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Predicting vaccination hesitancy: The role of basic needs satisfaction and institutional trust

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ABSTRACT

Autonomous motivation is considered a powerful driver of health behaviour, but less is known about the specific roles played by basic needs. Drawing on the context of the COVID-19 pandemic, this research examined basic needs as a motivational determinant of vaccination. We hypothesized that satisfaction of basic needs (autonomy, competence, relatedness) has both a direct and an indirect effect (through trust in science and government) on vaccine hesitancy. Two studies (Study 1: $N = 968$ French and British; Study 2, pre-registered: $N = 716$ Americans) tested our hypotheses and compared vaccinated and non-vaccinated individuals using multigroup structural equation models. We found positive direct (in both studies) and indirect (in Study 1) effects of autonomy satisfaction on vaccine acceptance. In contrast, competence satisfaction was directly and indirectly, via science mistrust, related to vaccine hesitancy, particularly among non-vaccinated people. Competence satisfaction also indirectly reduced the intention to vaccinate in both studies. We found no impact of relatedness. Complementing previous work on self-determination theory, our research demonstrates the importance of considering the distinct roles of basic needs. Moreover, we highlight that increasing autonomy and science trust may be an efficient strategy to improve vaccine acceptance and vaccination, even among reluctant individuals.

1. Introduction

At a time when the frequency and severity of pandemics are predicted to increase in the future [1], we need to anticipate how to enhance acceptance not only of curative measures, but also of preventive health measures. Among the preventive measures, one that is widely recognised as a powerful means of controlling the spread of infectious diseases is vaccination [2]. The COVID-19 pandemic provided an unprecedented opportunity to witness the challenges of vaccine acceptance and to examine ways to combat vaccine hesitancy. From the onset of the COVID-19 pandemic, vaccines were considered a critical step in the effort to reach herd immunity and control the spread of the virus. Yet, concerns about the vaccine have been expressed, and numerous protests have taken place around the world [3]. Despite many health benefits, public support for vaccines is mixed [4,5]. Many individuals still refuse to be vaccinated against COVID-19 [6], and a general decline in vaccination has been observed in recent years (e.g., concerning vaccination of children [7]). Previous work identified two key factors underlying vaccine hesitancy: lack of confidence in the efficacy and/or the safety of the vaccine [8,9]. Specific to the COVID-19 situation, both of these factors independently predicted lower intentions to accept COVID-19 vaccines [10]. Overall, research suggests that older, male, more educated, and richer individuals are more likely to have positive attitudes towards vaccines and higher intentions to get vaccinated [11]. Crucially, and irrespective of one's socioeconomic status and background, the strongest predictors of vaccine hesitancy seem to be individuals' (mis)trust in political and scientific institutions[11,12]. Building on the context of the COVID-19 pandemic, the aim of this paper is to highlight the individual psychological basis of (mis)trust in institutions that may explain vaccine hesitancy by looking at people's fulfillment of basic needs.

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1.1. Trust in institutions and vaccine hesitancy

In political science and psychology, trust in institutions is defined as a set of positive expectations referring to institutional benevolence, competence, and integrity [13,14]. In the context of vaccine hesitancy, Jennings and colleagues [15] highlighted the importance of distinguishing between trust in government and trust in science and scientific institutions, as both independently predicted the intention to vaccinate. Trust in political institutions and science was associated with positive attitudes toward the COVID-19 vaccination and a higher willingness to be vaccinated, whilst institutional distrust was associated with negative attitudes and vaccination hesitancy [15–19].

Previous research mostly focused on understanding how the broader socio-political context shapes individuals' trust in institutions (e.g., in countries with authoritarian regimes, trust in institutions is often low [14]), and overlooked the role individual factors play. In contrast, psychological work on basic needs satisfaction finds that unmet needs are linked to stronger resistance towards authorities [20,21]. Our work provides novel contributions to the literature on trust and vaccine hesitancy by looking at (mis)trust as a motivational process that stems from the satisfaction of individual needs.

1.2. The role of needs satisfaction

We situate our theoretical model in self-determination theory (SDT; [22,23]), which distinguishes between two forms of motivation. Autonomous motivation refers to the tendency to adopt behaviours because of their intrinsic value and is contrasted with controlled motivation, which refers to the tendency to adopt behaviours due to external (e.g., social norms) or internal pressures (e.g., avoiding feeling guilty). Importantly, the work in this area suggests that needs satisfaction is crucial in times of crisis [24]because it is a key psychological resource for resilience in the face of stress [25]. Needs satisfaction is the basis of both autonomous motivation and the internalization of extrinsically motivated activities [26]. Autonomous motivation is considered important for implementing sustainable health behaviours [22,27]. The COVID-19 context is no exception, and autonomous motivation has been shown to increase COVID-19 preventive behaviours such as social distancing [28] and intentions to vaccinate [10].

Moving beyond previous work, we explore the key underpinnings of autonomous motivation that may lead to compliance and vaccination uptake. According to SDT, autonomous motivation is determined by the satisfaction of three basic psychological needs [23,26]: autonomy (i.e., the experience of volition, willingness, and internal locus of causality), competence (i.e., the experience of effectiveness, efficacy, and mastery), and relatedness (i.e., the experience of care, inclusion, and interpersonal connection). The satisfaction of basic needs had positive effects on people's well-being even during the COVID-19 crisis, such as higher life satisfaction, better sleep quality, and fewer symptoms of depression and anxiety [29,30].

However, when individuals' needs are not met, they may lead to oppositional defiance or doing the opposite of what is expected [31]. Of importance for this study, previous work has shown that needs frustration predicts a range of aggressive and non-normative behaviours (e.g., bullying, cheating), including expressing resentment towards authorities [20,21]. In the context of the COVID-19 pandemic, Porat and colleagues [32] compared the link between basic needs satisfaction and intentions to vaccinate between Israel and the UK. To ensure herd immunity and motivate vaccine uptake, the Israeli government introduced vaccine passports. Unfortunately, the findings of Porat and colleagues suggest that the policy may have backfired because it frustrated individuals' needs and lowered individuals' autonomous motivation to get vaccinated.

1.3. Current research

To the best of our knowledge, Porat and colleagues' work [32] is the only published paper that has examined the link between the three basic needs and vaccine acceptance. But they looked at the individuals' needs in relation to getting vaccinated (e.g., "I feel [felt] a sense of choice and freedom in the decision to get vaccinated"), which may overestimate the association between needs satisfaction and vaccine hesitancy. In this project, we estimate the relationship between general needs satisfaction and all three components of vaccine hesitancy: perceptions of vaccine safety, effectiveness, and intentions to vaccinate. Moreover, we examine the reasons why needs may motivate vaccine hesitancy. Building on the arguments by Vansteenkiste and Ryan [31], we expect that unmet needs may motivate defiance and resistance to authorities, which should manifest in lower trust in key institutions promoting the uptake of vaccines, namely the government and science. Thus, we expect individuals' needs to predict vaccine hesitancy both directly, but also indirectly by motivating (mis)trust in authorities.

2. Study 1

We conducted a first study on French and UK samples to test our hypotheses (see Fig. 1). At the time of data collection (April to July 2021), France and the UK had begun their vaccination campaigns. As of July 27, 2021, 60.7 % of French people had received one dose of the COVID-19 vaccine, and 50.8 % were fully vaccinated with two doses [33]. As of July 25, 2021, 87.4 % of UK citizens had received the first dose, and 70.0 % were fully vaccinated [34].

For both studies, data, analysis script, and the full questionnaire can be found on the OSF: https://osf.io/45fce/. Details on demographics, alphas, descriptive statistics, and complete results of structural equation model (SEM) can be found in the Supplementary Material (SM). Studies 1 and 2 were reviewed by the Ethics Committee at Northumbria University (Approval number: 29510).

2.1. Method

2.1.1. Participants

We collected data from 1,031 participants. However, based on our a priori exclusionary criteria, we excluded participants who failed two attention checks, were not living in the target country, responded in under 100 s to the entire questionnaire, completed less than 10 % of the items, or did not answer the question about their vaccination status (n = 59). The final sample for analysis contained 968 participants (M_{age} = 39.0, SD_{age} = 13.3; 420 men, 540 women, four participants identifying as other genders, two preferred not to say). The sample consisted primarily of people with a higher education background who were employed. Concerning vaccination status, 512 participants (52.89 %) had not received any doses of the COVID-19 vaccine.

We intended to conduct a multigroup SEM, distinguishing between non-vaccinated individuals and those who received at least one dose of the COVID-19 vaccine. The two commonly used rules of thumb [35] in determining sample size in SEM indicated a sample size between 270 (with 10 participants per observed variable) and 375 (following a q:N ratio of 5). Therefore, we chose to recruit a sample of at least 400 participants per group. Monte Carlo analyses conducted with MPlus 8.5 [36] indicated that this sample is sufficiently powered (>=.80) to fit our model (see Model 1, Fig. 1) and detect small to medium regression coefficients (b = 0.20). We pooled the UK and French samples to achieve a reliable sample size for the analyses.

2.1.2. Procedure

Data were collected online using the crowdsourcing platforms Prolific (UK) and Foule Factory (France) between April and July 2021. The questionnaire was administered in English and French. After providing their consent, participants completed measures of basic needs

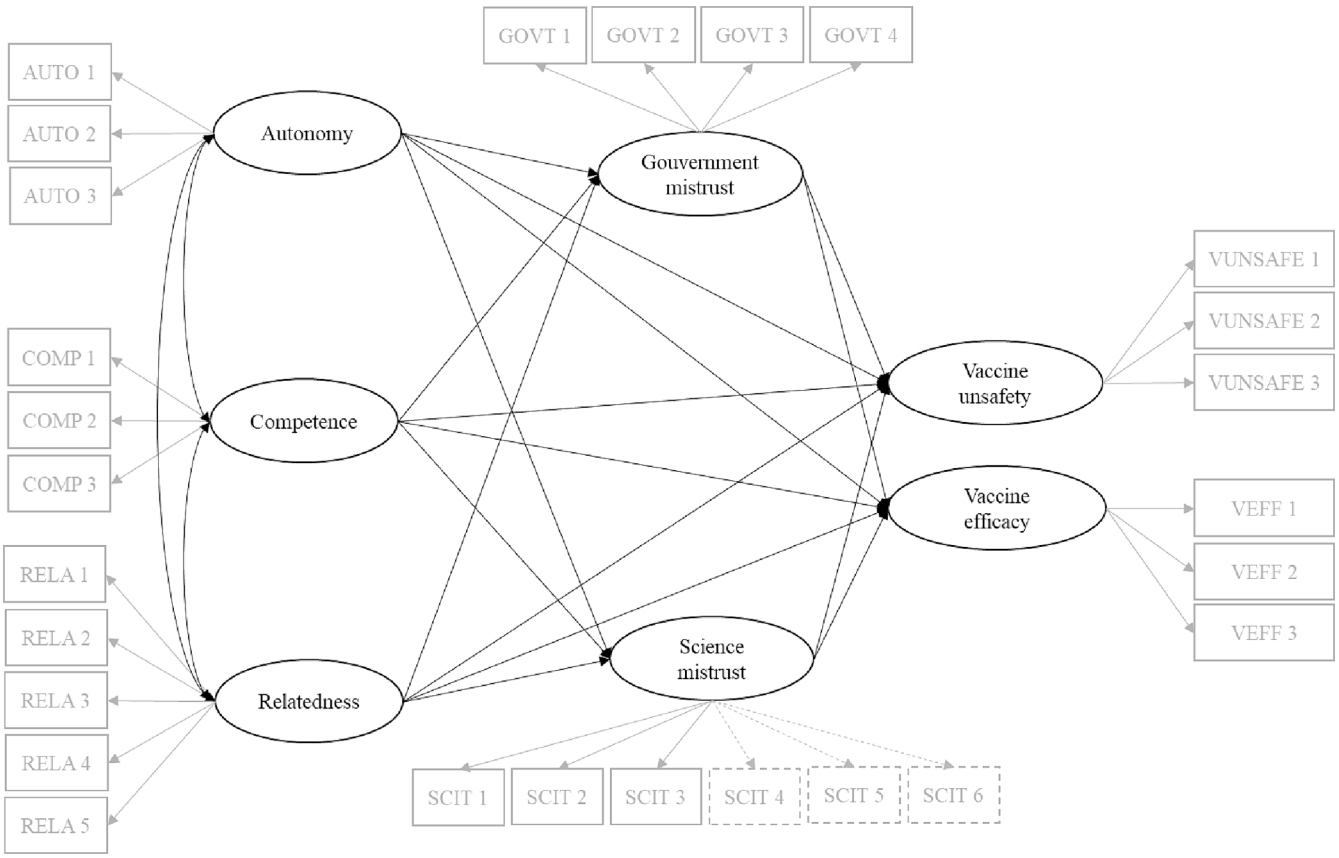

Fig. 1. Tested Structural Equation Model. Note. The dotted items are included in Model 1, but not in Model 2. AUTO = autonomy; COMP = competence; RELA = relatedness; GOVT = government (mis)trust; SCIT = science mistrust; VUNSAFE = perception of vaccine unsafety; VEFF = perception of vaccine efficacy.

satisfaction, political trust, science mistrust, vaccination status, attitude towards the COVID-19 vaccine, intention to get vaccinated (for non-vaccinated participants only), and demographics (age, gender, education level, employment status).[1] Participants were debriefed and reimbursed with £1.50 for their time.

2.1.3. Measures

Basic Psychological Needs. Twenty-one items [37] were used to measure autonomy, competence, and relatedness. Response options ranged from *Not at all true of myself* (1) to *Very true of myself* (7). We conducted factor analyses to check whether the three basic needs were distinct from each other (see SM). We found that negatively worded items did not load well, and Item 14 did not load onto the autonomy factor. Similar findings were reported previously [37]. Thus, we retained only positively worded items (three items for autonomy, three for competence, and five for relatedness).

Government (Mis)trust. Four items [38] were used to measure general political trust (e.g., "The leaders of the main political parties in the UK/France are trustworthy"), on a 7-point scale ranging from *Strongly disagree* (1) to *Strongly agree* (7). In the model, the latent variable refers to government mistrust, with positively worded items loading negatively on the variable.

Science Mistrust. Six items [39] were used to measure science credibility (e.g., "People trust scientists a lot more than they should"), on a 7-point scale ranging from *Strongly disagree* (1) to *Strongly agree* (7).

Vaccination Status. Participants were asked whether they had already received one or more doses of the COVID-19 vaccine. Response options were *No* or *Yes* for the UK participants, and *No*, *Yes one dose,* or *Yes two doses* for the French participants.

COVID-19 Vaccine Perception. Six items [40] were adapted for the COVID-19 vaccine to ask about its unsafety and efficacy, with response options ranging from *Strongly disagree* (1) to *Strongly agree* (7). Three items focused on unsafety (e.g., "I worry that the COVID-19 vaccine might negatively affect my body"). Three items focused on efficacy (e.g., "I believe the COVID-19 vaccine is effective in preventing COVID-19").

Vaccination Intention. For participants who indicated they did not receive any dose of the vaccine, we asked them about their intention to get vaccinated with three items [41] (e.g., "Do you intend to get the COVID-19 vaccine?"), on a 5-point scale ranging from *Definitely not* (1) to *Definitely yes* (7).

2.2. Results

2.2.1. Model and metric invariance

We first tested the full model (Model 1, see Fig. 1), evaluating the coefficients for each group (vaccinated and non-vaccinated) separately. We conducted a first test to assess the metric invariance between vaccinated and non-vaccinated individuals. This test indicated that loadings were non-invariant between our two groups, $\Delta\chi^2(20) = 52.97$, $p < .001$. We explored the non-invariant items by constraining the loadings one by one and found that the loadings of the last three items of mistrust of science differed between groups. We then removed these three items from our model (Model 2) and re-ran the metric invariance analysis, which confirmed the invariance between groups, $\Delta\chi^2(17) = 24.34$, $p = .111$.

[1] We included additional measures of general vaccine beliefs, norm perceptions, perception of correct handling with pandemic and vaccination by the government, national identification, and political orientation, which were not further analyzed.

2.2.2. Test of the multigroup Structural Equation Model on vaccine perception

We ran the final multigroup SEM (Model 2) with a 5,000-bootstrap resampling. The model with paths assessed separately in each group had a good fit and differed from the model constraining all intercepts and path coefficients to be equal (see Table 1). All the items loaded correctly on their respective latent variables.

To examine whether the regression coefficients differed between the groups, we performed Wald Chi-squared tests comparing the model with all freely evaluated path coefficients to models constraining each coefficient one by one. A significant difference between the models means that the path differs between vaccinated and non-vaccinated individuals.

As can be seen in Fig. 2, autonomy played a major role in determining mistrust of both government and science among vaccinated and non-vaccinated individuals. The more participants' need for autonomy was satisfied, the more they trusted both the government and science. In addition, competence had an effect among non-vaccinated people, being related to more mistrust in science (although this effect did not differ significantly from the non-significant effect observed among vaccinated people). Finally, competence satisfaction had no effect on government mistrust, and relatedness had no effect on government or science mistrust. Furthermore, as expected, science mistrust was related to the perception of the COVID-19 vaccine as less safe and less effective. Although both paths were significant, the Wald-test indicated that this relationship was stronger among non-vaccinated (vs. vaccinated) participants. Government mistrust was only related to the perception of the vaccine as less effective, and this relationship was again stronger among the non-vaccinated.

Regarding the direct effect of basic needs satisfaction on perception of vaccines, we observed a positive direct effect of autonomy on vaccine unsafety among vaccinated people. A negative direct effect of competence on the perception of vaccine effectiveness among non-vaccinated people was also significant. However, those two direct effects did not significantly differ between vaccinated and non-vaccinated participants.

In sum, autonomy was an indirect driver of perception of vaccine efficacy through an increase in institutional (government and science) trust, and an indirect and direct predictor of perception of vaccine safety through science trust (albeit among vaccinated people only). In contrast, competence was indirectly (through science mistrust) associated with the perception of vaccines as unsafe, and both directly and indirectly (through science mistrust) with the perception of vaccine inefficacy, but only among vaccinated participants.

2.2.3. Test of the Structural Equation Model on vaccination intention

We conducted a SEM analysis on vaccination intention among non-vaccinated participants only. We used the same latent variables to predict intention to get vaccinated, cf. Fig. 3. The model had an acceptable fit, see Table 1.

Consistent with the previous multigroup analysis, autonomy was related to less mistrust in science and government, while competence was related to more science mistrust. Moreover, mistrust in both government and science was related to a lower willingness to get vaccinated among non-vaccinated participants. Thus, interestingly, autonomy and competence had opposite indirect effects (resulting in opposite total effects, see SM) on vaccination intention. Autonomy satisfaction was indirectly related to higher vaccination intention, through higher institutional trust. In contrast, competence satisfaction was related to a lower intention to vaccinate, through a decreased trust in science.

There was no direct effect of basic needs on vaccination intention, indicating that these relationships were fully accounted for by institutional mistrust.

3. Study 2

Study 2 aims to replicate Study 1 on a US sample while preregistering our model (https://aspredicted.org/X58_TKS). Data were collected from December 7, 2021 to April 21, 2022. As of December 7, 2021, 71 % of Americans had received at least one dose of the vaccine, and 60 % were fully vaccinated with two doses. When we stopped data collection on April 21, 2022, rates of vaccination had risen slightly, with 77 % of Americans having received one dose and 66 % being fully vaccinated [42].

3.1. Method

3.1.1. Participants

We recruited 826 participants via the Prolific crowdsourcing platform to complete an online questionnaire. Based on our a priori criteria, we excluded participants who failed two attention checks, were not living in the target country, responded in under 100 s to the entire questionnaire, completed less than 10 % of the items, or did not indicate their vaccination status ($n = 101$). The final sample included 716 participants (Mage $= 40.7$, $SD = 13.7$, 347 men, 343 women, 17 participants identifying as other genders, and three preferred not to say). Concerning vaccination status, 336 participants (46.9 %) had not received any dose of the COVID-19 vaccine.

3.1.2. Procedure and measures

The procedure and materials were identical to Study 1. The only addition was to the demographics, where we asked about state of residence.

3.2. Results

3.2.1. Model and metric invariance

We performed a first analysis to check the metric invariance between vaccinated and non-vaccinated participants. This analysis confirmed that the configural (baseline) Model 1 and the model constraining loadings to be equal between groups did not differ significantly, $\Delta\chi^2(20) = 8.59$, $p = .987$. We therefore used Model 1 in the following analysis.

3.2.2. Test of the multigroup Structural Equation Model on vaccine perception

We ran the multigroup SEM (Model 1, cf. Fig. 1) with a 5,000-bootstrap resampling. The model with paths assessed separately in each

Table 1
Fit Indices of Models on Vaccine Perception (Model 2 and Constrained Model, With all Intercepts and Path Coefficients Constrained to be Equal Across Groups), and Model 2 on Vaccine Intention (Study 1).

Outcome	Model	χ^2 (df)	CFI	RMSEA	90 % CI RMSEA		SRMR	$\Delta\chi^2$ (Δdf)
Vaccine perception	Model 2	1205.53*** (606)	.95	0.05	0.05	0.06	.04	
	Constrained model	1313.12*** (628)	.95	0.06	0.05	0.06	.05	58.94*** (20)
Vaccination Intention	Model 2	428.64*** (174)	.95	0.05	0.05	0.06	.06	—

***$p < .001$.

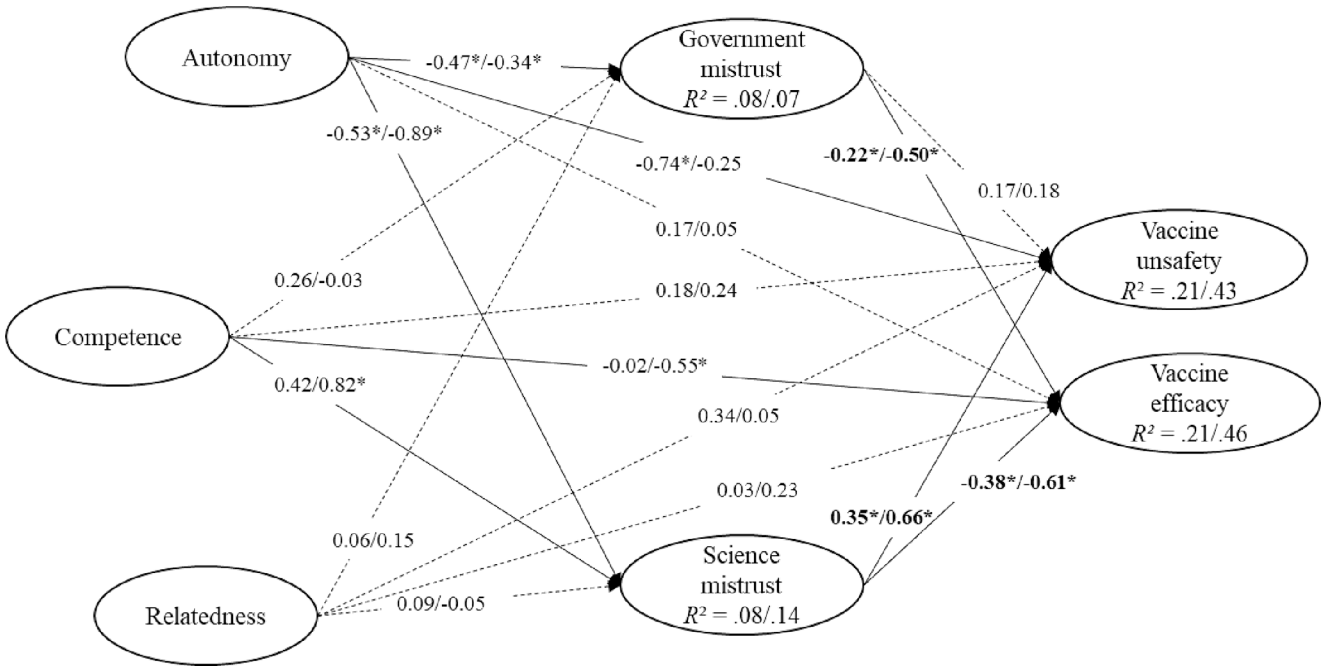

Fig. 2. Results of the Multigroup Structural Equation Model Analysis on Vaccine Perception (Study 1). Note. Coefficients indicated are unstandardized B. Coefficients for the group of vaccinated participants are indicated on the left, and coefficients for the group of non-vaccinated participants are on the right. The asterisk (*) indicates that the confidence interval associated with the coefficient does not contain 0. Coefficients indicated in bold mean that they differ between groups. Dotted arrows refer to a lack of significant effect in both groups.

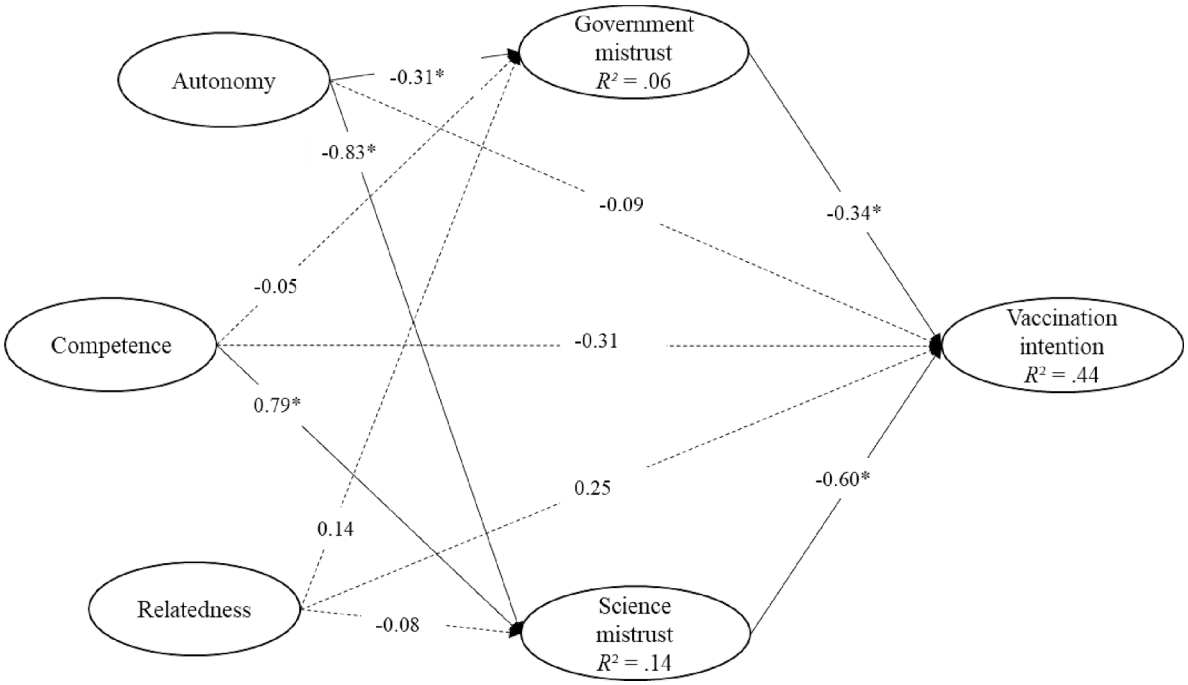

Fig. 3. Results of the Structural Equation Model Analysis on Vaccination Intention Among Non-Vaccinated Participants (Study 1). Note. Coefficients indicated are unstandardized B. The asterisk (*) indicates that the confidence interval associated with the coefficient does not contain 0. Dotted arrows refer to a lack of significant effect in both groups.

group had a satisfactory fit (see Table 2).

All items loaded correctly on the latent variables. We followed the same procedure as in Study 1: After estimating the path coefficients in the model, we constrained the paths one by one to examine the invariance between the groups. The results are shown in Fig. 4.

In contrast to Study 1, only competence satisfaction was positively related to science mistrust. The other basic needs were not related to government or science mistrust.

Furthermore, as in Study 1, both government and science mistrust were negatively related to the perception of the vaccine as effective; these effects did not differ between groups. Finally, as in Study 1, science mistrust (but not government mistrust) was related to the perception of

Table 2
Fit Indices of Models on Vaccine Perception (Model 1 and Constrained Model, With all Intercepts and Path Coefficients Constrained to be Equal Across Groups), and Model 1 on Vaccine Intention (Study 2).

Outcome	Model	χ^2 (df)	CFI	RMSEA	90 % CI RMSEA		SRMR	$\Delta\chi^2$ (Δdf)
Vaccine perception	Model 1	1205.53*** (606)	.95	0.05	0.05	0.06	.04	
	Constrained model	1313.12*** (628)	.95	0.06	0.05	0.06	.05	58.94*** (20)
Vaccination intention	Model 1	480.35*** (327)	.96	0.06	0.05	0.06	.04	—

*** $p < .001$.

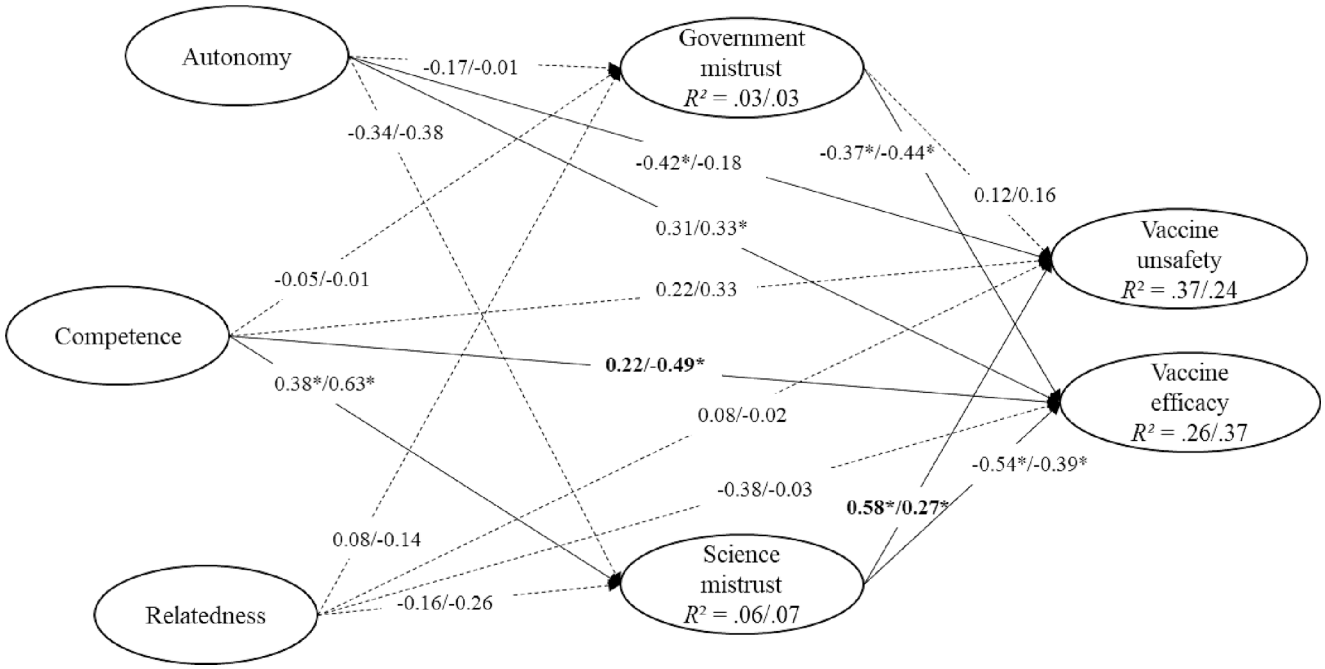

Fig. 4. Results of the Multigroup Structural Equation Model Analysis on Vaccine Perception (Study 2). Note. Coefficients indicated are unstandardized B. Coefficients for the group of vaccinated participants are indicated on the left, and coefficients for the group of non-vaccinated participants are on the right. The asterisk (*) indicates that the confidence interval associated with the coefficient does not contain 0. Coefficients indicated in bold mean that they differ between groups. Dotted arrows refer to a lack of significant effect in both groups.

the vaccine as unsafe. This association was stronger among vaccinated than non-vaccinated individuals.

Moreover, autonomy was directly related to the perception of vaccines as safe among vaccinated participants and as efficient among non-vaccinated people (although those effects did not differ from those observed among non-vaccinated and vaccinated participants, respectively). Competence had a negative direct effect on the perception of vaccine efficacy among non-vaccinated people only.

3.2.3. Test of the Structural Equation Model on vaccination intention

We conducted the same model with the intention to get vaccinated as the outcome, considering only non-vaccinated participants, see Fig. 5. The model had a satisfactory fit, $\chi^2(327) = 480.35$, $p < .001$, RMSEA = 0.06 [0.05, 0.06], CFI = .96, SRMR = .04.

As in the previous model, only competence satisfaction was related to science mistrust. There was no other association between need satisfaction and institutional mistrust. In addition, science (but not government) mistrust was related to a lower intention to get vaccinated.

Finally, as in Study 1, we found no direct relationship between satisfaction of basic needs and intention to get vaccinated.

4. Discussion

In the aftermath of the COVID-19 pandemic, and given the likelihood of increased pandemics in the future, it has become essential to anticipate and identify factors that predict preventive health behaviours, including vaccine uptake. Understanding these determinants can inform health policies and help authorities prepare for future health crises. Our research makes innovative contributions to the existing literature on trust, particularly regarding vaccine hesitancy, by looking at (mis)trust as a motivational process that stems from the satisfaction of psychological needs of autonomy, competence, and relatedness. We hypothesized that unfulfilled needs could motivate vaccine hesitancy both directly and indirectly, by fueling dissent and opposition towards key institutions that advocate for vaccine uptake, namely the government and scientific community. Our results partially confirmed these hypotheses and shed additional light on the complex relationship between basic needs, trust in institutions, and vaccine hesitancy. We discuss our results, considering the role of institutional trust on the one hand and the role of basic needs on the other.

4.1. Trust in science and government

Our research confirms the strong link between institutional

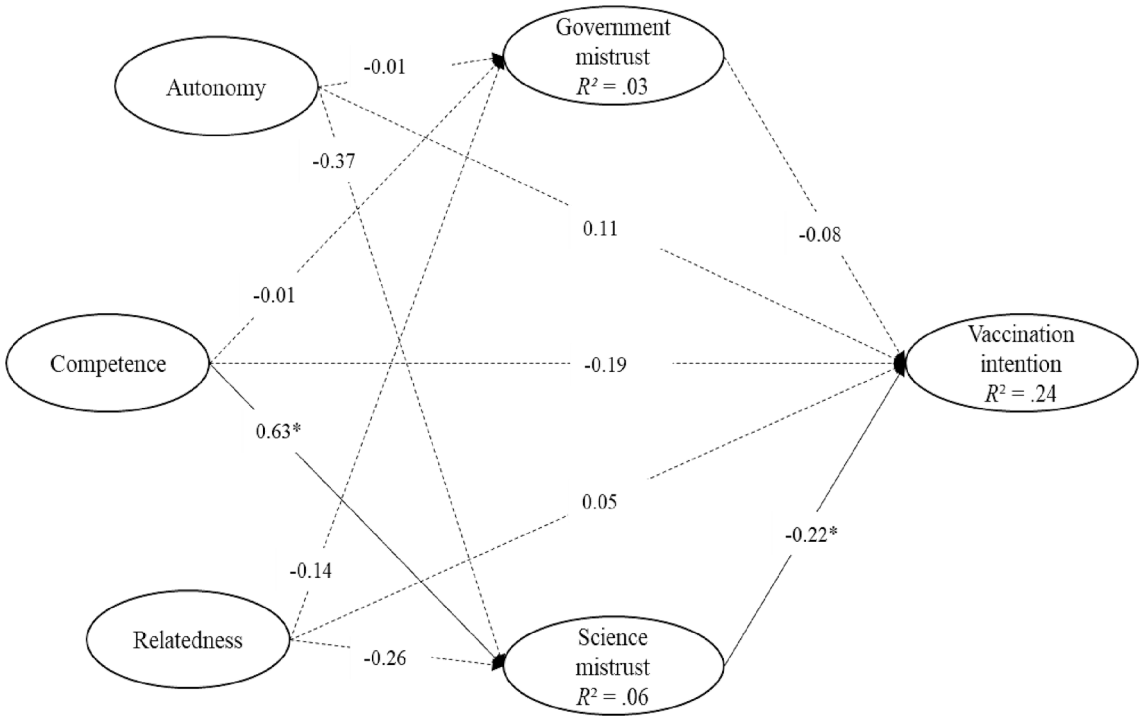

Fig. 5. Results of the Structural Equation Model Analysis on Vaccination Intention Among Non-Vaccinated Participants (Study 2). Note. Coefficients indicated are unstandardized B. The asterisk (*) indicates that the confidence interval associated with the coefficient does not contain 0. Dotted arrows refer to a lack of significant effect in both groups.

(government and science) mistrust and vaccine hesitancy. Yet, government and science mistrust did not follow exactly the same pattern regarding attitudes towards vaccines. Interestingly, in both of our studies (and thus in France, the UK, and the US), science mistrust was related to the perception of the vaccine as being unsafe and less effective among both vaccinated and (albeit somewhat weaker) non-vaccinated people, and to lower intention to vaccinate among non-vaccinated participants. In contrast, government trust was related to the perception of the vaccine as more effective, again among both vaccinated and non-vaccinated people, and was also linked to vaccination intention in Study 1 (but not in Study 2).

These findings complement the literature on institutional (mis)trust and vaccine hesitancy by first showing the distinct impact of government and science authorities. First, while trust in science promotes better attitudes towards vaccines in terms of safety and efficacy, as well as intention to vaccinate, government trust only promotes perception of vaccine efficacy and, less consistently, vaccination intention. Although some studies have shown a similar and parallel impact of political and scientific trust on vaccine acceptance [15,19], our results regarding the stronger impact of trust in science than in government echo those of Seddig and colleagues [11]. This points to the stable influence of trust in science, in contrast to the more volatile impact of trust in government and politics, which may be more dependent on the political context. Therefore, it may be desirable to prioritise increasing trust in science in order to improve health behaviours and to implement more global and longer-term strategies to improve science trust. Our second and particularly important contribution on institutional trust is that these relationships hold for both vaccinated and non-vaccinated people. Overall, our results suggest that increasing institutional trust, and in particular trust in science, can be an effective means of promoting vaccine uptake, even among the most skeptical people who have refused vaccination so far.

4.2. The distinct roles of autonomy, competence, and relatedness

An important factor that may influence trust is autonomous motivation. Although autonomous motivation has been identified as a key factor in health policy compliance, including COVID-19 vaccine uptake [10], few studies examined the impact of the putative underlying process, i.e., basic need satisfaction. Our research is one of the first to examine the impact of basic need satisfaction on vaccine hesitancy and to highlight the distinct, even opposing, roles of autonomy, competence, and relatedness.

First, with regard to autonomy, higher levels of autonomy satisfaction were related to greater perceptions of vaccine safety and efficacy, both directly (among vaccinated participants in both studies) and indirectly by promoting trust in government and science (in Study 1). Autonomy was also indirectly related (through trust in government and science) to intention to vaccinate among the non-vaccinated participants (in Study 1). The present results converge with other work showing that frustrated or satisfied autonomy can foster feelings of resentment or trust, respectively, towards authority [20,21], and with research underlining the role of autonomous motivation and autonomy in health compliance[22,27]. The effect of autonomy on institutional trust warrants further investigation as we did not replicate it in Study 2 with the American sample. One potential explanation could be the timing, as the vaccine roll-out was well underway in Study 2, in contrast to Study 1 when it was just beginning. Future research could explore whether autonomy satisfaction is a more important motivational determinant of trust in the early stages of vaccination efforts, when the government and scientific institutions are actively mobilizing their citizens, and whether its impact diminishes once vaccines have been widely rolled out.

A different picture emerges regarding competence. We initially assumed that competence satisfaction would also lead to greater vaccine acceptance. However, in both studies, higher competence satisfaction was directly related to lower perceptions of vaccine efficacy among non-vaccinated people (and among vaccinated people in Study 2).

Competence was also indirectly related (through greater science mistrust) to lower perceptions of vaccine efficacy and less intention to vaccinate among non-vaccinated participants. These results might be explained by the fact that non-vaccinated individuals are more likely to have a "conspiracy mindset/mentality" [43], and especially to express COVID-19 conspiracy beliefs [44]. Many COVID-19 conspiracies centered on ways to protect oneself did not involve vaccines (e.g., drinking bleach, sunlight) and may have led people who believed in these conspiracies to feel competent in protecting themselves. Furthermore, belief in COVID-19 conspiracies is associated with an intuitive thinking style and more cognitive biases, such as resistance to contradictory information [45]. Therefore, we speculate that competence satisfaction among non-vaccinated individuals may refer to their perception of knowledge based on misinformation, including skepticism about vaccines. Vaccine campaigns should pay more attention to potential backlash effects when aiming to increase the sense of competence, because competence based on misinformation or even conspiratorial beliefs can be problematic.

Finally, we did not observe any impact of relatedness. This might be surprising in view of the literature suggesting that identification or belonging are powerful motivators for health compliance in times of COVID-19 [46,47]. Perhaps processes differ between vaccine uptake and less invasive preventive behaviours such as social distancing. It may also be that general relatedness satisfaction is not related to vaccine acceptance, while identification with specific groups, such as family, activates specific prosocial motivations and thus may foster willingness to comply with health measures [47]. Finally, it is also possible that at the time of our studies, prosocial motivation was less relevant for improving compliance. Indeed, at the beginning of the COVID-19 pandemic, the main arguments to improve compliance were related to the common good and solidarity with vulnerable people [48]. However, even at the onset of the pandemic, cross-cultural work reported that group belongingness and solidarity did not necessarily lead to adoption of COVID-19 preventive behaviours [49]. The relation between relatedness and vaccine hesitancy seems to be more complex and may be more dependent on the cultural context, timing, and the characteristics of the specific health behaviour.

4.3. Limitations

First, the use of a cross-sectional design limits our capacity to establish causality. Future studies should use longitudinal designs to gain a better understanding of the interplay between basic needs, trust in authorities, and vaccination uptake, which may change throughout the vaccination campaign.

Second, we draw on the context of the COVID-19 pandemic, which provides an unprecedented opportunity to study vaccine hesitancy. However, we must bear in mind that the context of the COVID-19 pandemic was a global upheaval and the source of many anxieties and conspiracy theories. Our findings, particularly those related to competence, may be particularly relevant in crisis contexts such as the COVID-19 pandemic, which are prone to the rise of conspiracy theories and institutional distrust [50].

Third, we used existing scales to measure government (mis)trust, science mistrust, vaccine unsafety, and vaccine efficacy. Of these measures, science mistrust and vaccine unsafety involve negative perceptions, while vaccine efficacy involves a positive perception (government mistrust contains both positively and negatively worded items). We considered all variables, and especially institutional mistrust-trust, as unidimensional, continuous variables. However, it is possible that specifically measuring mistrust or trust may have led to some differences in the results (for example, it may be that trust in science has a weaker effect than mistrust in science on vaccine perceptions). Given this, and the fact that question wording influences how participants respond to the scales, future studies could consider having balanced measures for each variable, containing both positively and negatively worded items.

4.4. Practical implications

Our research highlights the key role of autonomy in increasing vaccination uptake and acceptance, not only among the convinced (i.e., vaccinated) but also among the non-vaccinated. It is also important to note that our results caution against a potential backlash effect of competence-boosting. Our findings highlight the necessity of distinguishing different basic needs to improve communication in the field of health prevention. Our research also suggests focusing more on building trust in science, rather than trust in government to achieve a stable and wider increase in vaccine acceptance and potentially other health promotion behaviours.

5. Conclusions

Vaccination is undeniably a critical tool in combatting infectious diseases, as seen during the COVID-19 pandemic. However, a significant proportion of the public remains hesitant. While many studies have examined the relation between vaccination uptake and trust in government or trust in science [17,19], our study is the first attempt to examine vaccine uptake by looking at (mis)trust as a motivational process that stems from satisfaction of individual needs, i.e., autonomy and competence satisfaction. Our findings provide new insights into the opposing roles of autonomy and competence satisfaction in predicting trust in authorities and trust in science. We highlight the importance of fostering autonomy satisfaction and science trust to improve vaccine acceptance and vaccination, even among reluctant citizens.

CRediT authorship contribution statement

Gaëlle Marinthe: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review & editing. **Genavee Brown:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Mioara Cristea:** Conceptualization, Investigation, Methodology, Project administration, Resources, Writing – review & editing. **Maja Kutlaca:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

For both studies, data, analysis script, and the full questionnaire can be found on the OSF: https://osf.io/45fce/.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2024.04.068.

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