

No fear needed when trust runs deep: The interplay of risk perception and institutional integrity shapes vaccination

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Abstract

Understanding the psychological determinants of vaccination behavior remains a key challenge for public health. In two studies conducted in Belgium during the COVID-19 pandemic, we examined how risk perception and trust in the government interact to predict vaccination intention (Study 1) and vaccine uptake (Study 2). People's trust rests on their evaluation of the target's trustworthiness. In the present studies, we considered three components of trustworthiness: integrity, benevolence, and ability. We found that integrity was the component most strongly associated with vaccination. In addition, our results show that risk perception does not only add up to trust, and specifically its integrity component, but that these two factors interact in predicting vaccination. Specifically, either high risk perception or high integrity was sufficient to motivate vaccination, while individuals low on both were the most likely to be hesitant (consistent with a distrustful complacency hypothesis). Taken together, our findings provide a deeper understanding of the psychological mechanisms underlying vaccination. In addition, they highlight the value of adopting a multidimensional approach about trustworthiness as this points to the key role of integrity.

KEYWORDS

COVID-19, risk perception, trust in government, trustworthiness components, vaccination

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INTRODUCTION

Already, several years have passed since the COVID-19 outbreak. At that time, a critical element in managing the pandemic and bringing it to an end was ensuring that people got vaccinated (Feikin et al., 2022; Moghadas et al., 2021). This made it crucial to understand the key factors influencing vaccination intention and uptake. Today, this question remains central, as recent measles outbreaks in the United States and Europe have taken place due to rising vaccine hesitancy and declining immunization rates (Parums, 2024). Moreover, scientists and the World Health Organization emphasize the importance of preparedness for potential future pandemics, highlighting the need for robust vaccination strategies to mitigate the impact of emerging infectious diseases (Shoichet & Craik, 2023). As a result, extensive research has focused on understanding the determinants of vaccination (Rahbeni et al., 2024), and even with the limited perspective we gained from the COVID pandemic, clear determinants have emerged, including risk perception (Viswanath et al., 2021) and trust in government (Wang et al., 2021).

Arguably, the most influential model of vaccination hesitancy is the World Health Organization's 3C model (MacDonald, 2015). Building on an extensive review of the literature, this model highlights three factors underlying vaccine decisions: *Confidence* - trust in the effectiveness and safety of the vaccine, in the system that delivers the vaccination, and in the policy-makers who decide on the required vaccines; *Complacency* - the perception that the risk of vaccine-preventable disease is low; and *Convenience* - the availability and accessibility of the vaccine (see also Betsch et al., 2018).

Interestingly, this approach has been guided by an additive perspective and, as such, resembles most of the research on vaccine hesitancy (e.g., Allington et al., 2023; Aw et al., 2021; Han, Zheng, Cristea, et al., 2023; Huang et al., 2025; for an overview, see Klein & Yzerbyt, 2024). Indeed, the central focus is to gauge the capacity of each subsequent factor to capture part of the variance in vaccine acceptance. However, in doing so, investigators may have neglected the possibility that some of these factors may not only operate independently but also interact with each other. In the present research, we return to two of the most central factors highlighted by the WHO SAGE Working Group on Vaccine Hesitancy, namely confidence and complacency.

We think it is particularly relevant to address these two predictors in combination because, although they are among the most robust predictors of vaccination, they reflect distinct psychological processes. Risk perception is *individually grounded* and motivates vaccination through a desire to protect oneself or others from harm. In contrast, trust in government is *socially grounded* and reflects the willingness to follow public health recommendations based on one's confidence in institutional authority. An intriguing possibility is that these two predictors could compensate for one another. Specifically, high risk perception or high trust in government may each be sufficient for people to get vaccinated, whereas a combination of low perceived risk and low trust may lead to markedly lower vaccination intentions. Put differently, the effect of risk perception on vaccination intention may be less strong when trust in government is high than when it is low. This pattern would be most valuable at a practical level because people may experience some difficulty in appraising the actual level of risk of infection and disease. Such a finding would also have important theoretical implications for vaccination research because it would suggest that rather than functioning according to an additive model, vaccination could obey a *disjunctive* or *threshold* model in which either trust in government or high risk perception could be sufficient to trigger vaccination.

Additionally, although trust in government has been widely recognized as a key determinant, few studies have examined which specific dimensions of trustworthiness (integrity, benevolence, or ability; Mayer et al., 1995; PytlikZillig et al., 2016), that is, the traits of others that people rely on when placing their trust, matter most. However, a vast amount of literature clearly establishes the validity of these distinctions, suggesting they may have different

implications. Understanding their respective roles in the context of vaccine hesitancy would not only refine theoretical insights into trust in government but also provide valuable guidance for tailoring public health recommendations more effectively. We present the results of two large-scale studies conducted in Belgium during the COVID-19 pandemic that tested the moderation hypothesis described above while examining the differential roles of three components of trustworthiness.

Risk perception and vaccination

Risk perception (or “concern”) is one of the first important predictors of vaccination behavior. People get vaccinated because they understand the risk that they or others will get sick and that the disease will have negative consequences. More precisely, risk perception is “the probability of negative outcomes weighted by their severity” (Wolff et al., 2019, p. 1). In other words, it involves both an estimation of how likely one or others in society are to contract the disease and an assessment of its potential consequences if they do.

A meta-analysis (Brewer et al., 2007) found that risk perception is a stable predictor of vaccination. More recent studies also highlight its strong influence on vaccine uptake during the COVID-19 crisis (e.g., Allington et al., 2023; Caserotti et al., 2021; Giancola et al., 2023; Viswanath et al., 2021). For instance, a longitudinal study on risk perception found that people perceived varying levels of risk depending on the COVID-19 variant, which affected their motivation and adherence to COVID-19 measures (Waterschoot et al., 2024). A literature review similarly suggests that risk perception is one of the strongest predictors of vaccine hesitancy in high-income countries (Aw et al., 2021). This being said, although risk perception plays a major role in vaccination decisions, research has shown that other variables are also important. Indeed, even those with low concern about infection may still choose to get vaccinated for reasons linked to other motives, and one of the most important is trust in the government.

Trust in government and vaccination

Trust is “a psychological state of the trustor characterized by willingness to rely upon, give control to, support, or otherwise be vulnerable to the trustee” (PytlikZillig et al., 2016, p. 2). Here, we are particularly interested in trust directed toward political figures or institutions.

Previous work revealed that people with higher trust in government are more likely to accept government recommendations regarding public health behaviors (e.g., Blair et al., 2017; Rubin et al., 2009; Verger et al., 2018). As such, trust in government has been identified as one of the key predictors of COVID-19 vaccination acceptance. The more people trust their government, the more willing they are to get vaccinated and, indeed, do so (e.g., Han, Zheng, Abakoumkin, et al., 2023; Lazarus et al., 2021; see also Devine et al., 2023, and Devine, 2024, for meta-analyses; and Dwyer et al., 2025, and Wang et al., 2021, for reviews).

The disjunctive role of political trust and risk perception: The distrustful complacency hypothesis

As we saw, people may decide to get vaccinated for different reasons: some because they perceive a high risk, others because they trust the authorities recommending vaccination. Crucially, both reasons need not be present for someone to get vaccinated; rather, having just one of these reasons may be sufficient. This is indeed what some recent work suggests, under the name of the “distrustful complacency hypothesis” (Lalot et al., 2022). Developed in the

context of the COVID-19 pandemic, this proposition builds on the concept of aversion amplification (Abrams & Travaglino, 2018), which stipulates that political trust interacts with other motivators to predict intentions or behavioral tendencies related to political issues, such that trust (or its absence) may amplify the effect of other motivators. The distrustful complacency hypothesis considers concern - a concept close to risk perception - as a second motivator. Specifically, it presents political trust and concern as two possible routes to compliance: people might follow recommendations because they have high trust *or* high concern. In contrast, non-compliance will be markedly amplified when both are absent compared to when at least one is present.

This reasoning is supported by empirical work. For instance, Lalot, Abrams, Heering, et al. (2023) found an interaction between trust in government and concerns regarding COVID-19 in predicting vaccine hesitancy, such that both concern and trust drove vaccination intention, and it was the lack of both that created the condition for markedly lower intentions. Similar patterns have also been observed in studies considering not vaccination but policy-compliant behavior in general (Lalot, Abrams, Jessop, et al., 2023; Lalot et al., 2022) as well as compliance with public health measures (Seyd & Bu, 2022; Vasilopoulos et al., 2023). These findings point to an intriguing and understudied possibility: that the (many) factors identified as facilitators of vaccination intentions should not be solely considered in isolation, as they might interact with one another. Adopting such a disjunctive approach, the present work seeks to examine the interaction between trust and risk perception in predicting vaccine intention and uptake.

However, in doing so, we deemed it crucial to consider trust not as a single, monolithic construct. Trust is shaped by how individuals evaluate the trustee, that is, perceived trustworthiness. As we explain below, trustworthiness is itself a multifaceted construct, comprising distinct components that may play different roles in shaping trust and potentially also in its interaction with risk perception.

The importance of considering the three components of trustworthiness

Many studies have shown the importance of trust in predicting vaccine attitude and behavior. However, this work typically relied on global measures of trust and did not differentiate between specific components of trustworthiness. As it turns out, trustworthiness is best seen as a multifaceted construct comprising (at least) three components. First, *Ability* is “the group of skills, competencies, and characteristics that allow a party to have influence within some specific domain” (Mayer et al., 1995, p. 717). Next, *Benevolence* denotes “the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive” (Mayer et al., 1995, p. 718). Finally, *Integrity* refers to “the trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable” (Mayer et al., 1995, p. 719). This multi-dimensional approach to trustworthiness has been supported by empirical work on trust in different actors (e.g., Grimmlikhuijsen & Knies, 2017). In addition, these efforts confirm that, while these components of trustworthiness do not theoretically represent trust as such but rather its determinants, operationally, they can be used to measure trust (Hamm et al., 2019; PytlikZillig et al., 2016).

Although previous research advocated for more attention to the different components (McEvily & Tortoriello, 2011), few studies pertaining to vaccination intentions have considered their distinct effects. We argue that not all components of trustworthiness may have the same impact when it comes to predicting vaccination intention and vaccine uptake. Hence, identifying the role fulfilled by each component could help determine which specific aspects should be highlighted to promote trust. Specifically, we suspect that *integrity* may play a key role.

As defined above, integrity refers to the perception that the trustee adheres to principles the trustor finds acceptable (Mayer et al., 1995). In this perspective, it captures whether the trustor believes the trustee holds values similar to their own. However, demonstrating integrity also means acting in a way that is consistent with one's claimed values. This more encompassing definition, based on word-action consistency in addition to trustor-trustee value congruence, offers the possibility to recognize integrity even in people we do not agree with (Tomlinson et al., 2014). It is especially important in the political domain when considering trust that goes beyond a mere partisanship bias (Hooghe & Oser, 2017). Indeed, nonpartisans may still judge that their government acts in an honest and ethical manner even if they disagree about specific policy decisions (Citrin & Stoker, 2018).

Integrity is the component that most directly speaks to citizens' perception of the *intentions* behind governmental recommendations—that is, whether the government made those recommendations in accordance with principles of honesty and transparency. While ability and benevolence may of course also matter, integrity may thus be the strongest predictor of trust-based vaccination.

Empirical evidence concerning the different effects of the trustworthiness components is unfortunately scarce. Among the few existing papers, a longitudinal study on trust in a US government agency (Van Fossen et al., 2025) found considerable interindividual variations in overall trust as well as in the relative impact of the different components of trustworthiness. Yet, this study revealed that high integrity led to a more consistent level of trust. This represents at least tentative evidence that integrity may well play a special role in the determination of how perceived trustworthiness relates to policy compliance.

Although the available literature on trust does not allow for clear conclusions, extant work in the neighboring field of social evaluation research provides some useful cues. It notably shows that people rely on different traits like morality, friendliness, ability, and assertiveness when evaluating others (Abele et al., 2008, 2016, 2021; Yzerbyt et al., 2025). Although not strictly equivalent, the traits morality, friendliness, and ability echo the trustworthiness components of integrity, benevolence, and ability, respectively. Crucially, these facets are not equally weighted in social evaluations. A sizeable amount of research showed that the morality facet is the strongest predictor of evaluations of and behaviors toward other individuals or groups (e.g., Brambilla et al., 2011, 2012, 2021; Koch et al., 2024; Leach et al., 2007). For instance, a study found that the perceived morality, but not competence, of a new colleague influences willingness to help them (Pagliaro et al., 2013). Taken together, these different research lines consistently suggest that, among the components of trustworthiness, integrity may be crucial in fostering trust and predicting vaccination.

THE PRESENT STUDY

Aims and hypotheses

The aim of this research was twofold. First, we aimed to test the hypothesis that risk perception and trust in government interact to predict COVID-19 vaccination intention and uptake. Drawing from a distrustful complacency hypothesis, we expected to observe markedly lower vaccination intention and vaccine intake among participants who reported *both* low risk perception and low political trust.

Our second aim was to better understand the role of each of the three components of trustworthiness, that is, integrity, benevolence, and ability, in this relationship. As noted above, identifying which specific dimension might drive vaccination intentions would be of great importance for public health interventions. Building on the reasoning that integrity carries a specific role in political trust contexts, and on converging evidence from social

evaluation research, we suspected that integrity may have the strongest influence on vaccination.¹

Data: The motivation barometer

We relied on two large samples ($N_{\text{total}} = 35,682$) recruited in Belgium during the COVID-19 pandemic. Specifically, the data are from the Motivation Barometer (Vansteenkiste et al., 2024), a consortium of researchers from different universities in Belgium who aimed to monitor and understand psychological and behavioral responses to the COVID-19 pandemic. They collected data on different aspects related to the crisis (e.g., motivation to follow the measures, communication, well-being, etc.) regularly throughout the pandemic by conducting surveys online through social media and newspapers. Some portions of the data used here have been used in prior publications (e.g., Schmitz et al., 2022; Van Oost et al., 2022), but the current study addresses a different research question and pertains to variables and analyses not reported elsewhere.

Study 1 was conducted at the very beginning of the vaccination campaign (between February and May 2021) and allowed us to investigate the interplay between risk perception and components of the government's trustworthiness in predicting vaccination intention. Study 2, conducted at the end of the booster vaccination campaign (between November 2021 and February 2022), extended this investigation by examining not only the interaction between risk perception and government trustworthiness, but also the role of health experts' trustworthiness in predicting self-reported vaccination uptake (rather than intention). Of note, during both time periods, the Belgian federal government was a coalition composed of seven parties representing almost the entire political spectrum (liberals, socialists, greens, and Christian-democrats from both linguistic communities). This means that trust in government in this context likely reflects a general evaluation of governmental institutions rather than support for a specific political party and reduces concerns about political polarization driving trust in government responses. The research received ethical approval from the ethics committee of Ghent University.

The data does not represent a representative sample from Belgium; for instance, it includes more women (50.72% in Belgium; Statbel, 2024). However, we ran all our models controlling for available demographics (age, gender, education, language), and the effects remain unchanged (see supplementary materials on OSF). Therefore, we are confident that the reported effects are reliable within the Belgian context. In both studies, participants completed the questionnaire in Dutch or in French. The items presented in the manuscript are an English translation, and the original wording can be found on the OSF repository.

STUDY 1

Method

Participants

The sample comprises all participants who indicated having not yet received a shot of vaccine against COVID-19 and who completed the measures of trust in the government, risk perception,

¹As indicated in the transparency statement, we did not formulate directional hypotheses regarding the role of each trustworthiness component in Study 1. In the second study, we aimed to replicate the findings of Study 1 and thus explicitly expected integrity to be the most strongly associated with vaccination.

and vaccination intentions between 6 February and 4 May 2021. There were $N=17,904$ participants (10,114 women, 6880 men, and 910 undisclosed; $M_{\text{age}}=48.54$, $SD_{\text{age}}=14.48$, range: 18–100 years old; we report all demographic information for both studies in the supplemental materials available on OSF).

Measures

Perceived government integrity, benevolence, and ability

Participants were asked to rate “the people in the government who make decisions about the pandemic” on six traits taken from the social evaluation literature (Abele et al., 2021), on a scale from 1 (totally disagree) to 5 (totally agree). These six items formed three two-item subscales corresponding to the three components of trustworthiness (Grimmelikhuijsen & Knies, 2017; PytlikZillig et al., 2016): integrity (“just”, “honest”; $r=.77$, $p<.001$), benevolence (“responsible”, “benevolent”; $r=.73$, $p<.001$), and ability (“competent”, “qualified”; $r=.84$, $p<.001$).

Risk perception

The measure of risk perception ($\alpha=.74$) consisted of four items adapted from Wolff et al. (2019). Two items assessed the perceived probability of infection, either for the participant themselves or for the general population in Belgium, on a scale from 1 (very small) to 5 (very large). The other two items measured the perceived severity of consequences in case of infection, either for the participant or for the general population, on a scale from 1 (not at all serious) to 5 (very serious).

Vaccination intention

One item measured vaccination intention: “If you had the opportunity to get vaccinated against COVID-19 next week, what would you decide?” Participants responded on a scale ranging from 1 (I would refuse without any hesitation) to 5 (I would accept without any hesitation), with intermediate options being 2 (I probably would refuse), 3 (Doubting), and 4 (I probably would accept).

Results

Preliminary analysis

We conducted confirmatory factor analyses (CFA) in R (R Core Team, 2024) with the *lavaan* package (Rosseel, 2012) to examine whether the six trust items corresponded to three distinct components of trustworthiness. We tested three competing models: a one-factor model, where all six items loaded onto a single latent factor; a two-factor model, where the four items measuring integrity and benevolence combined onto one factor, and the two items measuring ability loaded onto another factor; and a three-factor model, where the two items measuring ability, the two measuring integrity, and the two measuring benevolence each loaded onto separate latent factors (Table 1).

The three-factor model yielded the best fit, significantly better than the one- and two-factor models, supporting the conceptualization of trustworthiness as comprising three distinct components. This final model provided an overall good fit, with values of the CFI $\geq .95$, TLI $\geq .95$, RMSEA $\leq .08$, and SRMR $\leq .08$ (Hu & Bentler, 1999).

TABLE 1 Summary of the CFA results in Study 1.

Model	χ^2 (df)	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$ (df), p -value
One-factor	3082.20 (9)	.968	.947	.138	.024	—
Two-factor	418.79 (8)	.996	.992	.054	.009	2663.4 (1), $p < .001$
Three-factor	218.40 (6)	.998	.994	.044	.007	200.4 (2), $p < .001$

Note: Each chi square difference test compares a given model to the one above it.

TABLE 2 Descriptive statistics and correlations between all variables in Study 1.

	Variable	Descriptives		Pearson's correlations			
		M	SD	1	2	3	4
1	Gov. integrity	2.34	1.07	1			
2	Gov. benevolence	2.65	1.14	.83***	1		
3	Gov. ability	2.43	1.13	.82***	.80***	1	
4	Risk perception	3.01	.71	.34***	.36***	.34***	1
5	Vaccination intention	4.03	1.40	.44***	.43***	.40***	.42***

Note: All scales range from 1 to 5.

*** $p < .001$.

TABLE 3 Summary of the regression analysis predicting vaccination intention in Study 1.

Predictors	b	β	SE	$CI_{95\%} (b)$	$CI_{95\%} (\beta)$	t -value	p	η^2_{partial}
Intercept	4.11	.06	.01	[4.10, 4.14]	[.05, .07]	439.58	<.001	.302
Gov. integrity	.27	.21	.02	[.24, .31]	[.18, .23]	16.36	<.001	.015
Gov. benevolence	.15	.12	.01	[.12, .17]	[.10, .14]	9.83	<.001	.005
Gov. ability	.06	.05	.01	[.03, .09]	[.03, .07]	4.34	<.001	.001
Risk perception	.44	.22	.01	[.41, .47]	[.21, .24]	31.30	<.001	.052
Gov. inte $\times$ risk	−.20	−.11	.03	[−.25, −.15]	[−.14, −.08]	−7.83	<.001	.003
Gov. bene $\times$ risk	−.10	−.06	.02	[−.15, −.06]	[−.09, −.04]	−4.83	<.001	.001
Gov. ability $\times$ risk	.00	.00	.02	[−.04, .04]	[−.02, .03]	.05	.958	<.001

Note: Gov. inte, Gov. bene, and Gov. abil refer to perceived government integrity, benevolence, and ability, respectively.

Main analysis

We conducted descriptive analyses, including the means, standard deviations, and zero-order correlations of all variables from Study 1 (see Table 2).

We then conducted a linear regression with vaccination intention² as our criterion and the three components of trustworthiness (integrity, benevolence, and ability; all

²Given that our dependent variable is a single-item 5-point ordinal scale, a linear regression model may not be fully suitable. To ensure against estimation bias, we conducted two additional models: one with a log-transformed dependent variable and another using ordinal logistic regression. The model with the log-transformed dependent variable provided the best fit. However, the results were very similar across all models. Since the linear models do not compromise accuracy, we present their results here for ease of interpretation. Results from all additional models and model comparisons are available on the OSF.

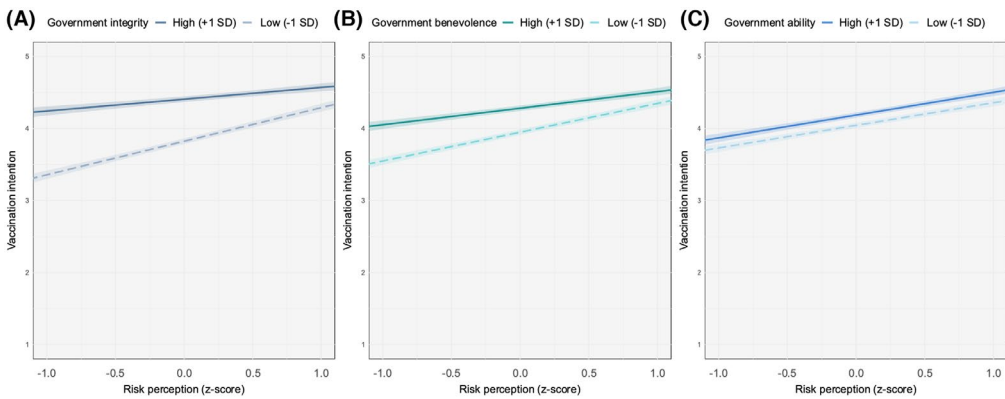


FIGURE 1 Vaccination intention depending on participants' perception of risk and government integrity (A), benevolence (B), and ability (C) in Study 1. Bands show 95% CI.

mean-centered), risk perception (mean-centered), and the interaction between each trustworthiness component and risk perception as predictors (see Table 3). We fixed α at .001 in both studies due to the large sample sizes and strong statistical power to detect small effects³ (Maier & Lakens, 2022). We checked for multicollinearity using the Variance Inflation Factor (VIF), with all predictors showing VIF values below 5, suggesting no problem with multicollinearity.

All trustworthiness components were significant predictors of vaccination intentions. The more participants perceived the government as high in integrity, benevolence, and ability, the more they intended to get vaccinated. Integrity showed the strongest effect, followed by benevolence and then ability. In addition, there was an even stronger main effect of risk perception, such that the more people perceived a risk, the more they were willing to vaccinate.

Importantly, we found a significant interaction between integrity and risk perception. Simple effect analyses showed that when participants rated the government lower in integrity (-1 SD), risk perception was much more strongly associated with vaccination intention, $b = .65$, $SE = .03$, $CI_{95\%} [.59, .71]$, $t(17,896) = 22.02$, $p < .001$, than when they rated the government higher in integrity ($+1$ SD), $b = .23$, $SE = .03$, $CI_{95\%} [.17, .29]$, $t(17,896) = 7.31$, $p < .001$, see Figure 1. Put differently, perceived integrity was more strongly associated with vaccination intention, $b = .41$, $SE = .03$, $CI_{95\%} [.36, .47]$, $t(17,896) = 16.08$, $p < .001$, at low levels of risk perception (-1 SD) than at high levels of risk perception ($+1$ SD), $b = .13$, $SE = .02$, $CI_{95\%} [.09, .18]$, $t(17,896) = 5.63$, $p < .001$. Consistent with a distrustful complacency account, this result reveals a compensatory effect: high perceived integrity seems to make up for low risk perception, and vice versa. This means that the people who both perceived low risk and low governmental integrity are likely to be vaccine hesitant.

There was also a significant interaction between benevolence and risk perception. This effect was directionally similar, although weaker than the previous one. Simple effect analyses indicated that when participants rated the government lower in benevolence (-1 SD), risk perception was more strongly associated with vaccination intention, $b = .56$, $SE = .03$, $CI_{95\%} [.51, .61]$, $t(17,896) = 20.36$, $p < .001$, than when they rated the government higher in benevolence ($+1$ SD), $b = .32$, $SE = .03$, $CI_{95\%} [.26, .38]$, $t(17,896) = 11.03$, $p < .001$. Put otherwise, perceived benevolence was more strongly associated with vaccination intention at low (-1 SD), $b = .22$,

³We tested additional models in Studies 1 and 2 controlling for demographic variables, specifically age, gender, language, work situation, education (only in Study 2), and province (only in Study 2). Controlling for these additional variables did not influence the conclusions of our models. These additional models can be found on OSF.

$SE = .02$, $CI_{95\%} [.18, .26]$, $t(17,896) = 10.02$, $p < .001$, than at high levels of risk perception (+1 SD), $b = .07$, $SE = .02$, $CI_{95\%} [.03, .11]$, $t(17,896) = 3.45$, $p < .001$. In stark contrast with these two effects, the interaction between perceived governmental ability and risk was not significant.⁴

Discussion

Study 1 offers two main insights. First, the data showed that among the three components of trustworthiness, integrity has the largest effect on vaccination intention, followed by benevolence and then ability. These results align with the literature on social evaluation (Abele & Wojciszke, 2014; Brambilla et al., 2021). Second, there was an interaction between integrity and risk perception, as well as between benevolence and risk perception. Specifically, individuals who scored high in either trustworthiness component (integrity or benevolence) or in risk perception reported a greater intention to vaccinate, suggesting that integrity or benevolence can compensate for low risk perception and vice versa, whereas those low in both reported markedly lower intentions. These results extend previous work on the distrustful complacency hypothesis, showing that risk perception and trust interact to predict vaccination intentions (Lalot, Abrams, Heering, et al., 2023) by clarifying the specific role each trustworthiness component seems to play in this interaction.

Promising as they may be, these results come with some limitations. First, they focus on vaccination intention and not actual vaccination behavior, so it remains uncertain whether they would hold for actual vaccination. Second, Study 1 examines the role of trustworthiness components regarding a single target, the government. Still, it would be important to determine whether the role of each component varies or remains stable across different targets. We conducted Study 2 to address these issues.

STUDY 2

Study 2 focused on self-reported vaccine doses received rather than vaccination intention. In addition, to further understand the dynamics of trustworthiness components, we examined the role of trust in health experts. Trust in health experts has indeed been identified as another key predictor of COVID-19 vaccination behavior (Austin et al., 2023; Silver et al., 2022), making it a relevant target to investigate in this context.

Method

Participants

The sample for Study 2 included all participants who completed the measures of trust in the government, trust in the health experts, and risk perception, and indicated how many doses of vaccine they had received, between 25 November 2021 and 4 February 2022. The sample comprised $N = 17,778$ participants (10,809 women, 6907 men, and 62 other or undisclosed; $M_{\text{age}} = 47.62$, $SD_{\text{age}} = 13.07$, range: 18–93 years old).

⁴We also ran the models using a global trust predictor (i.e., combining the three components of trustworthiness) to check whether the interaction with risk perception still emerged (see OSF for tables presenting the models' results). Across all models, we found the interaction, suggesting that the overall pattern holds even when trust is treated as a single construct. Although this pattern is consistent with the distrustful complacency hypothesis, separating the three components allows us to better understand which specific aspects of trustworthiness drive the interaction.

TABLE 4 Summary of the CFA results of Study 2.

Model	χ^2 (df)	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$ (df), <i>p</i> -value
<i>Government's trustworthiness</i>						
One-factor	2426.08 (9)	.973	.956	.122	.022	—
Two-factor	329.25 (8)	.996	.993	.047	.009	2096.80 (1), <i>p</i> < .001
Three-factor	131.58 (6)	.999	.997	.034	.006	197.67 (2), <i>p</i> < .001
<i>Health experts' trustworthiness</i>						
One-factor	5547.74 (9)	.958	.930	.185	.022	—
Two-factor	615.85 (8)	.995	.991	.065	.008	4931.90 (1), <i>p</i> < .001
Three-factor	345.47 (6)	.997	.994	.056	.006	270.38 (2), <i>p</i> < .001

Note: Each chi square difference test compares the given model to the one above it.

Measures

Perceived government integrity, benevolence, and ability

We measured the three components of government's trustworthiness, i.e., integrity, benevolence, and ability, as in Study 1 (correlation between the two items for each component: integrity, $r = .77$, $p < .001$; benevolence, $r = .71$, $p < .001$; ability, $r = .81$, $p < .001$).

Perceived health experts' integrity, benevolence, and ability

The measure of trust in health experts consisted of the same measure as for trust in government, but with participants rating health experts advising the government on COVID-19 on each trait (correlation between the two items for each component: integrity, $r = .87$, $p < .001$; benevolence, $r = .82$, $p < .001$; ability, $r = .89$, $p < .001$).

Risk perception

We measured risk perception with the same four items ($\alpha = .71$) as in Study 1.

Self-reported vaccine doses

Participants reported the number of COVID-19 vaccine doses they had received. Specifically, 0 indicated no vaccination (27.70% of the sample), 1 represented partial vaccination (1.25%), 2 indicated full vaccination (40.57%), and 3 represented full vaccination with an additional booster dose (30.48%). The first national booster vaccination campaign had started for all adults three months prior to the beginning of the sampling period (i.e., September 2021; Vermeiren et al., 2023). Most participants thus had the opportunity to receive a full vaccination plus a booster dose.

Results

Preliminary analysis

Government's trustworthiness

We conducted a CFA to examine whether the measure of the government's trustworthiness indeed comprised three components by comparing a one-, two-, and three-factor model, as in Study 1 (see Table 4 for fit indices of each model). The three-factor model showed the best fit and provided a good overall fit.

TABLE 5 Descriptive statistics and correlations between all variables in Study 2.

		Descriptives		Pearson's correlations						
		<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1	Gov integrity	1.85	.95	1						
2	Gov. benevolence	2.13	1.08	.82***	1					
3	Gov. ability	1.95	.99	.81***	.78***	1				
4	Exp. integrity	2.68	1.31	.67***	.63***	.60***	1			
5	Exp. benevolence	2.81	1.31	.63***	.65***	.58***	.90***	1		
6	Exp. ability	3.19	1.36	.60***	.60***	.58***	.86***	.85***	1	
7	Risk perception	2.93	.73	.36***	.36***	.34***	.53***	.54***	.53***	1
8	Vaccine doses	1.74	1.16	.45***	.42***	.40***	.55***	.52***	.53***	.41***

Note: All scales range from 1 to 5 except for the number of vaccine doses which ranges from 0 to 4.

****p* < .001.

TABLE 6 Summary of the regression analyses with variables related to government predicting the number of vaccine doses in Study 2.

	<i>b</i>	β	<i>SE</i>	<i>CI</i> _{95%} (<i>b</i>)	<i>CI</i> _{95%} (β)	<i>t</i> -value	<i>p</i>	η^2_{partial}
Intercept	1.79	.04	.01	[1.77, 1.80]	[.03, .06]	222.41	<.001	.286
Gov. integrity	.34	.28	.02	[.31, .37]	[.25, .30]	20.74	<.001	.024
Gov. benevolence	.11	.10	.01	[.09, .14]	[.08, .13]	8.65	<.001	.004
Gov. ability	.03	.02	.01	[.01, .06]	[.00, .05]	1.97	.049	<.001
Risk perception	.38	.24	.01	[.36, .41]	[.23, .25]	33.08	<.001	.058
Gov. inte × risk	−.18	−.11	.02	[−.23, −.13]	[−.14, −.08]	−7.33	<.001	.003
Gov. bene × risk	.01	.00	.02	[−.03, .05]	[−.02, .03]	.52	.605	<.001
Gov. ability × risk	−.03	−.02	.02	[−.07, .01]	[−.04, .01]	−1.43	.153	<.001

Note: Gov. inte, Gov. bene, and Gov. abil refer to perceived government integrity, benevolence, and ability, respectively.

Health experts' trustworthiness

We also conducted a CFA with the health experts' trustworthiness items to check whether this measure also comprised the three components of trust, again comparing the same one-, two-, and three-factor models. Here too, the three-factor model showed the best fit and provided a good overall fit.

Main analysis

We conducted descriptive analyses, including the means, standard deviations, and zero-order correlations of all variables from Study 2 (see Table 5). We conducted two linear regressions with the number of vaccine doses received (0; 1; 2; 3) as our criterion.⁵ In the first model, the predictors included perceived government integrity, benevolence, and ability (all

⁵As in Study 1, linear regression models may not be fully suitable given that our dependent variable was a count variable (number of doses received) rather than a continuous one. We conducted three additional models for each initial model: one poisson regression model, one with a log-transformed dependent variable, and another using ordinal logistic regression. The models with the log-transformed dependent variable provided the best fit. However, the results were very similar across all models. Since the initial linear models do not present a trade-off in terms of accuracy, we present their results here, for ease of interpretation. Results from all additional models and model comparisons are available on OSF.

TABLE 7 Summary of the regression analyses with variables related to health experts predicting the number of vaccine doses in Study 2.

	<i>b</i>	β	<i>SE</i>	<i>CI</i> _{95%} (<i>b</i>)	<i>CI</i> _{95%} (β)	<i>t</i> -value	<i>p</i>	η^2_{partial}
Intercept	1.77	.03	.01	[1.76, 1.79]	[.02, .04]	215.01	<.001	.335
Exp. integrity	.27	.31	.01	[.24, .30]	[.28, .34]	19.72	<.001	.021
Exp. benevolence	.03	.03	.01	[.00, .05]	[.00, .06]	2.06	.039	<.001
Exp. ability	.15	.18	.01	[.13, .17]	[.15, .20]	13.25	<.001	.010
Risk perception	.21	.13	.01	[.18, .23]	[.11, .14]	17.22	<.001	.016
Exp. inte $\times$ risk	-.13	-.11	.02	[-.17, -.09]	[-.14, -.07]	-6.39	<.001	.002
Exp. bene $\times$ risk	-.01	.00	.02	[-.05, .03]	[-.04, .02]	-.43	.664	<.001
Exp. abil $\times$ risk	.07	.06	.02	[.03, .10]	[.03, .08]	4.13	<.001	.001

Note: Exp. inte, Exp. bene, and Exp. abil refer to perceived integrity, benevolence, and ability of health experts, respectively.

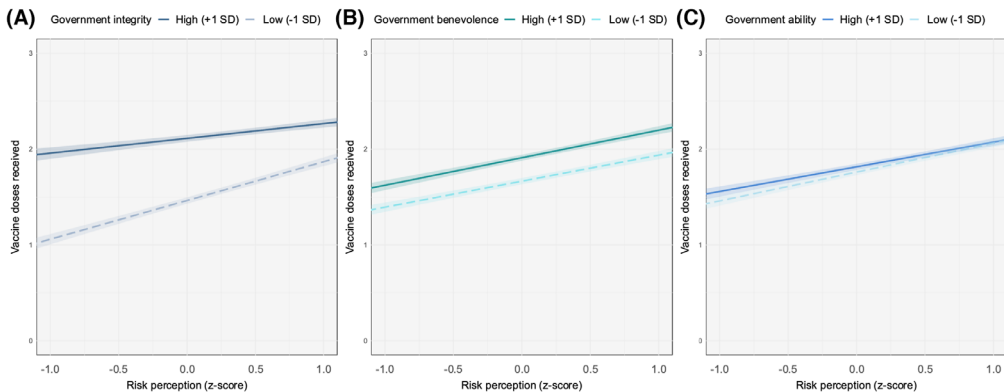


FIGURE 2 Vaccine doses received depending on participants' perception of risk and government integrity, benevolence, and ability in Study 2. Bands show 95% CI.

mean-centered), along with risk perception (mean-centered), and the interaction between each trustworthiness component and risk perception. In the second model, the same predictors were included, but they focused on the perceptions of health experts rather than the government (see Tables 6 and 7 for model results).

Risk and government trustworthiness

Replicating the findings from Study 1, we found main effects of integrity and benevolence such that the higher the perceived integrity and benevolence of the government, the higher the number of vaccine doses received, with integrity carrying a much stronger effect than benevolence. There was also a main effect of risk perception, such that the more people perceived a risk, the more vaccine doses they had received. Of greater interest, we replicated the interaction between integrity and risk perception: when participants rated the government as low in integrity (-1 SD), risk perception was much more strongly associated with the number of vaccine doses received, $b = .55$, $SE = .03$, $CI_{95\%} [.50, .60]$, $t(17,770) = 21.70$, $p < .001$, than when they rated the government as high in integrity ($+1$ SD), $b = .21$, $SE = .03$, $CI_{95\%} [.16, .26]$, $t(17,770) = 7.93$, $p < .001$ (see Figure 2). Put differently, perceived integrity was more strongly associated with the number of vaccine doses received at low levels of risk perception (-1 SD), $b = .47$, $SE = .03$, $CI_{95\%} [.42, .53]$, $t(17,896) = 17.11$, $p < .001$, than at high levels of risk perception ($+1$ SD), $b = .21$,

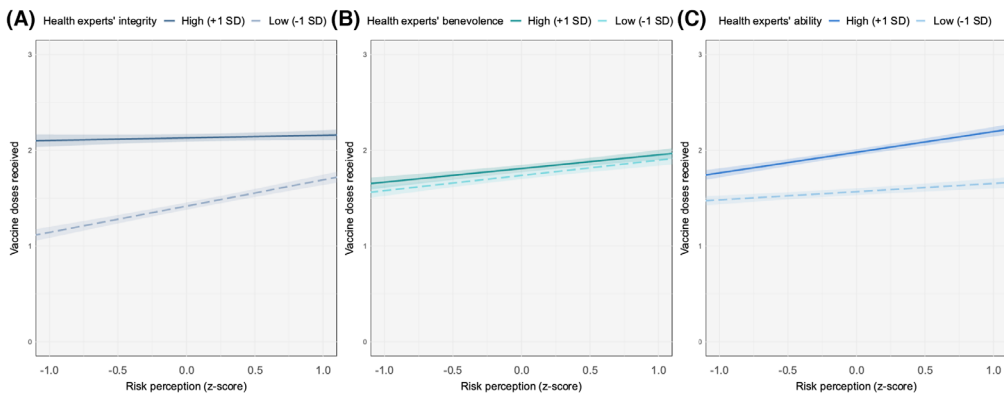


FIGURE 3 Vaccine doses received depending on participants' perception of risk and health experts' integrity, benevolence, and integrity in Study 2. Bands show 95% CI.

$SE = .02$, $CI_{95\%} [.17, .25]$, $t(17,896) = 10.19$, $p < .001$. Again, these results fully concur with a distrustful complacency account as they suggest that perceived high integrity and risk compensate for one another, such that either one is sufficient for people to get vaccinated. However, people who perceived low risk and attributed low integrity to the government were less likely to get vaccinated. In contrast to Study 1, there was no interaction effect involving benevolence.

Risk and health experts' trustworthiness

The model involving perceptions of health experts revealed main effects of integrity and ability such that the more people saw health experts as high in integrity and ability, the more doses they had received, with a stronger effect for integrity than ability. The main effect of risk perception emerged in this model as well. Here as well, there was an interaction between integrity and risk perception, such that when participants rated the health experts as low in integrity ($-1 SD$), risk perception was strongly associated with the number of doses received, $b = .38$, $SE = .03$, $CI_{95\%} [.32, .43]$, $t(17,770) = 13.17$, $p < .001$, while risk perception was not associated with the number of doses when participants rated health experts as high in integrity ($+1 SD$), $b = .04$, $SE = .03$, $CI_{95\%} [-.02, .10]$, $t(17,770) = 1.27$, $p = .206$ (Figure 3).

Somewhat surprisingly, there was also an interaction between ability and risk perception, going in the *opposite* direction as the one with integrity: when participants rated health experts as high in ability ($+1 SD$), risk perception was more strongly associated with the number of doses received, $b = .30$, $SE = .03$, $CI_{95\%} [.25, .34]$, $t(17,770) = 11.73$, $p < .001$, than when the health experts were seen as low in ability ($-1 SD$), $b = .12$, $SE = .02$, $CI_{95\%} [.07, .16]$, $t(17,770) = 4.91$, $p < .001$.

To shed light on this pattern, we ran an additional model where we regressed the number of doses only on health expert ability, risk perception, and their interaction (i.e., dropping the other trustworthiness components from the model). In this condition, the interaction was not significant, $b = -.01$, $SE = .01$, 95% CI $[-.02, .01]$, $t(17,770) = -1.03$, $p = .302$, suggesting that the previously observed interaction effect was likely influenced by the presence of the other trustworthiness components rather than a direct moderation between health expert ability and risk perception. In other words, the relationship between health experts' perceived ability and risk perception is partially explained by broader trust dynamics, and considering other trustworthiness components helps reveal an effect that remains undetectable when examined in isolation. Note that this is not the case when looking at the interaction between health experts' integrity and risk perception in isolation. Indeed, when we regressed the number of doses only on health expert integrity, risk perception, and their interaction, the interaction remained highly significant, $b = -.09$, $SE = .01$, 95% CI $[-.11, -.08]$, $t(17,770) = -11.96$, $p < .001$. This pattern further emphasizes the key role of integrity.

Discussion

The results from Study 2 largely confirm those obtained in Study 1, although there were some differences. First, as in Study 1, integrity was the component of government trustworthiness that was most strongly associated with vaccine uptake. Moreover, integrity again interacted with risk perception. In contrast to Study 1, however, benevolence did not interact with risk perception.

Turning to trust in health experts, integrity also emerged as the component most strongly associated with vaccine uptake. Interestingly, ability came second in importance and also interacted with risk perception. This interaction went in the opposite direction of the one observed with integrity. Specifically, the effect of risk perception on vaccine uptake was larger when participants perceived health experts to be high rather than low in ability. One possible account for this pattern is that trust in health experts may be closely linked to trust in vaccines themselves, simply because health experts are those expected to assess the vaccine's efficacy and safety. When health experts come across as hardly competent, people may refuse to get vaccinated even if they consider the COVID-19 situation to be serious. In contrast, when people perceive health experts as competent, they may be more inclined to act on their risk perception and get vaccinated.

GENERAL DISCUSSION

In the present research, we examined how risk perception interacts with trust to predict vaccination intention and uptake. Building upon the institutionalized trust literature, we distinguished between three components of trustworthiness, namely integrity, benevolence, and ability. In Study 1, in line with a tradition of work on social evaluation, government integrity was the component most strongly associated with vaccination intention, followed by benevolence and then ability. In addition, integrity and benevolence both interacted with risk perception in that people who were high in either one of these components *or* in risk perception intended to get vaccinated more. In other words, a high level in one of these two factors could offset a low level in the other. In contrast, those simultaneously low in integrity (or benevolence) *and* low in risk perception were more likely to show hesitancy. Interestingly, the interaction involving integrity was stronger than that involving benevolence.

In Study 2, we replicated the effects regarding integrity, this time predicting (self-reported) number of vaccine doses received. We also investigated how health experts' trustworthiness combined with risk perception. For this target, integrity again emerged as the strongest component associated with vaccine doses, but ability—and not benevolence—was the second strongest component. Similar to the results pertaining to perceptions of the government, there was an interaction between risk perception and integrity. People who judged health experts as high in integrity or who had high risk perception were likely to have received at least two vaccine doses, whereas those perceiving low integrity and low risk were more likely to remain unvaccinated. An unexpected interaction between ability and risk perception revealed that the relationship between risk perception and vaccination behavior was weaker when people perceived health experts as low (vs. high) in ability.

Distrustful complacency and the key role of perceived integrity

Prior research has identified risk perception (Aw et al., 2021; Waterschoot et al., 2024) and trust in government (Van Oost et al., 2022; Wang et al., 2021) as key psychological determinants of vaccination (see also MacDonald, 2015; Roy et al., 2022). Recent work further proposed that

concern and trust combine in such a way that only one of the two needs to be high for people to vaccinate (Lalot, Abrams, Heering, et al., 2023). The present findings replicate and extend this work by showing that risk perception not only interacts with trust but more specifically with the integrity component of trustworthiness. As such, perceiving the government or health experts as having high integrity can mitigate the reliance on risk perception for vaccination decisions. This confirms that people may choose to vaccinate for different reasons and, more importantly, that one good reason may suffice.

What does this suggest for the decision process that leads to vaccination? When deciding on whether to engage in vaccination recommended by authorities, people seek indicators of trust in these authorities as well as information about the risks posed by the disease (Chen, 2015). In general, these indicators may consist of attitudes or evaluations stored in memory, but they may also be constructed based on the available evidence. The present study suggests that when either of these judgments reaches a satisfactory level, people may not seek to retrieve information relative to the other dimension and engage in vaccination. If, on the contrary, such a level is not reached, people may seek or retrieve information about the other dimension and still intend to vaccinate if a satisfactory level is reached on this second dimension. Can we gauge in which order these judgments are made (i.e., trust or risk first)? Previous research suggests that social trust can operate as a heuristic cue when deciding on complex issues (Siegrist et al., 2000), such as vaccination (Chen, 2015). People may initially rely on such a heuristic to decide to vaccinate (“Given that I trust the authorities, I will take the shot”) before engaging in more systematic processing based on risk assessment (e.g., cost–benefit analysis) if trust cannot be established. Addressing this possibility appears as a promising avenue for future research.

Previous research has identified integrity as the most stable predictor of government trust (Van Fossen et al., 2025). Our results extend this work by showing that integrity is also the trustworthiness component most strongly associated with health behaviors promoted by the government. This aligns with research on social evaluation (see Koch et al., 2024; Yzerbyt et al., 2025), which has consistently shown that morality—the equivalent facet of integrity in this domain—is a central facet in determining how people evaluate others and behave toward them (Brambilla et al., 2011, 2021). Our findings thus also contribute to the trust literature at a theoretical level by being among the first to highlight the primacy of integrity in predicting highly significant behaviors such as vaccination. Future studies could investigate whether integrity similarly emerges as the key component of trustworthiness for other important outcomes, such as tax compliance (Kogler et al., 2013). This would help determine whether the central role of integrity generalizes across various behaviors and domains where trust in government is critical.

Going beyond the issue of government trust, our work also evidences this interaction for another important target in the context of a pandemic: health experts. Interestingly, the relative importance of the different trustworthiness components varied with the target. Although integrity emerged as the strongest predictor for both government and health experts, the role of benevolence and ability differed: Benevolence was the second strongest predictor when considering trust in the government, whereas ability was the second strongest predictor when considering trust in health experts. One possible explanation is that the government's ability may appear less directly relevant to vaccination behavior, as it does not relate to the vaccine itself but rather to logistical tasks such as its distribution. In other contexts, such as the support for new environmental policies, perception of the government's ability might play a bigger role in shaping behavioral compliance, as citizens will depend on the government's competence to manage these policies effectively (see e.g., Hoffmann et al., 2022).

TABLE 8 Key findings and practical recommendations.

Finding	Implication	Recommended action
High levels of either trust (especially integrity) or risk perception are each associated with greater vaccination intention; both are not necessarily needed	Trust can compensate for low perceived risk	Avoid relying solely on fear-based messaging; invest in building long-term trust
Integrity is the strongest component of trust for both government and health experts	Integrity is likely central in trust-building strategies	Emphasize honesty, transparency, and moral responsibility in official communication

Practical implications

Our findings point to two key messages (see [Table 8](#) for overview and practical implications). First, rather than contributing independently, specific psychological determinants of vaccination *combine* to shape vaccination intentions and behavior. This holds important practical implications, as people do not necessarily need to perceive a high level of risk to get vaccinated. Rather, high trust in authorities can compensate for low risk perception. From a communication perspective, this implies that governments do not necessarily need to point to high levels of risk associated with an outbreak but are probably better off investing on a more chronic basis in a culture of trust toward authorities among their citizens. This is particularly relevant given the potential downsides of risk perception, such as negative emotions and fragile mental health (Han et al., 2021; Li & Lyu, 2021).

Second, as discussed above, perceived integrity plays a primary role across different trust targets, thereby emphasizing the importance of considering the distinct components of trustworthiness to better understand how trust operates. Specifically, our findings suggest that it is especially important for the government to appear honest to encourage public adherence to health recommendations. This implies that instances where the government is caught in dishonest or morally questionable actions, even if these actions are not directly aimed at the public, could seriously undermine its long-term credibility. To the extent that ability was less strongly linked to vaccination behavior, occasional failures in organizational tasks or actions that may portray the government as less competent might be less detrimental.

Limitations

In spite of several strengths (large sample size, reliable measurement), the present work also presents some limitations that must be acknowledged. First, our recruiting of respondents through newspaper advertisements and via social media made the sample not representative of the Belgian population. Moreover, participation was voluntary, which may have led to self-selection bias (De Man et al., 2021) based on a particular interest or concern regarding the COVID-19 situation. However, research indicates that responses from participants recruited via social media during the COVID-19 pandemic did not differ based on whether they were recruited via ads featuring COVID-related images (e.g., someone wearing a mask) or unrelated images (e.g., sports athletes; Donzowa et al., 2023), which suggests the selection bias in the present study may be rather minor. In addition, robustness tests ensured our findings remained the same when controlling for demographic variables such as age, gender, work situation, and language. Nonetheless, it would be relevant for future studies to replicate these findings with

representative samples or even among target vulnerable populations, such as individuals with limited access to official news sources or digital technologies, as their trust in government and health experts might differ (Ali et al., 2020).

Second, the cross-sectional design of the studies necessarily prevents drawing firm conclusions about causality. This being said, our models are firmly grounded in the literature, and previous studies using longitudinal designs have observed similar patterns to those identified in our research (e.g., Han, Zheng, Cristea, et al., 2023; Hilverda & Vollmann, 2021). Nonetheless, experimental designs would allow disentangling the causal processes underlying our findings.

A third limitation is that our data sets were collected at two points in time, each of which covered approximately a three-month period. Although relying on such periods of two to three months ensured a very large sample size, a feature that solidifies our conclusions, one may wonder to what extent such aspects as respondents' perceptions of risk or their level of trust might have changed during that time. Having said this, the finding that our two samples were measured more than half a year apart and delivered a very congruent message, with limited variation in the distribution of our core variables and their relations (see Tables 2 and 5), makes us confident about the robustness of the message.

A final limitation is that both studies concern COVID-19 vaccination. It remains unknown whether these results can be generalized to other vaccines. Indeed, some vaccines may carry different characteristics and implications. In particular, the COVID-19 vaccine was newly developed, introduced in an exceptional context, and has been associated with greater hesitancy compared to routinely recommended vaccines (Nguyen et al., 2024). At the same time, having received previous vaccines is frequently identified as one of the strongest predictors of accepting a new one (Luisi et al., 2024), suggesting that the underlying mechanisms might be shared across vaccination contexts. Nonetheless, further research is needed to assess the extent to which the present findings generalize beyond COVID-19.

CONCLUSION

This research examined how risk perception and trust in government interact to shape vaccination intention and uptake, with a particular focus on the distinct role of trustworthiness components. Across two studies, we found that risk perception interacted with trust to predict vaccination, particularly via the integrity component, suggesting that strong trust in government can compensate for lower perceived risk. Our findings also emphasize that integrity emerged consistently as the most critical component of trustworthiness. Together, our findings provide a deeper understanding of the psychological mechanisms underlying vaccination and contribute to the literature by highlighting the importance of considering the multidimensionality of trustworthiness in understanding trust.

More practically, our research also offers actionable recommendations for public health communication strategies aimed at fostering trust and promoting adherence to health measures: government and health experts alike should avoid relying solely on fear-based messaging but instead invest in building long-term trust. This could be done, among other things, by emphasizing honesty, transparency, and moral responsibility in official communication.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from University of Ghent. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of University of Ghent.

TRANSPARENCY STATEMENT

The materials, data, and analysis scripts for the present research are available on OSF: https://osf.io/ahruc/overview?view_only=7e716b974a184801b763ead3297418d4. These studies were conducted using data collected by the Motivation Barometer project (Vansteenkiste et al., 2024). The idea for these analyses emerged during collaborative discussions held during Fanny Lalot's visit to the Université libre de Bruxelles, where we developed and tested the hypotheses directly in response to our ongoing exchanges. For the first study, we formulated an a priori hypothesis that trust in government and risk perception would interact to predict vaccination, but we had no clear expectations regarding the role of each trustworthiness component. In the second study, we explicitly aimed to replicate the findings of Study 1. Given the context, these studies were not preregistered.

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