirus (COVID-19) is a bioweapon engineered by scientists"). We

[2] This dataset also includes three unique samples from Brazil, two from Canada, two from Colombia, two from India, two from Italy, and two from Mexico. Two samples were not included in the "no bots" cleaned dataset for not having attention check responses.

[3] It is worth noting that there is a distinction between the term coronavirus and COVID-19. The coronavirus—known formally as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—is the virus that causes the coronavirus disease, also known as COVID-19 (World Health Organization, n.d.). Although COVID-19 tests are used to test for the presence of the SARS-CoV-2 virus, positive tests are used to determine confirmed and probable cases of the COVID-19 disease (Centers for Disease Control and Prevention, 2021). Although the questions assessing direct and indirect experiences with COVID-19 specifically state infection of the coronavirus disease, which are our key variables of interest, we wanted to make this distinction clear as the wording of these questions include both "coronavirus" and "COVID-19" terms.

averaged across all four items to create a composite COVID-19 conspiracy beliefs score, such that higher mean scores indicate stronger conspiracy beliefs (*M* = 3.06, *SD* = 2.93, α = .92).

COVID-19 Risk Perception

Participants responded to two items along a 0-100% slider scale to measure their perceived risk of testing positive for COVID-19 (e.g., "How likely do you think it is that you will get infected by the Coronavirus (Covid-19)?"). We averaged across the two items to create a composite COVID-19 risk perception score, such that higher mean scores indicate higher perceived risk of COVID-19 infection (*M* = 44.71%, *SD* = 25.50%, inter-item *r* = .91).

COVID-19 PHBs

To assess COVID-19 PHBs, participants responded to three separate public health support measures, each measured with five items along an 11-point scale (0 = *strongly disagree*, 10 = *strongly agree*). First, participants completed a five-item measure assessing their spatial distancing behaviours (e.g., "I have been staying at home as much as practically possible"). Second, participants completed a five-item measure assessing their hygiene behaviours in response to the pandemic (e.g., "I have been washing my hands longer than usual"). Third, participants completed a five-item measure assessing their support for policies designed to slow the spread of COVID-19 (e.g., "I have been in favor of closing all schools and universities"). After reverse scoring the second spatial distancing item, we averaged across the five items for each scale to create composite spatial distancing (*M* = 8.34, *SD* = 1.70, α = .73), hygiene (*M* = 7.93, *SD* = 1.88, α = .79), and policy support (*M* = 7.86, *SD* = 2.27, α = .87) scores, such that higher mean scores on these measures indicate higher public health support.

Results

Testing Hypotheses 1-6: Multilevel Models

We first wanted to test the individual links between experience (direct and indirect) with COVID-19, COVID-19 conspiracy beliefs, COVID-19 risk perception, and COVID-19 PHBs. To do so, we ran a series of multilevel models (MLMs) using the "lme4" package in R (Bates et al., 2015), considering the nested nature of participants within country samples (Raudenbush & Bryk, 2002). To distinguish between within-group and between-group effects, we group-mean centered all continuous predictor variables (Enders & Tofighi, 2007). Moreover, for all models, we included random effects to account for between-group variability in the intercepts and the slopes (Barr et al., 2013), but we only report the fixed effects as they pertain directly to our hypotheses.

In line with our analyses, we only included a single predictor variable in each model (see Table 1 for all MLM results). We first found that indirect experience positively predicted hygiene and policy support—confirming our first hypothesis—but not spatial distancing. However, contrary to our first hypothesis, direct experience *negatively* predicted each of these PHBs. Confirming our second hypothesis, we found that direct and indirect experience would positively predict risk perception. Contrary to our third hypothesis, indirect experience did not have a significant negative association with conspiracy beliefs, while direct experience showed a *positive* association. Confirming our fourth hypothesis, conspiracy beliefs negatively predicted all three PHBs. Contrary to our fifth hypothesis, conspiracy beliefs did not negatively predict perceived risk. Finally, partially supporting our sixth hypothesis, risk perception positively predicted two PHBs—hygiene and policy support—but not spatial distancing.

Because there was a sizable number of participants who indicated that they themselves tested positive for COVID-19 and knew someone who tested positive, we also deemed it important to test the extent to which direct and indirect experience uniquely predict conspiracy beliefs, perceived risk, and PHBs (Hypotheses 1-3), when both predictors are included in the same model. Therefore, we ran additional exploratory MLMs to test these effects (see Table 2). These findings largely mirrored the previous findings, with one exception: When direct experience was included in the same model as indirect experience, indirect experience had a significant positive association with spatial distancing and conspiracy beliefs, falling in line with our first and third hypotheses.

Table 1

Multilevel Models for Individual Associations Between COVID-19 Experience (Direct and Indirect), Conspiracy Beliefs, Risk Perception, and PHBs (Hypotheses 1-6)

Hypothesis	Predictor	Outcome	df	*t*	*b* [95% CI]
1	DE	Spatial Distancing	53.93	-8.17***	-.568 [-.705, -.425]
		Hygiene	34.34	-2.44*	-.162 [-.304, -.013]
		Policy Support	13.92	-6.48***	-.439 [-.592, -.282]
	IE	Spatial Distancing	47.18	-.183	-.006 [-.073, .059]
		Hygiene	47.89	5.34***	.152 [.093, .211]
		Policy Support	43.28	2.32*	.081 [.008, .152]
2	DE	RP	52.89	6.78***	7.775 [5.398, 10.015]
	IE	RP	52.13	10.04***	5.549 [4.460, 6.647]
3	DE	CB	62.78	3.77***	.553 [.255, .843]
	IE	CB	52.44	-.55	-.034 [-.157, .088]
4	CB	Spatial Distancing	68.96	-12.40***	-.266 [-.308, -.223]
		Hygiene	64.43	-4.54***	-.080 [-.116, -.043]
		Policy Support	69.18	-9.34***	-.313 [-.379, -.245]
5	CB	RP	68.29	.42	.161 [-.610, .915]
6	RP	Spatial Distancing	69.04	1.11	.024 [-.019, .067]
		Hygiene	60.03	5.66***	.098 [.061, .132]
		Policy Support	69.53	6.11***	.140 [.092, .185]

Note. DE = Direct Experience, IE = Indirect Experience, CB = Conspiracy Beliefs, RP = Risk Perception; *$p < .05$, **$p < .01$, ***$p < .001$

Table 2

Multilevel Models Testing the Extent to Which Both Direct and Indirect Experience Predict PHBs, Conspiracy Beliefs, and Perceived Risk, When Holding Each Other Constant (Hypotheses 1-3)

Hypothesis	Predictors	Outcome	df	*t*	*b* [95% CI]
1	DE	Spatial Distancing	55.67	-8.41***	-.588 [-.726, -.444]
	IE		41.31	2.22*	.060 [.005, .113]
	DE	Hygiene	32.95	-3.39**	-.223 [-.364, -.075]
	IE		45.49	5.97***	.170 [.111, .229]
	DE	Policy Support	135.59	-7.60***	-.487 [-.632, -.350]
	IE		47.33	3.32**	.115 [.044, .186]
2	DE	Perceived Risk	49.40	5.65***	4.893 [3.732, 7.957]
	IE		47.53	9.94***	4.724 [3.778, 5.677]
3	DE	Conspiracy Beliefs	64.019	4.14***	.576 [.306, .850]
	IE		70.33	-3.16**	-.131 [-.213, -.050]

Note. DE = Direct Experience, IE = Indirect Experience; *$p < .05$, **$p < .01$, ***$p < .001$

Testing Hypothesis 7: Structural Equation Models

In our original pre-registered analysis plan, we planned to test Hypothesis 7 using a series of multilevel structural equation models (SEMs) to test our overall proposed path model in which experience with COVID-19 predicts PHBs through conspiracy beliefs and risk perception. However, several of the country samples exhibited zero within-group variance, prohibiting us from using the multilevel approach. Therefore, we deviated from our analysis plan and tested our analyses using a series of SEMs, without taking into consideration within-group differences. As support for this revised analytic plan, the intra-class correlations for all endogenous variables exhibited relatively little within-group variance: conspiracy theory beliefs ICC = .17; risk perception ICC = .13; spatial distancing ICC = .09; hygiene ICC = .13; policy support ICC = .18.

We modeled seven SEMs with increasing complexity using the “lavaan” package in R (Rosseel, 2012). For each model, we used full information maximum likelihood estimation to account for missing data. We also estimated corresponding indirect effects with 95% confidence intervals using 10,000 percentile method bootstrapped samples (see Table 3).

First, we tested the path models in which direct experience predicts each of the three PHBs, through conspiracy beliefs and risk perception (see Figure 1; Models 1-3). Direct experience positively predicted conspiracy beliefs, which negatively predicted perceived risk, which in turn, positively predicted all three PHBs. While direct experience positively predicted conspiracy beliefs (contradicting our hypothesis), direct experience did positively predict risk perception, hygiene behaviours, and policy support. Moreover, as hypothesized, conspiracy beliefs negatively predicted risk perception and the PHBs, and risk perception positively predicted the PHBs. Moreover, the total indirect effects for each model were significant.

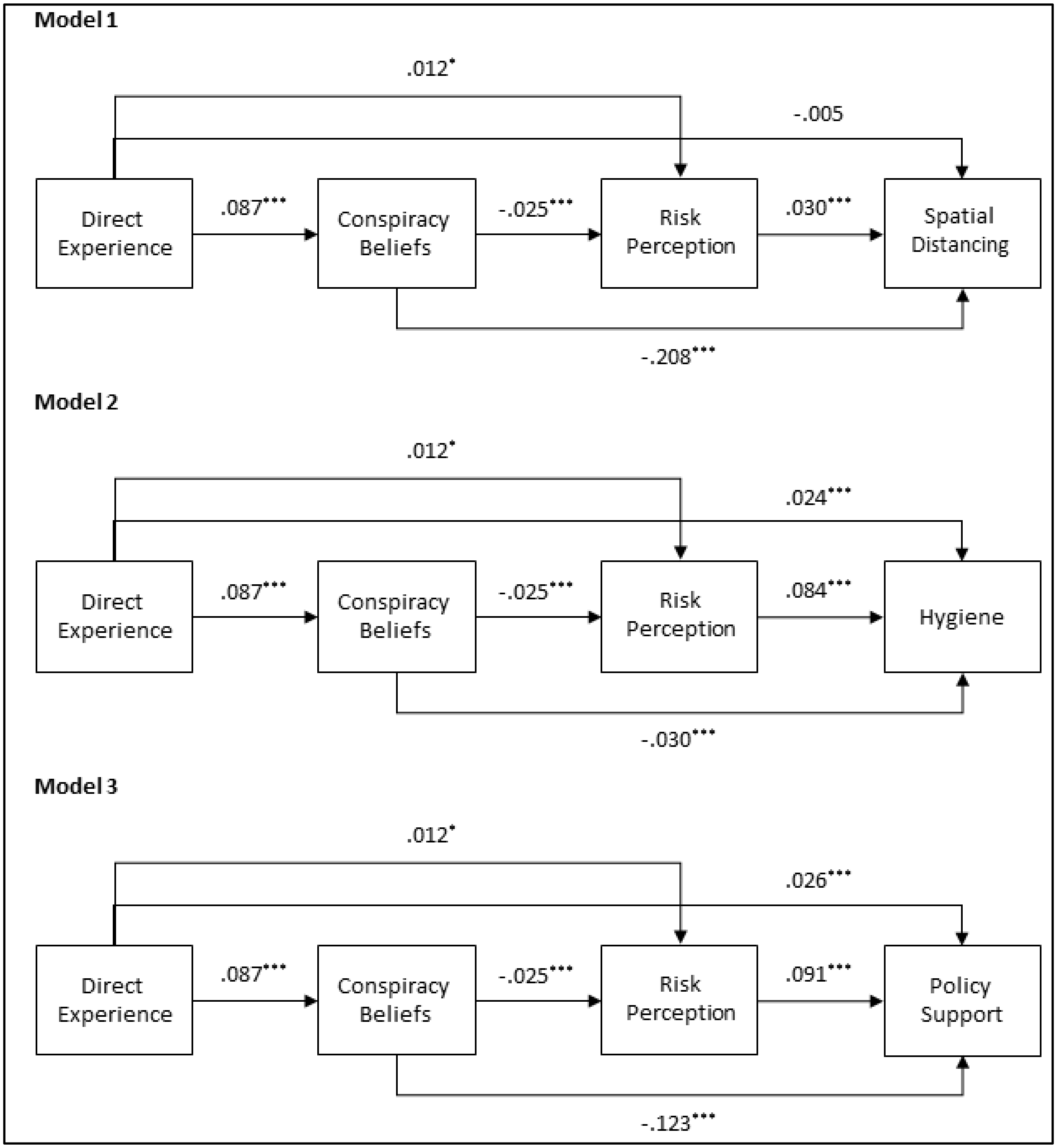
Second, we tested the path models in which indirect experience predicts each of the three PHBs, through conspiracy beliefs and risk perception (see Figure 2; Models 4-6). As hypothesized, indirect experience negatively predicted conspiracy beliefs, which negatively predicted perceived risk, which in turn, positively predicted all three PHBs. Indirect experience also positively predicted risk perception and all three PHBs. Moreover, conspiracy beliefs negatively predicted risk perception and the PHBs, and risk perception positively predicted the PHBs. The total indirect effects for each model were also significant, supporting our mediating path.

Third, we tested the path models in which direct *and* indirect experience predicts each of the three PHBs, through conspiracy beliefs and risk perception (see Figure 3; 7-9). Contradicting our hypothesis, direct experience with COVID-19 positively predicted conspiracy beliefs, while it negatively predicted risk perception and spatial distancing. However, direct experience did positively predict hygiene behaviours and policy support. The total indirect effects for direct experience were all statistically significant. Supporting our hypothesis, indirect experience negatively predicted conspiracy beliefs and positively predicted risk perception and the three PHBs. Moreover, conspiracy beliefs negatively predicted risk perception and the PHBs, and risk perception positively predicted the PHBs. The total indirect effects for indirect experience were all statistically significant.

Finally, we tested a full path model in which direct and indirect experience predicts all three PHBs together, through conspiracy beliefs and risk perception (see Figure 4; Model 10). Mirroring the previous models, direct experience positively predicted conspiracy beliefs while negatively predicting risk perception and spatial distancing. However, it did positively predict policy support. Indirect experience negatively predicted conspiracy beliefs while positively predicting risk perception and all three PHBs, supporting our hypotheses. Moreover, conspiracy beliefs negatively predicted risk perception and the PHBs, and risk perception positively predicted the PHBs. Finally, all total indirect effects were significant for the paths between 1) direct experience, conspiracy beliefs, risk perception, and the PHBs; and 2) indirect experience, conspiracy beliefs, risk perception and the PHBs.

Figure 1

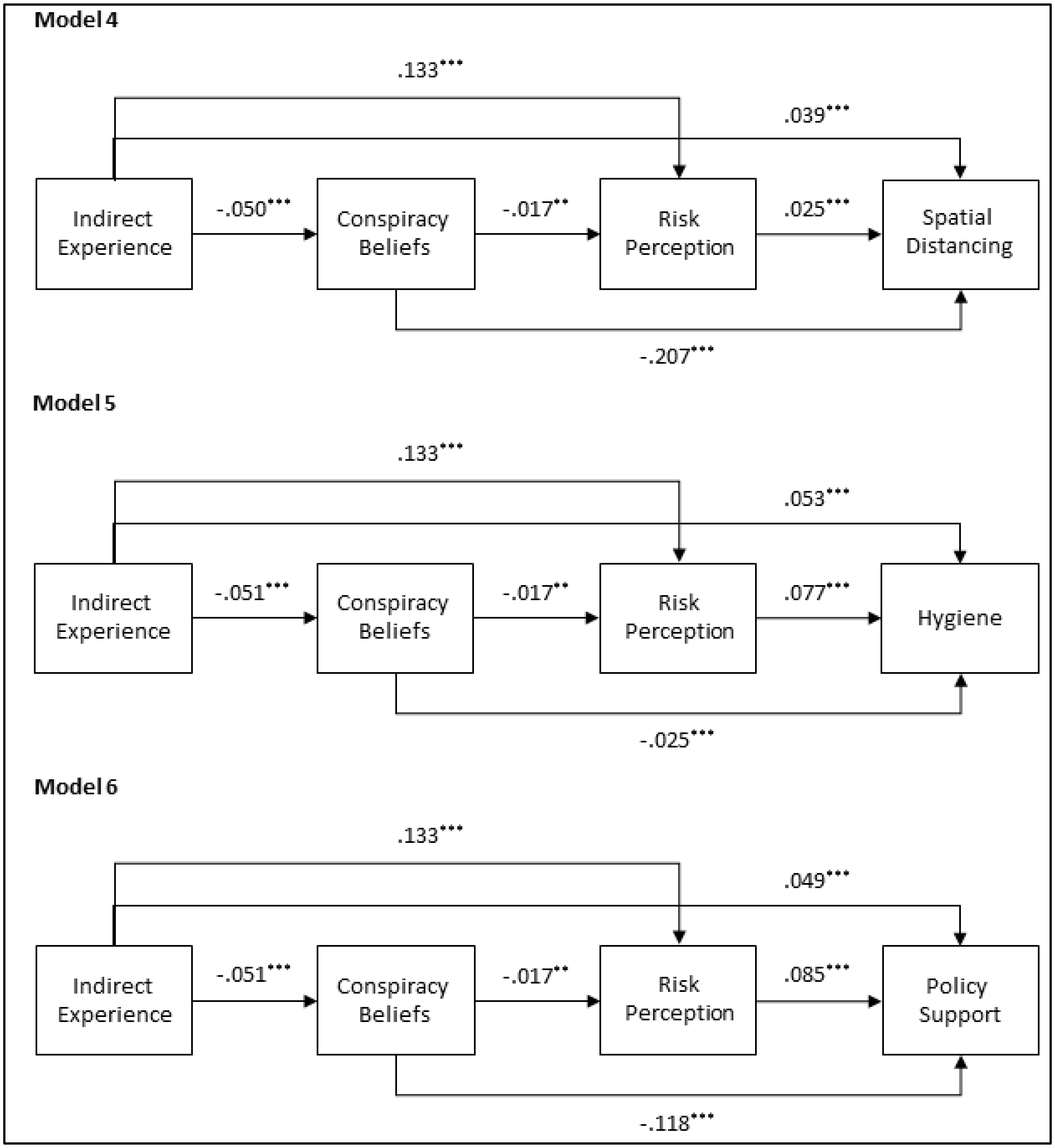
Path Models for Direct Experience Predicting Each PHB, through Conspiracy Beliefs and Risk Perception (with Standardized Coefficients)



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

Figure 2

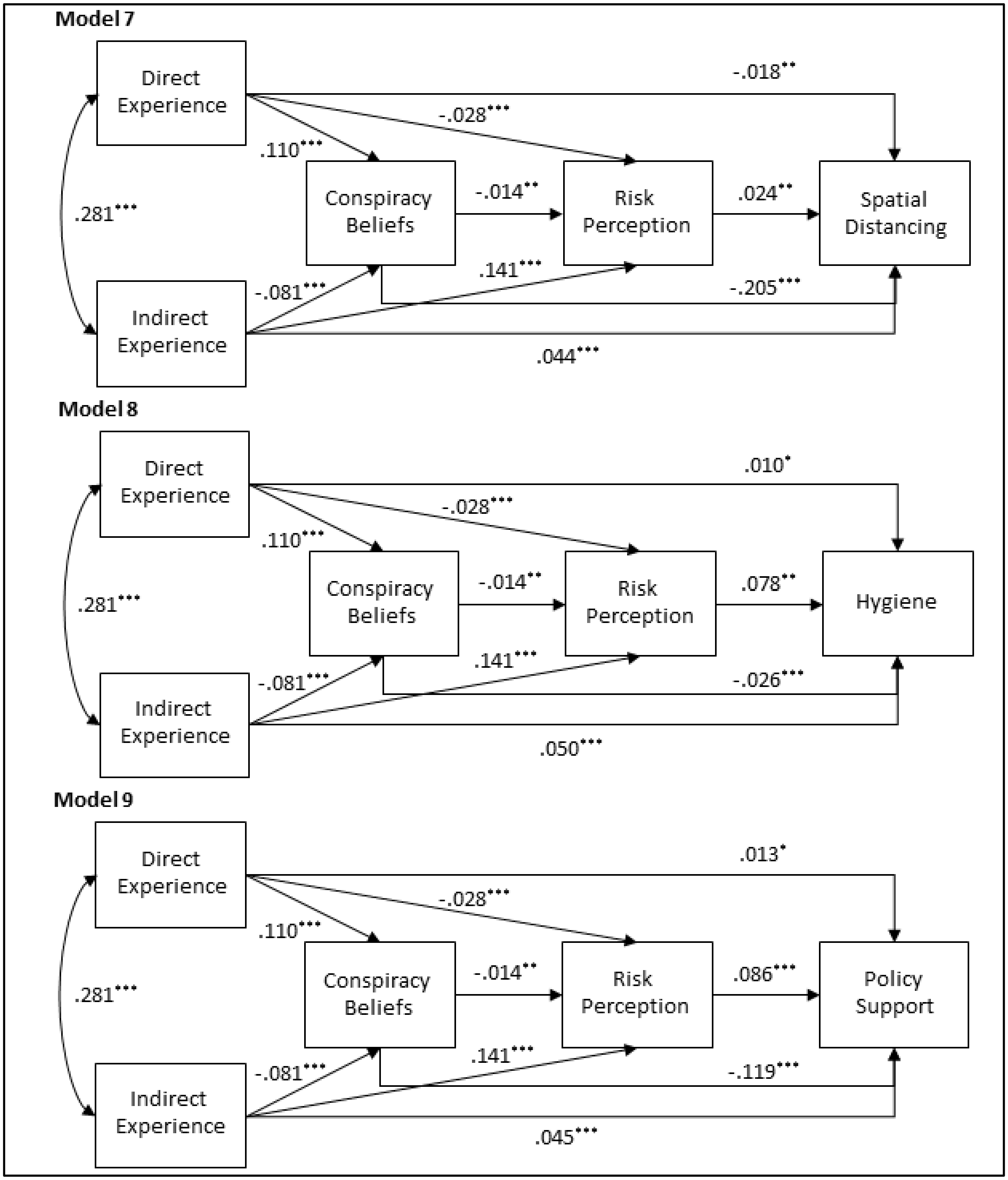
Path Models for Indirect Experience Predicting Each PHB, through Conspiracy Beliefs and Risk Perception (with Standardized Coefficients)



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

Figure 3

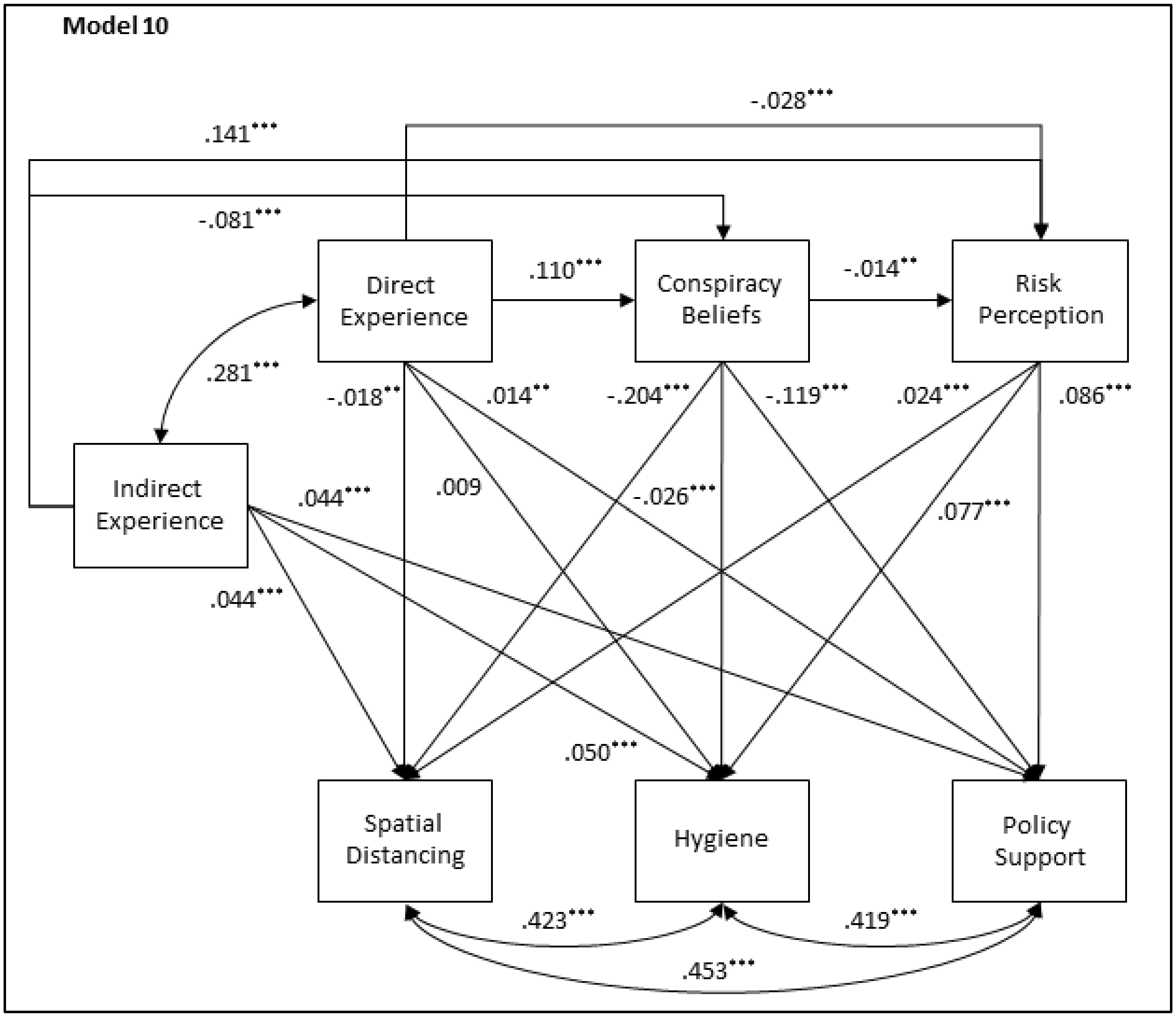
Path Models for Direct and Indirect Experience Predicting Each PHB, through Conspiracy Beliefs and Risk Perception (with Standardized Coefficients)



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

Figure 4

Path for Direct and Indirect Experience Predicting the PHB, through Conspiracy Beliefs and Risk Perception (with Standardized Coefficients)



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

Table 3

Indirect Effects for the Path Models in Which Direct and Indirect Experience Predict PHBs, through Conspiracy Beliefs and Risk Perception

Model	Indirect Effect	*β*	*b* [95% CI]
1	DE → CB → RP	-.002***	-.237 [-.336, -.142]
	DE → CB → SD	-.018***	-.132 [-.148, -.117]
	DE → RP → SD	.000*	.003 [.000, .005]
	CB → RP → SD	-.001***	.000 [-.001, .000]
	Total: DE → CB → RP → SD	-.087***	-.367 [-.471, -.267]
2	DE → CB → RP	-.002***	-.237 [-.335, -.141]
	DE → CB → H	-.003***	-.021 [-.028, -.014]
	DE → RP → H	.001*	.008 [.002, .015]
	CB → RP → H	-.002***	-.001 [-.002, -.001]
	Total: DE → CB → RP → H	-.006***	-.251 [-.351, -.155]
3	DE → CB → RP	-.002***	-.236 [-.335, -.139]
	DE → CB → PS	-.011***	-.105 [-.119, -.091]
	DE → RP → PS	.001*	.011 [.002, .019]
	CB → RP → PS	-.002***	-.002 [-.002, -.001]
	Total: DE → CB → RP → PS	-.014***	-.332 [-.436, -.231]
4	IE → CB → RP	.001**	.054 [.023, .088]
	IE → CB → SD	.010***	.044 [.036, .052]
	IE → RP → SD	.003***	.014 [.009, .019]
	CB → RP → SD	.000**	.000 [.000, .000]
	Total: IE → CB → RP → SD	.014***	.111 [.076, .149]
5	IE → CB → RP	.001**	.054 [.022, .088]
	IE → CB → H	.001***	.006 [.003, .008]
	IE → RP → H	.010***	.048 [.041, .055]
	CB → RP → H	-.001**	-.001 [-.001, .000]
	Total: IE → CB → RP → H	.011***	.106 [.074, .141]
6	IE → CB → RP	.001**	.053 [.022, .087]
	IE → CB → PS	.006***	.033 [.027, .040]
	IE → RP → PS	.011***	.063 [.055, .072]
	CB → RP → PS	-.001**	-.001 [-.002, .000]
	Total: IE → CB → RP → PS	.017***	.149 [.115, .187]
7	DE → CB → RP	-.002**	-.171 [-.290, -.052]
	DE → CB → SD	-.023***	-.164 [-.180, -.147]
	DE → RP → SD	-.001***	-.005 [-.008, -.003]
	IE → CB → RP	.001**	.072 [.022, .123]
	IE → CB → SD	.017***	.069 [.061, .078]
	IE → RP → SD	.003***	.014 [.009, .020]
	CB → RP → SD	.000*	.000 [.000, .000]
	Total 1: DE → CB → RP → SD	-.025***	-.340 [-.463, -.220]
	Total 2: IE → CB → RP → SD	.021***	.156 [.104, .209]

8	DE → CB → RP	-.002**	-.171 [-.293, -.053]
	DE → CB → H	-.003***	-.023 [-.032, -.014]
	DE → RP → H	-.002***	-.018 [-.025, -.011]
	IE → CB → RP	.001**	.072 [.022, .124]
	IE → CB → H	.002***	.010 [.006, .014]
	IE → RP → H	.011***	.051 [.044, .058]
	CB → RP → H	-.001**	-.001 [-.001, .000]
	Total 1: DE → CB → RP → H	-.008**	-.212 [-.335, -.094]
	Total 2: IE → CB → RP → H	.013***	.132 [.082, .185]
9	DE → CB → RP	-.002**	-.170 [-.289, -.053]
	DE → CB → PS	-.013***	-.128 [-.144, -.113]
	DE → RP → PS	-.002***	-.024 [-.033, -.015]
	IE → CB → RP	.001**	.072 [.022, .123]
	IE → CB → PS	.010***	.054 [.047, .062]
	IE → RP → PS	.012***	.068 [.059, .077]
	CB → RP → PS	-.001**	-.001 [-.002, .000]
	Total 1: DE → CB → RP → PS	-.018***	-.322 [-.445, -.204]
	Total 2: IE → CB → RP → PS	.022***	.192 [.142, .246]
10	DE → CB → RP	-.002**	-.171 [-.292, -.054]
	DE → CB → SD	-.022***	-.164 [-.180, -.147]
	DE → RP → SD	-.001***	-.005 [-.008, -.003]
	IE → CB → RP	.001**	.072 [.023, .123]
	IE → CB → SD	.017***	.069 [.061, .078]
	IE → RP → SD	.003***	.014 [.009, .020]
	CB → RP → SD	.000*	.000 [.000, .000]
	DE → CB → H	-.003***	-.023 [-.032, -.014]
	DE → RP → H	-.002***	-.018 [-.024, -.011]
	IE → CB → H	.002***	.010 [.006, .014]
	IE → RP → H	.011***	.051 [.043, .058]
	CB → RP → H	-.001**	-.001 [-.001, .000]
	DE → CB → PS	-.013***	-.128 [-.145, -.113]
	DE → RP → PS	-.002***	-.024 [-.032, -.015]
	IE → CB → PS	.010***	.054 [.046, .062]
	IE → RP → PS	.012***	.067 [.058, .077]
	CB → RP → PS	-.001**	-.001 [-.002, .000]
	Total 1: DE → CB → RP → SD	-.025***	-.339 [-.465, -.221]
	Total 2: IE → CB → RP → SD	.021***	.155 [.104, .209]
	Total 3: DE → CB → RP → H	-.008**	-.221 [-.335, -.095]
	Total 4: IE → CB → RP → H	.013***	.132 [.082, .183]
	Total 5: DE → CB → RP → PS	-.018***	-.323 [-.450, -.205]
	Total 6: IE → CB → RP → PS	.022***	.193 [.142, .246]

Note. β = standardized coefficients, *b* [95% CI] = unstandardized coefficients with bias-corrected confidence intervals; DE = Direct Experience, IE = Indirect Experience, CB = Conspiracy Beliefs, RP = Risk Perception, SD = Spatial Distancing, H = Hygiene, PS = Policy Support; *$p < .05$, **$p < .01$, ***$p < .001$

Discussion

Using a multinational dataset collected during the early days of the COVID-19 pandemic, we largely found support for our hypotheses. Most importantly, we found support for our proposed path model of personal experience (specifically, indirect experience) contributing to COVID-19 PHB compliance. While the direct and indirect effects of our path models for Hypothesis 7 tended to be smaller in terms of their standardized regression coefficients[4] when compared to effects from prior research investigating the links between our variables of interest, the effects of our multilevel models (in which we report coefficients standardized within each country) for Hypotheses 1-6 demonstrate comparable effects to. However, contrary to our hypotheses, people with direct experience with COVID-19 tended to believe in conspiracy theories surrounding COVID-19 more and perceived themselves as being at lesser risk of becoming infected with the disease. These mixed findings warrant further discussion.

Implications

The findings from this study have both theoretical and practical implications. First, these findings contribute to the science denial literature. Evans and Fetterman (2022) demonstrated that when confronted with scientific findings that contradict their own personal experiences, people tend to experience cognitive dissonance and deny the science to reduce that dissonance. While this prior work only investigated relatively benign research findings, other work has addressed the role of personal experience in denying scientific findings that may have dire consequences. For example, personal experience plays a key role in perceiving the risk of the potentially catastrophic outcomes of climate change (Van der Linden, 2014). Therefore, the current study extends these findings to a recent (and arguably ongoing) pandemic that has rocked

[4] Prior work has demonstrated that standardized regression coefficients can be used as valid effect size estimates, especially when comparing effects across multiple studies (Nieminen, 2022).

the entire globe. When people knew someone close to them who has experienced COVID-19 infection, they tended to hold lesser COVID-19 specific conspiracy beliefs, perceived themselves as more likely to be infected with the disease (and possibly even its negative health consequences), and ultimately enacted behaviours to reduce the spread of the virus.

While the data for this study was collected before the rollout of the COVID-19 vaccines, these findings have implications for people’s hesitancy to receive the COVID-19 vaccine. Several other emotional (e.g., the potential feeling of regret of infection if one does not receive the vaccine), social (e.g., social norms), and non-psychological influences (e.g., lack of access) have certainly been shown to contribute to vaccine hesitancy, while behavioural interventions have been shown to enhance vaccinations (Brewer et al., 2017). Nevertheless, prior work also highlights associations between both perceived risk and conspiracy beliefs and vaccine hesitancy. Brewer et al. (2007) noted that perceived risk—consisting of three dimensions: likelihood of infection, susceptibility to infection, and severity of infection—is significantly positively linked to adult vaccination behaviours. Directly related to the COVID-19 pandemic, Caserotti et al. (2021) investigated the association between perceived risk—operationalized as perceived likelihood of infection, perceived severity of the disease, and fear of the disease—and COVID-19 vaccination hesitancy. Perceived risk was a strong predictor of whether participants would accept the eventual COVID-19 vaccines. Overall, perceived risk stands out as a potent factor in understanding vaccine hesitancy (Brewer et al., 2007). Building on these findings, Salvador Casara et al. (2022) found that, in addition to perceived risk, conspiracy beliefs and trust in scientists predict intentions to get the COVID-19 vaccine. Moreover, similar to conspiracy beliefs’ negative link to policy support, Earnshaw et al. (2020), found that this extends to vaccine intentions.

Earlier research on general vaccine hesitancy also hints at the role personal experience plays in contributing to COVID-19 vaccine hesitancy. For example, Dubé et al. (2013) pointed to a related issue that impacts perceived risk: the visibility of the vaccine compared to the disease. Vaccines are meant to mitigate complications with a disease and are most often taken by patients when healthy (i.e., prior to infection). As a result, the risk of the disease is relatively invisible, while the risks of the vaccine are more apparent. That is, prior to getting vaccinated, a person is not currently sick, nor do they have a vaccine in them. Getting a vaccine is a proactive action that changes the latter. As a result, the disease-to-vaccine risk ratio can be difficult to overcome. Therefore, it is likely that personal experience with the disease against which the vaccine is designed to protect contributes to the perceived risk of both the disease and the vaccine itself, and in turn, the willingness or hesitancy to get vaccinated.

This work may also extend beyond individuals' hesitancy to vaccinate themselves to parents' hesitancy to vaccinate their children. Prior work investigating parental attitudes toward infant vaccinations has demonstrated that in addition to misconceptions regarding the negative side effects of vaccines (Geoghegan et al., 2020), including the disproven (Leask et al., 2010; Taylor et al., 1999; Madsen et al., 2002) belief that measles, mumps, and rubella vaccine causes autism in children (Shelby & Ernst, 2013), a lack of trust in the child's pediatrician significantly contributed to vaccine hesitancy (Benin et al., 2006). While these factors have likely played a role in parent's hesitancy to allow their children to receive the COVID-19 vaccine, recent work on parental attitudes toward children receiving the COVID-19 vaccine has demonstrated that lower perceived risk of infection was linked to greater vaccine hesitancy (Horiuchi et al., 2021). As these findings mirror the work demonstrating that a lower perceived risk of infection is linked to greater hesitancy for oneself to receive the COVID-19 vaccine (Caserotti et al., 2021), having personal experience with COVID-19 may additionally play a role in reducing parents' hesitancy to vaccinate their children by enhancing perceived risk of infection.

Additionally, this study offers knowledge that is beneficial to society. The COVID-19 pandemic has not ended, and future pandemics are nearly a certainty (Marani et al., 2021). As such, it is important to take what we have learned from the COVID-19 pandemic and how people responded to it to help inform how people will respond to a future pandemic (Taylor, 2022). During the COVID-19 pandemic, health officials assumed the daunting task of keeping citizens informed about the ongoing spread of the disease, the effective measures to help reduce the spread, and the development of safe vaccines. There have been mixed results (Park et al., 2020). One issue is that scientific information can be hard to understand (Skierkowski et al., 2019), whereas personal experiences are easier to understand. Providing personal experiences could serve as an intervention to help reduce the hesitancy to engage in PHBs and receive a potential future vaccine if and when a new pandemic does occur. Indeed, earlier work hints at the potential utility of leveraging anecdotes and stories to reduce vaccine hesitancy (Shelby & Ernst, 2013). These findings, therefore, may apply to PHBs in the midst of a potential future outbreak or pandemic. Of course, such an intervention will have limited effectiveness on its own, as Shelby and Ernst (2013) highlight. However, when combined with other factors, like countering misinformation and making personal protective equipment and vaccines easily accessible, it could prove significant.

Limitations and Future Directions

While we generally found support for our hypotheses, namely for the role indirect experience plays in fostering COVID-19 PHBs, some limitations must be taken into consideration as potential avenues for future research. First, the links between direct experience with COVID-19 and conspiracy beliefs, risk perception and the PHBs were, by and large, in the opposite directions from what we hypothesized. We believe that the severity of the symptoms of the disease is likely underlying these associations. On one hand, people who tested positive for COVID-19 but were asymptomatic were likely to believe that the dire consequences of the disease that they heard through social media and other news outlets were largely overblown. On the other hand, those who were hospitalized or suffered long-term health issues as a result of COVID-19 infection would be more likely to hold conspiracy beliefs to a lesser extent, and in turn, perceive the disease as posing a greater threat to their health. However, the dataset used in this study did not assess the severity of COVID-19 symptoms for participants who reported direct experience with the disease. Furthermore, those who experienced the worst of the disease were likely unable to participate in this study. Future work investigating public health behaviours in response to infectious diseases should, therefore, assess participants' severity of infection.

Along similar lines as the measure used to assess direct experience with COVID-19, this dataset also did not assess the extent to which participants knew others who were infected. In other words, both the quantity and quality of their indirect experiences (i.e., the number of people they knew who were infected with the disease and the severity of their symptoms) were not assessed in the Azevedo et al. (2023) study. Had these data been collected, in addition to the single binary item asking whether participants knew someone infected with the disease, we may have seen a stronger association between indirect experiences with COVID-19 and conspiracy beliefs, perceived risk, and PHBs. Therefore, in addition to assessing participants' own severity of infection, future work should also take into consideration both how many people in one's social circle were afflicted by the disease as well as the severity of their symptoms.

Another limitation to the current study is how we operationalized perceived risk. As we analyzed data from a secondary source (Azevedo et al., 2023), we operationalized perceived risk in line with the items they used to measure this variable. Namely, we conceptualized perceived risk as the perceived probability of becoming infected with COVID-19. While much of the prior research investigating risk perception includes in their operational definition of perceived risk the perceived probability of risk of infection (Bruine de Bruin & Bennett, 2020; Schumpe et al., 2022; Wise et al., 2020), researchers have also taken into consideration perceived severity or danger of COVID-19 in addition to (Bruine de Bruin & Bennett, 2020; Wise et al., 2020) or instead of (Abdelrahman, 2020; Hughes et al., 2022) perceived probability of risk of infection. We believe both operational definitions are equally important, and it would be particularly important for future work to disentangle the role of perceived probability of infection from perceived danger or severity in our model of direct and indirect experiences with COVID-19 predicting PHBs.

Beyond testing the individual associations between direct and indirect experience, COVID-19 conspiracy beliefs, risk perception, and COVID-19 PHBs (e.g., Hypotheses 1-6), we tested Hypothesis 7 using a structural equation modeling approach, in which we also estimated indirect effects. Typically, path models with mediations assume a causal association between the variables. However, the dataset used for this study is cross-sectional, and as such, we cannot assume causation within the path models. For mediations involving cross-sectional data, the parameter estimates obtained for the indirect effects are likely biased (Maxwell & Cole, 2007; Maxwell et al., 2011). Thus, these path model results should be interpreted cautiously, and future work should test the causal links between our variables.

Conclusion

Overall, we obtained evidence for a model emphasizing the role of personal experience with COVID-19 in fostering PHBs through conspiracy beliefs and perceived risk of infection. These findings build on a growing line of research demonstrating that people tend to deny research findings when they conflict with their own lived experiences. This “seeing is believing” effect can extend to scientific findings that have potentially fatal consequences to health and well-being. Therefore, this work may shed light on how health officials and policymakers can combat science denialism and promote positive behaviours to ensure the safety of the public.

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