Superstitious Beliefs, Locus of Control, and Feeling at Risk in the Face of Covid-19

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Abstract

Unprecedented uncertainty during the Covid-19 pandemic stimulated anxiety amongst individuals, while the associated health restrictions contributed to a feeling of loss of control. Prior research suggests that, in times of crisis, some individuals rely on superstitious beliefs as a coping mechanism, but it remains unclear whether superstition is positively or negatively associated with fear of Covid-19 during the pandemic, and the role that individuals' locus of control plays in this regard. In two studies conducted amongst individuals in Belgium and the U.S., we therefore examined the relationship between superstitious beliefs, locus of control, and feeling at risk of Covid-19. Across both countries, we found that superstition is positively, and internal locus of control negatively, related with feeling at risk of Covid-19. Moreover, in Belgium, the effect of superstition was less pronounced for individuals with a higher level of internal locus of control. The absence of an interaction effect between superstition and locus of control in the U.S. could be explained by this country's higher level of superstitious beliefs and lower level of internal locus of control combined with a stronger feeling of being at risk of Covid-19 or cultural differences such as Belgium's higher uncertainty avoidance compared to the U.S.

Keywords: Covid-19; fear; feeling at risk; locus of control; pandemic; superstitious beliefs.

1. Introduction

Since March 2020, the Covid-19 pandemic has turned the whole world upside down. Lockdowns and sanitary restrictions, uncertainty, and continuing fear of getting infected have governed everyday life. The intensive presence of Covid-19 in the news generated fear and phobia (Arpaci et al. 2020). Indeed, since it is difficult to predict the development of the crisis and control its effects (Liu et al. 2020), the pandemic has increased individuals' worries about their present and future (Giallonardo et al. 2020; Usher et al. 2020). Fear of Covid-19 is important in itself, as it reflects one of the multiple negative effects of the pandemic on consumer well-being. Moreover, perceived vulnerability to disease has been positively associated with criticism towards government's handling of the pandemic (De Coninck et al. 2020), while generalized fear and fear-induced overreactive behavior hinder disease control (Lu and Bouey 2020). Hence, it is important to better understand what drives and what attenuates individuals' fear of Covid-19.

In this regard, the unprecedented uncertainty associated with the pandemic and its abundant coverage in the media are expected to not only propagate stress and anxiety, but also stimulate superstitious beliefs. Vyse (2013, p. 201) argued that "superstitious behavior emerges as a result of uncertainty to circumstances that are inherently random or uncontrollable." According to the Oxford Advanced American Dictionary (2022), superstition is "the belief that particular events happen in a way that cannot be explained by reason or science and/or the belief that particular events bring good or bad luck." Indeed, although researchers have not provided a unified definition of superstitious beliefs, it is often related to having irrational or false beliefs (Jahoda 1969) and trying to control good or bad luck (Kramer and Block 2011). Although most definitions include believing in magic and paranormality, some research has suggested that seeing a connection between an action and a cause that does not really exist is sufficient to qualify as being superstitious (Schippers and Van Lange 2006). For instance, thinking that sticking to

certain rituals that one believes to bring good luck or help avoid bad luck would also protect oneself from getting infected with Covid-19 would qualify an individual as being superstitious.

Superstitious beliefs are related to health and individual differences regarding illnesses and epidemics. Superstition may lead to stress, depression, and related health problems (Day and Maltby 2003; James and Wells 2002). Importantly, superstition has been shown to be able to jeopardize the implementation of Covid-19 safety measures because it leads some individuals to believe that the disease does not affect them but only other people (Amoah and Simpeh 2020). In contrast, individuals who do not believe in conspiracy theories have shown lower levels of fear and higher levels of preventive health behaviors (Jovančević and Milićević 2020).

Superstitious beliefs are often attempts to understand and control uncertainty (Ya'akov et al. 2018). Observing superstition helps regulate tension in uncertain and stressful situations, creating a feeling of control (De Paola et al. 2014; Keinan 2002), called secondary control when it does not affect real outcomes. Several studies have demonstrated a link between superstition and attitude toward life's uncontrollability (Edis 2000; Hughes and French 2002; Irwin 1994). This need to account for and cope with life's uncontrollability is closely related to locus of control, which reflects a person's general belief whether the events in their life are under her personal control or not (Rotter 1966). Therefore, to better explain how superstitious beliefs shape individuals' Covid-19 related attitudes such as the feeling of being at risk of the virus, it is important to also consider locus of control as a relevant personality and individual difference factor (Jovančević and Milićević 2020). In particular, for individuals with a stronger internal locus of control, superstitious beliefs might play less of a role in driving their fear of Covid-19.

Against this theoretical background, we performed two studies which contribute to the literature by showing that during the pandemic, superstitious beliefs did not act as a coping mechanism that helped individuals reduce their anxiety (Schippers 2020). Instead, superstitious beliefs were positively associated with fear of Covid-19, while an internal locus of control

counterbalanced this effect. Public policy makers in charge of health communications are thus advised to develop campaigns aimed at weakening individuals' reliance on superstitious beliefs while strengthening their internal locus of control by increasing the feeling of personal agency.

2. Theoretical Background and Hypotheses Development

2.1 Effect of Superstitious Beliefs on Feeling at Risk of Covid-19

Superstition is widespread, being present in developed and developing nations alike (Tsang 2004; Vyse 2013). Recently, the fear and anxiety associated with Covid-19 stimulated people's obsession with superstitions (Karmakar and Chattopadhyay 2021). Indeed, especially in times of uncertainty, individuals feel a need to rely on superstitious behaviors and/or beliefs (Schippers and Van Lange 2006). Schippers (2020) found that relying on superstitious beliefs and conspiracy theories might be one of the coping strategies individuals use to find meaning and reduce stress and anxiety related to the pandemic. This finding suggests that people carry out superstitious behaviors to gain control of situations in which, in fact, they have no control. However, as superstitious beliefs relate to individuals' tendency to try to control the uncontrollable, they can actually lead to more stress and fear (Jovančević and Milićević 2020). Hence, we expect individuals' superstitious beliefs to be positively related to fear of Covid-19:

H1: *Superstitious beliefs are positively related to individuals feeling at risk of Covid-19.*

2.2 Effect of Internal Locus of Control on Feeling at Risk of Covid-19

Locus of control reflects individuals' general beliefs about the causes of rewards and punishments (Rotter 1966). It refers to the extent to which an individual believes that life outcomes are within her personal control and dependent on her own efforts and choices (internal locus of control), rather than being dependent on fate, luck, or others (external locus of control). Previous studies have shown that internal locus of control is negatively related to fear of death (Vargo and Black 1984) and other health-related fears (Indelicato et al. 2017). Accordingly, we

expect individuals with a more pronounced internal locus of control to believe to be more in control of avoiding contracting the coronavirus and therefore feel less at risk of Covid-19:[1]

H2: *Internal locus of control is negatively related to individuals feeling at risk of Covid-19.*

2.3 Interaction Effect between Superstitious Beliefs and Internal Locus of Control

Superstitious beliefs are often associated with individuals having an external instead of internal locus of control (Belter and Brinkmann 1981; Sagone and De Caroli 2014; Stanke and Taylor 2004). Importantly, Irwin (1994) suggested that superstitious (paranormal) beliefs reflect the attempt of individuals with an external locus of control to deal with the perceived uncontrollability of their lives. Thus, we expect that for individuals with an internal locus of control, the effect of superstitious beliefs on their feelings of being at risk of Covid-19 is attenuated as these individuals' perceived ability to control what happens to them in the future is higher:

H3: *Internal locus of control negatively moderates the effect of superstitious beliefs on feeling at risk of Covid-19.*

3. Study 1

3.1 Data Collection

To test our hypotheses, we carried out an online survey. We recruited N=500 participants from an online panel of Belgians managed by data provider Qualtrics, using quotas to approach as close as possible national statistics in terms of basic socio-demographics (i.e., age, gender, income, and education). Acknowledging that Belgium consists of two language regions, the sample was equally distributed between French-speaking Walloons and Dutch-speaking Flemings. We excluded n=13 participants with incomplete or invalid responses, leaving N=487. Apart from socio-demographics, we measured participants' superstitious beliefs, internal locus of control, feeling of being at risk of Covid-19, numeracy (i.e., basic math skills), and Covid-

[1] In our analyses, we control for socio-demographic factors such as age that drive actual vulnerability to Covid-19.

19 experience in terms of having had the coronavirus themselves.[2] We discuss these measures in detail in a later section.

3.2 Sample Description

The final sample of $N = 487$ participants was equally distributed between men ($n = 242$) and women ($n = 245$), and participants from the Flemish (n=252) and Walloon (n=235) regions. The average age was 44.9 years, and many participants held university degrees (29.4% had a Bachelor's degree and 15.4% had a Master's degree), while 38% had completed secondary school. Average monthly net income was €2,669 (≈$3,017). In terms of numeracy, 8.2% of participants had no correct answers out of three questions, 18.6% had one correct answer, 41.9% had two correct answers, and 31.3% had three correct answers. The sample seemed relatively representative of the national population of Belgium in terms of its Covid-19 experience, with 7.57% of participants answering 7 on a seven-point Likert scale (anchored at 1 = completely disagree and 7 = completely agree) for a question asking "I had a confirmed Covid-19 infection." This percentage was below but approached the around 10% of the Belgian population which has had a confirmed Covid-19 infection at the time of launching the survey in September 2021.

3.3 Measurement Scales

Table 1 presents measurement scales and their reliability. Where applicable, all measures used a seven-point Likert scale for consistency and uniform appearance. In terms of reliability, all measures had Cronbach's alpha (Nunnally 1978) and composite reliability (Chin 1998) exceeding 0.70. In terms of confirming convergent validity, all items loaded significantly only on their underlying construct and the average variance extracted (AVE) exceeded 0.50 (Fornell

[2] We counterbalanced the question order to be able to control for the possibility that asking participants about their Covid-19 experience is related to their feeling of being at risk for the virus. When including a dummy variable for question order in our regression models, we find that it is non-significant itself and all other reported results remain the same.

and Larcker 1981), with the exception of the internal locus of control measure, whose AVE was marginally below 0.50 at 0.48. To establish discriminant validity, we verified that each construct's AVE was greater than the squared correlations between any set of two constructs (Fornell and Larcker 1981).

3.3.1 Feeling at Risk of Covid-19

Participants' feeling of being at risk of Covid-19 was measured with one item from the adapted Brief Illness Perception Questionnaire (Broadbent et al. 2006): "I think I am a vulnerable person who is at risk in the face of COVID-19."

3.3.2 Superstitious Beliefs

To measure superstitious beliefs, we used Carlson et al.'s (2009) four-item trait superstition scale, which included such items as "I must admit that sometimes I act like I am superstitious." One item had a relatively low factor loading but we did not delete it as this was an established and validated scale and Cronbach's alpha was still satisfactory at 0.78 with this item included.

3.3.3 Locus of Control

Participants' internal locus of control was measured with seven items from Rotter (1966), which included such items as "What happens to me in the future depends on me." Also here, there was one item with a relatively low factor loading, but as this was an established scale and Cronbach's alpha was good at 0.82, we again decided to maintain this item instead of deleting it.

3.3.4 Numeracy

Participants' numeracy was assessed with three items on a summative scale from Lusardi and Mitchell (2007), which included such items as "If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease?"

3.3.5 Control Variables

Superstition has been linked to many socio-demographic factors as well as culture (Irwin 1993). Usually, women exhibit higher levels of superstition than men (Dag 1999; Wiseman and Watt 2004). Superstition and paranormal beliefs are also usually related to lower cognitive ability (Musch and Ehrenberg 2002) and lower education levels (Aarnio and Lindeman 2005). Hence, in our analyses, we controlled for participants' age, gender, education, income, language as a proxy for within-country cultural differences, and numeracy as a proxy for cognitive ability.[3] Numeracy is also a relevant control variable as individuals' feeling of being at risk of Covid-19 should be related to their understanding of infection and mortality rates (Roozenbeek et al. 2020). We also controlled for actual experience with Covid-19, given that personal experience with Covid-19 has been found to affect people's perceived risk of the virus (Dryhurst et al. 2020).

[Insert Table 1 here]

3.4 Common Method Variance

Given that all measures were administered through a single survey, we examined the potential of common method variance (CMV) influencing our results. First, we performed a Harman's single-factor test with exploratory factor analysis based on Podsakoff et al. (2003) and confirmed that the different variables that we measured did not all load on a single factor. Second, we included in our survey a theoretically unrelated question on participants' attitude towards the color blue as a "marker variable" as per Simmering et al. (2015) and performed a Lindell and Whitney (2001) marker variable test. Participants' score on the marker variable did not correlate significantly with any of the key variables of interest. Overall, these test results suggested that there were no serious concerns of CMV bias affecting the results of our study.

[3] To address skewness in the distribution of the income variable, we followed prior literature (Gerhard et al. 2018), and took the natural log of income. To account for participants with zero income, we first added 1 to the actual value.

3.5 Results

3.5.1 Zero-Order Correlations

First, we computed zero-order correlations between the key variables of interest (Table 2). Consistent with our expectations, superstitious beliefs were significantly and positively correlated with feeling at risk of Covid-19 (coef. = .134, p = .005). Furthermore, consistent with our expectations, superstitious beliefs were significantly and negatively correlated with internal locus of control (coef. = -.201, p = .000). Finally, as expected, internal locus of control was negatively and significantly correlated with feeling at risk of Covid-19 (coef. = -.222, p = .000).

[Insert Table 2 here]

3.5.2 Regression Analysis

To test our hypotheses, we ran a series of hierarchical linear regressions (Table 3).[4] We first tested the main effect of superstitious beliefs on feeling at risk of Covid-19 and found it to be positive and significant (coef. = .146, p = .005, CI 95% [.044; .249]), supporting H1. The effect remained positive and significant after accounting for socio-demographic factors and Covid-19 experience (coef. = .206, p = .000, CI 95% [.103; .309]). We found that age was positively and significantly related to feeling at risk of Covid-19 (coef. = 0.036, p = 0.000, CI 95% [.025; .047]), consistent with the higher mortality of Covid-19 amongst older people (Yanez et al. 2020). Participants' actual Covid-19 experience was not significant and did not help explain individuals' fear of Covid-19. However, as expected, internal locus of control was significantly and negatively related to feeling at risk of Covid-19 (coef. = -.325, p = .000, CI 95% [-.457; -.192]), supporting H2. Finally, the interaction effect of superstitious beliefs and internal locus of control was significant and negative (coef. = -.078, p = .025, CI 95% [-.147; -.010]), supporting H3. To uncover simple effects of interaction at every level of internal locus of

[4] In all regression models discussed in this section, apart from those simultaneously including superstitious beliefs in the form of a main effect and an interaction effect with internal locus of control, variance inflation factors (VIFs) were below 5, meaning that multicollinearity was not a serious concern (Hair et al. 2006).

control, we performed a formal moderation analysis using Model 1 of Hayes and Preacher's (2014) Process macro. Doing so allowed us to perform a "floodlight" analysis (Spiller et al. 2013) and define Johnson-Neyman significance regions for different values of internal locus of control (Figure 1). This analysis indicated that the effect of superstitious beliefs on fear of Covid-19 started at a value of internal locus of control of 1.714 (coef. = .467, p = .003, CI 95% [.158; .775]), gradually diminished across the range of values of internal locus of control, and became insignificant from a value of internal locus of control of 5.184 (coef. = .124, p = .063, CI 95% [.000; .248]).

[Insert Table 3 here]

[Insert Figure 1 here]

3.6 Discussion

Study 1 demonstrated that superstitious beliefs are positively associated with feeling at risk of Covid-19 while this effect is attenuated for individuals with a higher internal locus of control. A limitation of Study 1 was that we measured superstitious beliefs as trait superstition, using the scale of Carlson et al. (2009) which is validated but does not distinguish between positive and negative superstition. However, Wiseman and Watt (2004) developed a scale that makes such a distinction. In this regard, negative superstition relates to individuals' beliefs that certain behaviors (e.g., breaking a mirror) are associated with harmful consequences, while positive superstition relates to individuals' beliefs that certain behaviors (e.g., carrying a good luck charm) bring about beneficial consequences. Theoretically, these two dimensions of superstition could have opposite effects on individuals' feeling of being at risk of Covid-19.

Indeed, while negative superstition has been found to relate to low self-efficacy (Tobacyk and Shrader 1991), high anxiety (Wolfradt 1997), and external locus of control (Dag 1999), positive superstition has been suggested to actually be psychologically adaptive rather than maladaptive (Wiseman and Watt 2004). In Study 2, we therefore aimed to both replicate and extend the results of Study 1, by adding a measure distinguishing between positive and negative

superstition. While we expected to find the same effect for the trait superstition measure used in Study 1, we also expected to find a differentiated effect for the positive and negative superstition measure in that positive superstitious beliefs would be negatively related to feeling at risk of Covid-19 while negative superstitious beliefs would be positively related to feeling at risk of Covid-19.

Furthermore, to assess the applicability of our findings across countries with relevant cultural differences, in Study 2 we used a sample from the U.S. Belgium has a very high score on Hofstede's cultural dimension of uncertainty avoidance (94), while the U.S. has a very low score (46) (Hofstede Insights 2022). Given that relying on superstition is a reaction of individuals to cope with uncertainty (Vyse 2013), comparing these two countries is relevant in the context of our research. A U.S. sample offered the additional benefit of access to a diverse and reliable participant pool through the crowdsourcing platform Amazon MTurk (Goodman and Paolacci 2017).

4. Study 2

4.1 Data Collection

We again performed an online survey to test our hypotheses of the positive effect of superstitious beliefs (H1), the negative effect of internal locus of control (H2), and the negative interaction effect of superstitious beliefs and locus of control (H3) on feeling at risk of Covid-19. We recruited N=500 U.S. participants using Amazon MTurk, which provides data deemed at least as reliable as those from traditional sample pools (Goodman and Paolacci 2017). Participants were asked to complete a survey on their attitudes toward Covid-19 and paid $1 in compensation. As the survey took on average 6 minutes to complete, our payment translated into an hourly wage of $10, well-above the federally mandated U.S. minimum wage of $7.25. We required participants to have a HIT rate (i.e., approval of previous tasks) higher than 90% and to be a resident of the U.S. The survey was hidden, so that only participants who met our requirements could see and access it, minimizing the bounce rate. To minimize social desirability bias, we highlighted that there were no right or wrong answers. We excluded n=67 participants

with incomplete or invalid responses, leaving *N*=433. We included the same measures as used in Study 1, with the addition of Wiseman and Watt's (2004) positive and negative superstition scale.

4.2 Sample Description

The final sample of *N*=433 participants was relatively equally distributed between men (*n*=230) and women (*n*=203). The average age of the participants was 37 years, and many held university degrees (i.e., 64.2% had a Bachelor's degree and 18.9% had a Master's degree), while 5.5% had completed secondary school. Average monthly net income of the participants was $2,966. In terms of numeracy, 28.9% of participants had no correct answers out of three questions, 37.9% had one correct answer, 20.3% had two correct answers, and 12.9% had three correct answers. The sample seemed relatively representative of the national population of the U.S. in terms of its Covid-19 experience, with 17.3% of participants answering 7 on a seven-point Likert scale for a question asking "I had a confirmed Covid-19 infection." This percentage was below but approached the around 24% of the American population which has had a confirmed Covid-19 infection at the time of launching the survey in February 2022.

4.3 Measurement Scales

Table 4 presents measurement scales and their reliability. We used the same scales as in Study 1, but added Wiseman and Watt's (2004) superstition scale. This scale had three items for positive superstition, which included such items as "Do you say 'fingers crossed' or actually cross your fingers?", and three items for negative superstition which included such items as "Would you be anxious about breaking a mirror because it is thought to cause bad luck?"

We found that the same two internal locus of control items with low factor loadings in Study 1 again had low factor loadings in Study 2. As this was a validated scale and Cronbach's alpha was still high at 0.83, we again retained these items.[5] We noted that these two items were

[5] Results were robust to excluding these two items and doing so did not change the relationships presented below.

scored in the opposite direction of the other five items of the scale which can explain their low loadings, given research on misresponse to reverse coded items (Swain et al. 2008). We confirmed that any such misresponse is unlikely to be due to respondent inattention or acquiescence effects, since all included participants passed an attention check following Paas and Morren (2018).

We confirmed the reliability of all scales, with Cronbach's alpha (Nunnally 1978) and composite reliability (Chin 1998) exceeding 0.70. Convergent validity was also established, with all items loading significantly only on their underlying construct and AVEs exceeding 0.50 (Fornell and Larcker 1981). Discriminant validity was also verified. Finally, as in Study 1, we performed a Harman's single-factor test with exploratory factor analysis (Podsakoff et al. 2003) and a marker variable test (Lindell and Whitney 2001) using the same scale of Simmering et al. (2015) as in Study 1 and confirmed that there was no substantial risk of CMV biasing the results.

[Insert Table 4 here]

4.4 Results

4.4.1 Zero-Order Correlations

As in Study 1, we again found that superstitious beliefs were significantly and positively correlated with feeling at risk of Covid-19 (Table 5). This result held for trait superstition (coef. = .554, p = .005) as well as negative (coef. = .577, p = .000) and positive superstition (coef. = .591, p = .000). Against our expectations, we did not find a differentiated effect of positive and negative superstition on fear of Covid-19. We also found that the superstition measures of Carlson et al. (2009) and Wiseman and Watt (2004) were significantly and positively correlated. Furthermore, in line with Dagnall et al.'s (2009) findings, Wiseman and Watt's (2004) positive and negative superstition scales are significantly and positively correlated (coef. = .859, p = .000). Consistent with Study 1's findings, all measures of superstitious beliefs were significantly and negatively correlated with internal locus of control (trait superstition: coef. = -.600, p = .000; negative superstition: coef. = -.642, p = .000; positive superstition: coef. = -

.667, p = .000). Finally, confirming the results of Study 1, internal locus of control was negatively and significantly correlated with feeling at risk of Covid-19 (coef. = -.550, p = .000).

[Insert Table 5 here]

4.4.2 Regression Analysis

We again ran a series of hierarchical linear regressions.[6] We provide separate results for the trait superstition scale of Carlson et al. (2009) (Table 6) and the negative (Table 7) and positive (Table 8) superstition scale of Wiseman and Watt (2004). As in Study 1, we found a positive and significant main effect of superstitious beliefs on feeling at risk of Covid-19 for trait superstition (coef. = .625, p = .000, CI 95% [.536; .714]), supporting H1. In addition, we found positive and significant main effects of both negative (coef. = .555, p = .000, CI 95% [.480; .629]) and positive superstition (coef. = .587, p = .000, CI 95% [.511; .663]) on feeling at risk of Covid 19, against our expectation of the two types of superstition having differentiated effects. These effects remained positive and significant after accounting for socio-demographic factors and Covid-19 experience. We note that the magnitude of the effect of superstitious beliefs appeared stronger than that found in Study 1. In contrast to Study 1, we did not find a significant effect of age on feeling at risk of Covid-19 in Study 2. However, while participants' actual Covid-19 experience had no effect in Study 1, it was significantly and positively related to feeling at risk of Covid-19 in Study 2. In line with the absence vs. presence of an effect of age and Covid-19 experience, we note that the magnitude of the regression coefficients of these two variables also appeared to differ across Study 1 and 2. As in Study 1, internal locus of control was significantly and negatively related to feeling at risk of Covid-19 in the regressions reported in Table 6 (coef. = -.391, p = .000, CI 95% [-.548; -.235]), Table 7 (coef. = -.353, p = .000, CI 95% [-.512; -.193]), and Table 8 (coef. = -.319, p = .000, CI 95% [-.480; -.157]),

[6] In all regression models discussed in this section, apart from those simultaneously including superstitious beliefs in the form of a main effect and an interaction effect with internal locus of control, variance inflation factors (VIFs) were below 5, meaning that multicollinearity was not a serious concern (Hair et al. 2006).

supporting H2. This effect appears similar in magnitude to that found in Study 1. Finally, H3 was not supported in Study 2 since we did not find a significant interaction effect of superstitious beliefs and internal locus of control, regardless of the superstition scale used.

[Insert Tables 6-8 here]

4.5 Discussion

Using a different sample, Study 2 confirmed the findings of Study 1 regarding the main effects of superstitious beliefs and internal locus of control on individuals' feeling of being at risk of Covid-19. Furthermore, Study 2 allowed us to confirm that not only a superstitious personality in general, but also positive and negative superstitious beliefs are related to fear of Covid-19. Against our expectations, positive and negative superstitious beliefs displayed similar effects.

While in the Belgian sample of Study 1, we found an interaction effect of superstitious beliefs and internal locus of control such that higher levels of internal locus of control reduced the effect of superstitious beliefs on the feeling of being at risk of Covid-19, in the U.S. sample of Study 2, we did not find such an interaction effect despite internal locus of control's negative main effect. This absence of an interaction effect could potentially be explained by the lower level of internal locus of control in the U.S. sample (mean = 3.87; SD = 1.21) compared to the Belgian sample (mean = 4.58; SD = 1.05) ($t(916) = 9.59$, $p = .000$), combined with the higher level of superstitious beliefs (trait) in the U.S. sample (mean = 4.73; SD = 1.65) compared to the Belgian sample (mean = 3.21; SD = 1.62) ($t(916) = -13.87$, $p = .000$). However, the means in both samples were fairly far away from their respective floor and ceiling values, so reduced variability might not be a reason for the absence of the interaction effect.

A more plausible explanation for the differences in results could be the aforementioned cultural differences. In particular, the U.S. has a much lower score on uncertainty avoidance compared to Belgium (46 vs. 94) (Hofstede Insights 2022). Uncertainty avoidance refers to "the extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions that try to avoid these" (Hofstede et al. 2005, p. 167).

As a coping mechanism of dealing with uncertain situations, an internal locus of control could thus play a more important role in Belgium than in the U.S., which would be consistent with the absence of an interaction effect of superstitious beliefs and internal locus of control in the U.S. sample.[7]

Another interesting difference between the two studies was the effect of an actual Covid-19 experience. That is, while having a Covid-19 experience was not significantly related to feeling at risk of Covid-19 for the Belgian participants of Study 1, it was positively and significantly related to feeling at risk of Covid-19 for the U.S. participants of Study 2. The magnitude of the regression coefficient also appeared substantially larger in Study 2 than in Study 1. This variation in results could potentially be explained by differences in access to free health care across these countries (Guendelman et al. 1999), making a Covid-19 experience a more fearful experience in the U.S. than in Belgium. Indeed, there was a higher level of fear of Covid-19 in terms of feeling at risk of it in the U.S. sample (mean = 4.78; SD = 1.86) compared to the Belgian sample (mean = 3.55; SD = 1.88) ($t(916) = -9.89$, $p = .000$). The latter difference could, in turn, be related to the lower level of numeracy in terms of number of correctly answered questions in the U.S. sample (mean = 1.17; SD = 0.99) compared to the Belgian sample (mean = 1.96; SD = 0.91) ($t(916) = 12.58$, $p = .000$), given prior research that numeracy is related to individuals' understanding of Covid-19 infection and mortality rates (Roozenbeek et al. 2020).

Finally, we found that age was positively and significantly related to feeling at risk of Covid-19 in Study 1 but not in Study 2. The magnitude of the regression coefficient also appeared larger in Study 1 than in Study 2. This difference in result could potentially be explained by the higher level of and variation in age of participants of Study 1 (mean = 44.96; SD = 15.15) compared to Study 2 (mean = 37.31; SD = 10.27) ($t(916) = -8.77$, $p = .000$). Moreover, given that the mortality of Covid-19 is negligible among people less than 65 years old (Yanez et al. 2020), it is also relevant to note that in Study 2 only 1.2% of participants were older than 65 years, while

[7] A statistical power analysis using G*Power (Faul et al. 2009) excluded the possibility of an underpowered sample as a robust explanation for the lack of an interaction effect between superstitious beliefs and locus of control in Study 2.

the corresponding proportion in Study 1 was 8.2%. This age difference can be traced back to the variation in sample pools, with Amazon MTurk participants as used in Study 2 known to be younger than general population participants as used in Study 1 (McCredie and Morey 2019).[8]

5. General Discussion

The results of our two studies improve our understanding of the role of superstitious beliefs on feeling at risk of Covid-19. Our findings add to prior work by documenting how being superstitious increased one's fear of Covid-19, no matter whether the individual held positive or negative superstitious beliefs (cf. Wiseman and Watt 2004). Thus, superstitious beliefs did not seem to act as a coping mechanism to deal with an uncertain situation as suggested by some recent studies (Schippers 2020), but rather were associated with an increased feeling of being at risk. Furthermore, unlike the inconclusive findings of prior research (Stanke and Taylor 2004), we demonstrated across both our studies that an internal locus of control was negatively correlated with individuals' superstitious beliefs and was also negatively related to their fear of Covid-19.

In light of the necessity to better understand the drivers of individuals' feeling of being at risk of Covid-19 to be able to improve public health measures and policy communications, our findings provide several practical guidelines. Specifically, it is important for public policy makers to understand which measures can help restore within individuals a sense of control over their life outcomes and reduce the reliance on superstitious rituals. Health interventions focused on helping individuals understand their sources of personal power, their core beliefs, and envisioning future goals can assist in building their personal agency (Shankar et al. 2019). Given that fear appeals often have unintended consequences, such as distrust in public health

[8] We performed a Multi-Group Analysis (MGA) using SmartPLS SEM to formally assess the significance of the reported differences in results between Study 1 and 2. The results of this analysis indicated that there was a significant difference in the effects of age and Covid-19 experience across the two studies. Moreover, the effect of superstitious beliefs on feeling at risk of Covid-19 was significantly greater in magnitude in Study 2 than in Study 1. For reasons of brevity, the MGA results are not tabulated, but are available from the authors upon request.

authorities, skepticism of health messaging, and a lack of uptake in recommended health behaviors (Stolow et al. 2020), our recommendations aim to reduce fear and increase knowledge.

Practically speaking, our findings lead us to posit that policy makers should: (i) address misinformation and reduce the reliance on unverified sources such as social media to fight superstitious beliefs about Covid-19 and help individuals distinguish facts from unfounded opinions; (ii) highlight the ability of individuals to reduce the spread of the virus through their own actions, stressing individuals' personal agency to stimulate their internal locus of control; and (iii) provide clear and verified facts on infectiousness and mortality, using an intuitive way to present probabilities to decrease the fear of Covid-19 among individuals with low numeracy.

Similar to "accuracy nudges" designed to reduce the spread of Covid-19 misinformation on social media (Pennycook et al. 2020), to stimulate individuals to question superstitious beliefs policy makers could use statements such as "Rely on facts, not feelings in fighting Covid-19." To increase internal locus of control and decrease fear of Covid-19, campaigns could also include statements such as "I have the power to slow the spread." Indeed, similar to the famous World War II slogan, the Centers for Disease Control and Prevention (2021) stressed individuals' potential for control over the pandemic and infection by stating "We Can Do It!"

Optimal intervention design might vary due to cultural differences. Apart from the aforementioned difference in uncertainty avoidance between Belgium and the U.S., which suggests that successful interventions in Belgium need to focus on reducing ambiguity, there is also an important difference between both countries in terms of their long-term orientation. Belgium scores much higher than the U.S. in this regard (82 vs. 26) (Hofstede et al. 2005), and individuals in the former (latter) country might thus be more responsive to health communication highlighting the long-term (short-term) virtues of changes in behavior in order to fight Covid-19.

Despite its contributions, our research was subject to some limitations which provide opportunities for future research. First, although we used a well-established measure of locus

of control from Rotter (1966) and found that it had satisfactory reliability, we found that two items that were scored in the opposite direction of the other five items had low loadings, suggesting the need for scales without reversed items as per Swain et al. (2008). Second, research should further investigate the interaction effect between superstitious beliefs and internal locus of control on feeling at risk of Covid-19 using samples from different countries, as we found such an interaction effect in Belgium but not in the U.S. Related to this is the need to more formally account for cultural differences. Third, we note that the zero-order correlations between the key variables was substantially higher in the Amazon Mturk sample of Study 2 compared to the Qualtrics sample of Study 1, which could indicate common method variance bias. However, our tests in this regard did not support such an explanation and research has shown that Amazon Mturk samples are not more prone to bias compared to other participant pools, offering reliable data (Paolacci and Chandler 2014). Hence, we call for future research to examine this issue in more detail. Fourth, we measured fear of Covid-19 by adapting an item from the well-established Brief Illness Perception Questionnaire of Broadbent et al. (2006), but acknowledge that more recently a dedicated Covid-19 Phobia Scale (C19P-S) has been developed by Arpaci et al. (2020). To examine generalizability across alternative measures, future research could also include the C19P-S scale in examinations of the relationship between superstitious beliefs, internal locus of control, and fear of Covid-19. Finally, given the cross-sectional nature of our studies, we cannot make claims regarding causality. Future research could run longitudinal surveys or experiments to establish causality.

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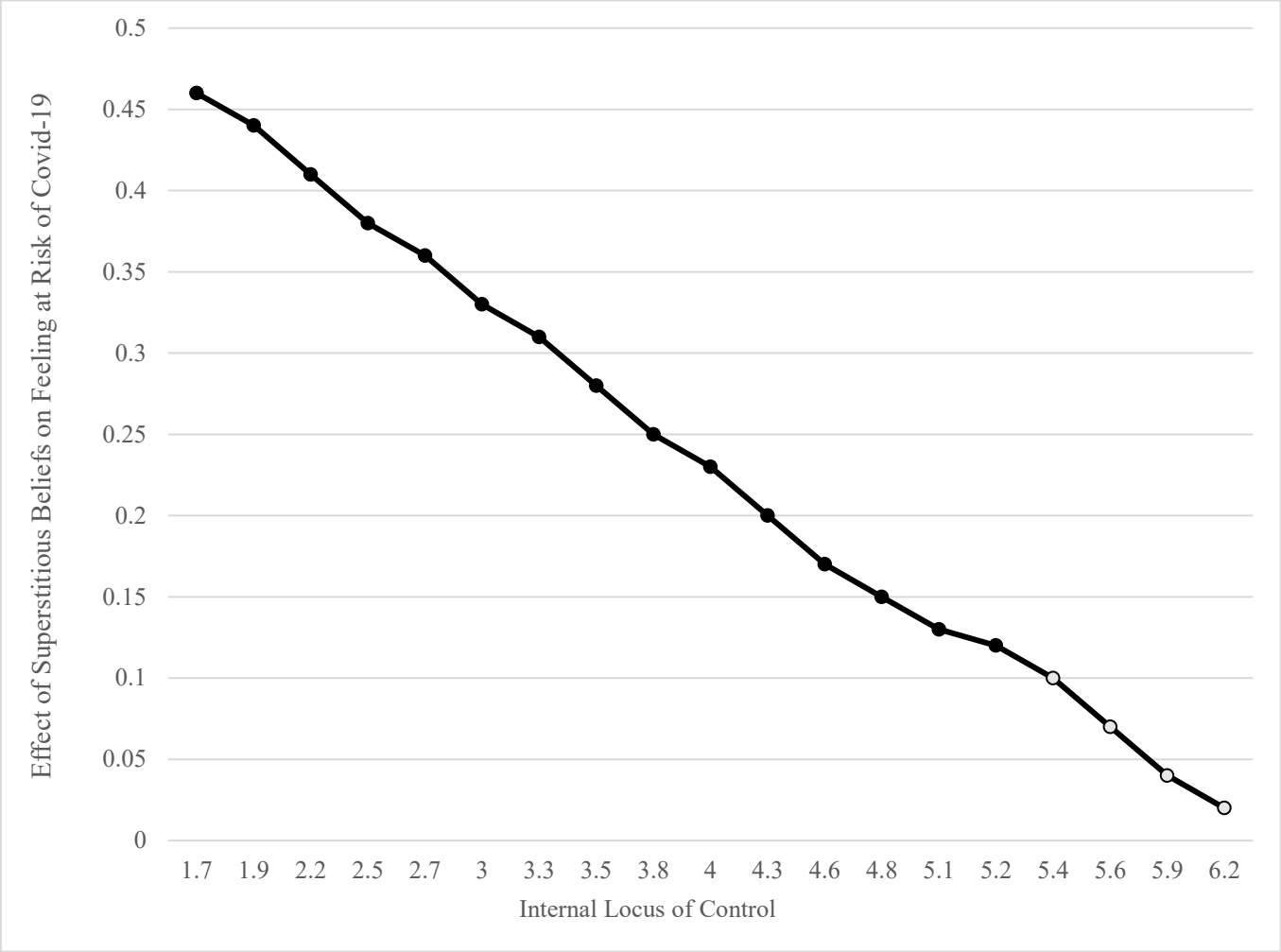
Figure 1: Johnson–Neyman Scatter Plot of Effect of Superstitious Beliefs on Feeling at Risk of Covid-19 for Different Levels of Internal Locus of Control in Study 1



Note. Non-filled markers are non-significant. Moderator value defining Johnson-Neyman significance regions: Value = 5.184, 72% below, 28% above.

Table 1: Measure Description and Reliability of Key Variables in Study 1

Scale and Authors	Items	Mean (SD)	Loading	Cronbach's Alpha	CR	AVE
Feeling at Risk of Covid-19 (Broadbent et al. 2006)	1. I think I am a vulnerable person who is at risk in the face of Covid-19.	3.55 (1.88)	n/a [a]	n/a [a]	n/a [a]	n/a [a]
Superstitious Beliefs (Trait) (Carlson et al. 2009)	1. I do not want to lose things that bring me good luck.	4.94 (1.69)	.386	.783	.862	.628
	2. I sometimes perform little rituals to bring good luck.	3.13 (1.90)	.875			
	3. I must admit that sometimes I act like I am superstitious.	3.49 (1.88)	.910			
	4. People who know me would say that I am superstitious.	2.89 (1.77)	.879			
Internal Locus of Control (Rotter 1966)	1. There is really no way I can solve some of the problems I have. (R)	4.59 (1.60)	.780	.818	.864	.484
	2. Sometimes I feel that I am being pushed around in life. (R)	4.10 (1.64)	.682			
	3. There is little I can do to change many of the important things in my life. (R)	4.54 (1.53)	.778			
	4. I can do just about anything I really set my mind to.	4.74 (1.39)	.565			
	5. What happens to me in the future depends mostly on me.	5.15 (1.34)	.457			
	6. I often feel helpless in dealing with the problems of life. (R)	4.64 (1.66)	.802			
	7. I have little control over the things that happen to me. (R)	4.36 (1.49)	.733			
Numeracy (Lusardi and Mitchell 2007)	1. If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease? (86.2% of participants gave correct answer of "100")	Summative scale:		n/a [a]	n/a [a]	n/a [a]
	2. If 5 people all have the winning numbers in the lottery and the prize is two million dollars, how much will each of them get? (72% of participants gave correct answer of "$400,000")	No correct answer: 8.2%				
	3. Let's say you have $200 in a savings account. The account earns ten percent interest per year. How much would you have in the account at the end of two? (39.3% of participants gave correct answer of "$242")	One correct answer:18.6%				
		Two correct answers: 41.9%				
		Three correct answers: 31.3%				
Marker Variable (Simmering et al. 2015)	1. I prefer blue to other colors.	3.46 (1.68)	.861	.855	.917	.786
	2. I like the color blue.	4.31 (1.31)	.921			
	3. I like blue clothes.	4.12 (1.40)	.878			

Note. SD = standard deviation. CR = composite reliability. AVE = average variance extracted. n/a [a] = not applicable as this is either a single-item or summative scale. R = reverse scored.

Table 2: Zero-Order Correlations between Key Variables in Study 1

Variables	1	2	3
1. Feeling at Risk of Covid-19	–		
2. Internal Locus of Control	-.222***	–	
3. Superstitious Beliefs	.134**	-.201***	–

Note. *** $p < .001$; ** $p < .010$. N=487.

Table 3: The Effects of Superstitious Beliefs and Internal Locus of Control on Feeling at Risk of COVID-19 in Study 1

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Variables	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***
Intercept	3.085*** (.188)	1.481 (.728)	1.424 (.744)	2.621*** (.769)	1.382 (.943)
Superstitious Beliefs (Trait)	0.146** (.052)	.208*** (.052)	.206*** (.052)	.151** (.052)	.506** (.166)
Age		.036*** (.006)	.036*** (.006)	.038*** (.006)	.037*** (.006)
Gender (1 = male; 2 = female)		.402* (.166)	.408* (.166)	.360* (.163)	.360* (.162)
Education		-.047 (.064)	-.048 (.064)	-.018 (.062)	-.026 (.062)
Income (ln)		.021 (.049)	.021 (.049)	.021 (.048)	.021 (.047)
Language (1 = Dutch; 2 = French)		-.367* (.166)	-.363* (.167)	-.238 (.165)	-.217 (165)
Numeracy		-.086 (.093)	-.081 (.094)	-.052 (.092)	-.030 (.092)
Covid-19 Experience (1 = no; 2 = yes)			.018 (.046)	.021 (.045)	.016 (.045)
Internal Locus of Control				-.325*** (.067)	-.059 (.136)
Superstitious Beliefs (Trait) * Internal Locus of Control					-.078* (.035)
R^2	.016	.120	.121	.161	.170
F	F(1, 485)=7.894**	F(7,479)=9.367***	F(8, 478)=8.200***	F(9, 477)=10.205***	F(10, 476)=9.769***
ΔR^2		.104	.000	.041	.009
ΔF		F(6, 479)=9.475***	F(1, 478)=.702	F(1, 477)=23.193***	F(1, 476)=5.064*

Note. *** p < .001, ** p < .010, * p < .050. ln = natural log. *B* = unstandardized regression coefficient. *SE* = standard error.

Table 4: Measure Description and Reliability of Key Variables in Study 2

Scale and Authors	Items	Mean (SD)	Loading	Cronbach's Alpha	CR	AVE
Feeling at Risk of Covid-19 (Broadbent et al. 2006)	1. I think I am a vulnerable person who is at risk in the face of Covid-19.	4.78 (1.86)	n/a [a]	n/a [a]	n/a [a]	n/a [a]
Superstitious Beliefs (Trait) (Carlson et al. 2009)	1. I do not want to lose things that bring me good luck. 2. I sometimes perform little rituals to bring good luck. 3. I must admit that sometimes I act like I am superstitious. 4. People who know me would say that I am superstitious.	4.94 (1.61) 4.53 (2.01) 4.83 (1.92) 4.65 (2.04)	.715 .893 .919 .919	.888	.922	.749
Superstitious Beliefs (Negative) (Wiseman and Watt 2004)	1. I have avoided walking under a ladder because it is associated with bad luck. 2. I would be anxious about breaking a mirror because it is thought to cause bad luck 3. I am superstitious about the number 13.	4.41 (2.08) 4.36 (2.07) 4.07 (2.28)	.913 .905 .888	.884	.929	.813
Superstitious Beliefs (Positive) (Wiseman and Watt 2004)	1. I say 'fingers crossed' or actually cross my fingers. 2. I say 'touch wood' or actually touch or knock on wood. 3. I sometimes carry a lucky charm or object.	4.51 (2.02) 4.57 (2.05) 4.44 (2.18)	.907 .908 .882	.880	.926	.808
Internal Locus of Control (Rotter 1966)	1. There is really no way I can solve some of the problems I have. (R) 2. Sometimes I feel that I am being pushed around in life. (R) 3. There is little I can do to change many of the important things in my life. (R) 4. I can do just about anything I really set my mind to. 5. What happens to me in the future depends mostly on me. 6. I often feel helpless in dealing with the problems of life. (R) 7. I have little control over the things that happen to me. (R)	3.37 (1.89) 3.18 (1.85) 3.24 (1.87) 5.42 (1.32) 5.42 (1.24) 3.29 (1.96) 3.18 (1.82)	.877 .910 .884 .141 .015 .890 .889	.849	.875	.569
Numeracy (Lusardi and Mitchell 2007)	1. If the chance of getting a disease is 10 percent, how many people out of 1,000 would be expected to get the disease? (68.1% of participants gave correct answer of "100") 2. If 5 people all have the winning numbers in the lottery and the prize is two million dollars, how much will each of them get? (32.1% of participants gave correct answer of "$400,000")	Summative scale: No correct answer: 28.9% One correct answer:37.9% Two correct answers: 20.3%		n/a [a]	n/a [a]	n/a [a]

	3. Let's say you have $200 in a savings account. The account earns ten percent interest per year. How much would you have in the account at the end of two? (17.1% of participants gave correct answer of "$242")	Three correct answers: 12.9%				
Marker Variable (Simmering et al. 2015)	1. I prefer blue to other colors.	5.20 (1.51)	.783	.727	.851	.656
	2. I like the color blue.	5.77 (1.18)	.797			
	3. I like blue clothes.	5.73 (1.21)	.849			

Note. SD = standard deviation. CR = composite reliability. AVE = average variance extracted. n/a [a] = not applicable as this is either a single-item or summative scale. R = reverse scored.

Table 5: Zero-Order Correlations between Key Variables in Study 2

Variables	1	2	3	4	5
1. Feeling at Risk of Covid-19	–				
2. Internal Locus of Control	-.550***	–			
3. Superstitious Beliefs (Trait)	.554**	-.600***	–		
4. Superstitious Beliefs (Negative)	.577***	-.642***	.799***	–	
5. Superstitious Beliefs (Positive)	.591***	-.667***	.805***	.859***	–

Note. *** $p < .001$; ** $p < .010$. N=433.

Table 6: The Effects of Superstitious Beliefs (Trait) and Internal Locus of Control on Feeling at Risk of COVID-19 in Study 2

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Variables	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***
Intercept	1.823*** (.227)	1.916* (.676)	1.483* (.663)	3.525*** (.768)	3.850*** (.975)
Superstitious Beliefs (Trait)	.625*** (.045)	.492*** (.055)	.390*** (.057)	.302*** (.058)	.226^{T} (.153)
Age		.001 (.007)	.004 (.007)	.006 (.007)	.006 (.007)
Gender (1 = male; 2 = female)		.180 (.148)	.185 (.144)	.113 (.141)	.111 (.142)
Education		.100 (.076)	.072 (.074)	.065 (.072)	.063 (.073)
Income (ln)		.010 (.027)	.011 (.026)	.014 (.025)	.013 (.025)
Numeracy		-.368*** (.092)	-.274** (.092)	-.141 (.093)	-.146 (.094)
Covid-19 Experience (1 = no; 2 = yes)			.194*** (.039)	.144*** (.039)	.147*** (.039)
Internal Locus of Control				-.391*** (.080)	-.460** (.150)
Superstitious Beliefs (Trait) * Internal Locus of Control					.018 (.588)
R^2	.307	.337	.374	.408	.408
F	F(1, 431)=190.705***	F(6,426)=36.133***	F(7, 425)=36.241***	F(8, 424)=36.455***	F(9, 423)=67.880***
ΔR^2		.031	.037	.034	.000
ΔF		F(5, 426)=3.924**	F(1, 425)=24.785***	F(1, 424)=24.144***	F(1, 423)=.294

Note. *** p < .001, ** p < .010, * p < .050, ^{T} p < .100. ln = natural log. *B* = unstandardized regression coefficient. *SE* = standard error.

Table 7: The Effects of Superstitious Beliefs (Negative) and Internal Locus of Control on Feeling at Risk of COVID-19 in Study 2

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Variables	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***
Intercept	2.408*** (.178)	2.294** (.644)	1.840** (.638)	3.632*** (.749)	3.454*** (.869)
Superstitious Beliefs (Negative)	.555*** (.038)	.455*** (.046)	.370*** (.049)	.287*** (.052)	.338* (.241)
Age		-.001 (.007)	.007 (.007)	.005 (.007)	.005 (.007)
Gender (1 = male; 2 = female)		.134 (.146)	.147 (.143)	.091 (.141)	.093 (.141)
Education		.093 (.075)	.070 (.074)	.065 (.072)	.067 (.072)
Income (ln)		.029 (.026)	.026 (.026)	.025 (.025)	.025 (.025)
Numeracy		-.330*** (.091)	-.254** (.091)	-.144 (.092)	-.142 (.092)
Covid-19 Experience (1 = no; 2 = yes)			.174*** (.039)	.136*** (.039)	.135*** (.039)
Internal Locus of Control				-.353*** (.081)	-.315* (.123)
Superstitious Beliefs (Negative) * Internal Locus of Control					-.013 (.032)
R^2	.333	.358	.386	.412	.413
F	F(1, 431)=215.218***	F(6,426)=39.517***	F(7, 425)=38.215***	F(8, 424)=37.207***	F(9, 423)=33.026***
ΔR^2		.025	.029	.026	.000
ΔF		F(5, 426)=3.252**	F(1, 425)=19.890***	F(1, 424)=18.889***	F(2, 423)=.164

Note. *** p < .001, ** p < .010, * p < .050. ln = natural log. *B* = unstandardized regression coefficient. *SE* = standard error.

Table 8: The Effects of Superstitious Beliefs (Positive) and Internal Locus of Control on Feeling at Risk of COVID-19 in Study 2

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Variables	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***
Intercept	2.138*** (.188)	2.130*** (.643)	1.635** (.636)	3.302*** (.759)	3.388*** (.911)
Superstitious Beliefs (Positive)	.587*** (.039)	.497*** (.049)	.412*** (.051)	.327*** (.054)	.304* (.142)
Age		.001 (.007)	.004 (.007)	.005 (.007)	.005 (.007)
Gender (1 = male; 2 = female)		.013 (.146)	.045 (.143)	.016 (.141)	.015 (.141)
Education		.087 (.074)	.061 (.073)	.059 (.072)	.057 (.072)
Income (ln)		.028 (.026)	.026 (.026)	.025 (.025)	.025 (.025)
Numeracy		-.289** (.092)	-.205* (.091)	-.117 (.092)	-.118 (.093)
Covid-19 Experience (1 = no; 2 = yes)			.180*** (.038)	.145*** (.039)	.146*** (.039)
Internal Locus of Control				-.319*** (.082)	-.337* (.134)
Superstitious Beliefs (Positive) * Internal Locus of Control					.006 (.034)
R^2	.349	.367	.399	.419	.419
F	F(1, 431)=231.341***	F(6,426)=41.109***	F(7, 425)=40.229***	F(8, 424)=38.246***	F(9, 423)=33.922***
ΔR^2		.017	.032	.021	.000
ΔF		F(5, 426)=2.342*	F(1, 425)=22.502***	F(1, 424)=15.055***	F(1, 423)=.029

Note. *** p < .001, ** p < .010, * p < .050. ln = natural log. *B* = unstandardized regression coefficient. *SE* = standard error.