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RESEARCH ARTICLE

The role of trust in government and risk perception in adherence to COVID-19 prevention measures: survey findings among young people in Luxembourg

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Abstract

Citizens' trust in government is crucial in managing crises that require coordination as it is linked to cooperative behaviour and sociability. Willingness to adopt appropriate health measures plays a decisive role in the effective containment of COVID-19 and other pandemics. Preventive health measures such as physical distancing, avoiding crowded places, wearing masks, and frequent hand washing reduce the spread of the virus. In this study, we examined how trust in government, risk perception, and knowledge were separately and jointly related to compliance with preventive health measures. We focused on young adults who are less prone to the disease than older demographics, who therefore have fewer incentives to protect themselves, and are accordingly pertinent for the study of public health and understandings of risk. Using recent data from a survey completed by 2,455 young people in Luxembourg, we employed structural equation modelling to assess our hypotheses. We found that trust in government, risk perceptions, and COVID-19 knowledge are important predictors of young people's adherence to health measures and prosocial protection. Additionally, these factors are interrelated in several complex and non-linear ways. Our findings provide insights into young people's specific health behaviours, highlighting the roles of risk perception and trust in government in mitigating the spread of COVID-19 and other infectious diseases.

Keywords: Risk perception; youth; COVID-19; trust; structural equation modelling

Introduction

Exploring the measures that contained, or failed to contain, the COVID-19 pandemic, alongside the factors shaping the levels of cooperation with these measures, such as wearing masks and social distancing, is essential in order to inform public health approaches in future pandemic outbreaks (Ward & Atchison, 2020). In most countries, the state plays the role of crisis manager and communicates the health measures necessary to manage the disease (Christensen & Lægreid, 2005; Devine et al., 2020; Han et al., 2021; O'Malley et al., 2009). Trust in government plays a key role in the public adoption of these measures. In the past decades, risk researchers have shown such

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trust to be an effective and efficient tool in risk management (see, for example, Fjaeran & Aven, 2021; Poortinga & Pidgeon, 2003; Slovic, 1992). In this context, trust functions as a means of reducing complexity to orient one's own behaviour when faced with uncertainty and a lack of information (Cologna & Siegrist, 2020; Fukuyama, 1996; O'Malley et al., 2004). It is important, therefore, to understand the relationship between trust in government and the adoption of preventive health behaviours and to investigate factors that affected this trust when managing the COVID-19 pandemic.

As a construct determined by cultural, social, and individual factors (Brown, 2020; Douglas & Wildavsky, 1983; Dryhurst et al., 2020; Leiserowitz, 2006), risk perception (or threat appraisal) is deeply connected to trust. People's perceptions of COVID-19-related health risks can, therefore, be assumed to be strongly associated with respective health measures, as people attempt to minimise the risk of infection by acting accordingly (Aerts et al., 2020; Ferrer et al., 2018; Kim & Choi, 2016). Young people generally have a lower medical and perceived risk of severe progression when affected by COVID-19 than older adults and therefore it is interesting and important to investigate what motivates them to relinquish their individual freedom to protect the more vulnerable, generally older, population, despite the lack of direct incentives (Bruine de Bruin & Isaacowitz, 2021; Hertwig et al., 2020; Reniers et al., 2016; Rosi et al., 2021; Yang et al., 2020).

In this study we examine the relationship between trust in government and risk perception, and the health behaviours of young adults in terms of self-interested and prosocial behaviours. We use theoretical considerations and empirical evidence to build a conceptual model and derive hypotheses, with a particular focus on exploring the interplay of trust and risk.

Context

The COVID-19 pandemic has been characterised by a particularly diverse problem situation. On the one hand, it is in people's interest to protect themselves from the virus. On the other hand, there is a considerable proportion of young people who are comparatively less directly affected by disease risk (Bi et al., 2020; Shekerdemian et al., 2020; Zimmermann & Curtis, 2020) and who yet have adhered to several restrictions[1] to protect older adults from virus infection. Therefore, exploring their ambiguous situation is significant for understanding what drives their behaviours and the roles of trust and risk therein.

While COVID-19 is now an extensively researched topic, with contributions from a variety of disciplines and a focus on medicine and epidemiology, social science studies on the relationship between the (psycho)social factors of trust in government, affective risk perceptions, and adherence to health measures among young people remain relatively limited (however, see Dryhurst et al., 2020; Han et al., 2021; Lim et al., 2021).

Addressing this research gap, we investigated the (psycho-)social antecedents of adherence to COVID-19 health measures. In the absence of pertinent theoretical frameworks in a large swathe of the COVID-19 literature, we draw on the rich wider literature on people's trust in government and their risk perceptions, as well as more specific research on perceived knowledge, risk perception and trust in government pertaining to COVID-19. This allowed us to derive theoretical and empirical hypotheses for young people's actions which then tested on data from a survey of a large stratified-random sample of young people in Luxembourg. In the following, we introduce and discuss the factors that are relevant to our investigation, derive our hypotheses, and present our conceptual framework.

Trust in government

Understanding the interdependence of trust and policy in modern societies is important for identifying factors that determine policy responses. In this sense, studying co-operation with COVID-19 health measures is relevant as such behaviours are based on political interventions (Devine et al., 2020).

It is generally assumed that trust promotes the smooth and harmonious functioning of social interactions at various levels by reducing social complexity and social uncertainty (Luhmann, 1979; Poortinga & Pidgeon, 2003). Trust in government represents people's confidence and satisfaction with a government's performance (Bouckaert & van de Walle, 2003; Christensen & Lægreid, 2005). It is a cornerstone of political systems in modern democratic societies during the social management of natural disasters, economic crises, and most recently, pandemics (Rodríguez et al., 2018). In the context of COVID-19 specifically, empirical studies show that greater trust in government is associated with higher compliance with health policies. These findings are consistent with those of studies on previous epidemics. Siegrist and Zingg (2014) showed that trust in health authorities positively contributed to people's willingness to adopt recommended health behaviours. Blair et al. (2017) observed that respondents who expressed low trust in the government were also less likely to follow precautionary measures such as social distancing. In their study of the H1N1 influenza pandemic, Rubin et al. (2009) reported that people with greater trust in government were more likely to follow public health recommendations. Further, in another study conducted in the context of the Severe Acute Respiratory Syndrome (SARS) outbreak, Fong and Chang (2011) demonstrated that trust in government is associated with greater adherence to public health recommendations.

A variety of empirical work in recent decades has highlighted that trust in, and legitimacy of, government are related to the acceptance of and adherence to preventive or curative measures, as well as behavioural changes in individuals to reduce infection risk (Dryhurst et al., 2020; Hills & Eraso, 2021; Leavitt, 2003; Mohseni & Lindstrom, 2007; O'Malley et al., 2004; Shanka & Menebo, 2022; van Bavel et al., 2020; Wong & Jensen, 2020). Therefore, we propose the following hypothesis:

H1: Trust in government is positively associated with compliance with health measures.

Risk

It is commonly assumed that people's risk perceptions of COVID-19 have a strong association with the respective health measures and that people would attempt to minimise their risk of infection by acting accordingly (Aerts et al., 2020; Ferrer et al., 2018; Kim & Choi, 2016). Moreover, Leppin and Aro (2009) observed a decreasing marginal utility for compliance with health measures for risk perceptions, with excessively high perceptions of risk potentially undermining compliance. Drawing on a wealth of empirical work over the past decades and more recently, we generally find that risk perception is related to the acceptance of and adherence to prevention or treatment measures (Dryhurst et al., 2020; Garfin et al., 2021; Lo Presti et al., 2022; Yang et al., 2020). In other words, a higher level of perceived risk results in a higher level of preventive behaviour. Hence, we formulate the following hypothesis.

H2: Risk perception is positively associated with compliance with health measures.

Risk researchers have highlighted the key role of trust in institutions (as risk managers) and the relevance of trust as an important factor in risk perception and acceptance (Poortinga & Pidgeon, 2003; Wynne, 1980). Researchers have found a negative effect between confidence and risk perception in different risk contexts, such as epidemics or climate change. Thus a higher level of trust should lead to more optimistic attitudes towards risk so that negative associations can be found (Siegrist et al., 2005; Smith & Mayer, 2018). However, some researchers have observed this relationship differently and describe a positive association between these two factors (Gilson, 2003; Larson et al., 2018). The ambivalent theoretical relationship between trust and risk perception is presented in detail in the works of sociologist Georg Simmel. He argued that trust is based neither on rational decisions nor on hope, and that risk perception derives from a potential lack of trust or a divergent understanding of trust on different social levels (Simmel, 1990). Luhmann (1979) also posited that trust takes on a implicit social role that is fundamentally different from a calculated construction of alternatives (as prevails in risk evaluation). A similar effect was partially observed in a few countries in a recent study of the role of trust in COVID-19 risk perception. This effect raises interesting questions about the possible causes: Dryhurst et al. (2020) findings ranged between a negative relationship and no association at all, hence suggesting a certain degree of ambivalence. In the trust and risk research, it is assumed that trust negatively influences risk perception; in other words, a high level of trust has been associated with lower risk perception (Siegrist et al., 2005). Thus, in our study, we cautiously expect a negative relationship in this case and hypothesise:

H3: Trust in government is negatively associated with risk perceptions.

COVID-19 knowledge

Knowledge is considered a central element to the understanding of health behaviour. In the environmental sciences, it is considered a necessary precondition for meaningful pro-environmental behaviour (DiClemente, 1989; Fisher & Fisher, 1992; Heimlich & Ardoin, 2008; Kaiser et al., 2008). Individuals behave in a particular manner only if they are aware of the consequences of their actions. Knowledge is necessary for behaviour change, health promotion, and disease prevention; a lack of it leads to misconceptions (Tenkorang, 2018). Lower levels of perceived knowledge are associated with lower trust in government and a higher likelihood of accepting misinformation (Vinck et al., 2019); thus, insufficient knowledge about disease prevalence could undermine prevention efforts and behaviours (Ejaz et al., 2021). Knowledge can have a direct impact on disease prevention as those aware of the precautions behave accordingly (Bandura, 1998). This relationship was more thoroughly examined in a recent empirical study that found that people who were aware of information about COVID-19 were more compliant with the related health measures (Pan et al., 2020). Thus, we propose the following hypothesis:

H4: COVID-19 knowledge is positively associated with compliance with health measures.

However, knowledge of a disease can also have an indirect impact through risk perception; that is, people who are knowledgeable about diseases are more likely to assess their risk of contracting these diseases (Prati et al., 2021; Tenkorang & Maticka-Tyndale, 2014). Consequently, we hypothesise:

H5: COVID-19 knowledge is positively associated with risk perception.

Knowledge can be seen as a form of self-empowerment that influences risk perception and is associated with trust in government; thus, it directly and indirectly promotes the awareness needed to adopt necessary health behaviours (Di Wang & Mao, 2021). This conclusion has also been drawn in more recent studies of the COVID-19 pandemic, although more detailed studies of the relationship between these two quantities are still lacking (Han et al., 2021; Lim et al., 2021). Informed by the existing theoretical reflections and empirical evidence, we assume knowledge to be both a precondition in explaining health behaviours and an antecedent of trust in government and risk perception. Therefore, we formulate the following hypothesis:

H6: COVID-19 knowledge is positively associated with trust in government.

Considering the above, we developed a conceptual model (Figure 1). The main components of the model are COVID-19 knowledge, trust in government, risk perception, and compliance with COVID-19 health measures to protect others as well as oneself (Han et al., 2021).

Given the implied relationships in the conceptual model, it was imperative to check whether the hypothesised antecedents are indirectly associated with the outcome; thus, we also formulated the following additional hypotheses:

H7: Risk perception mediates the relationship between trust in government and compliance with health measures.

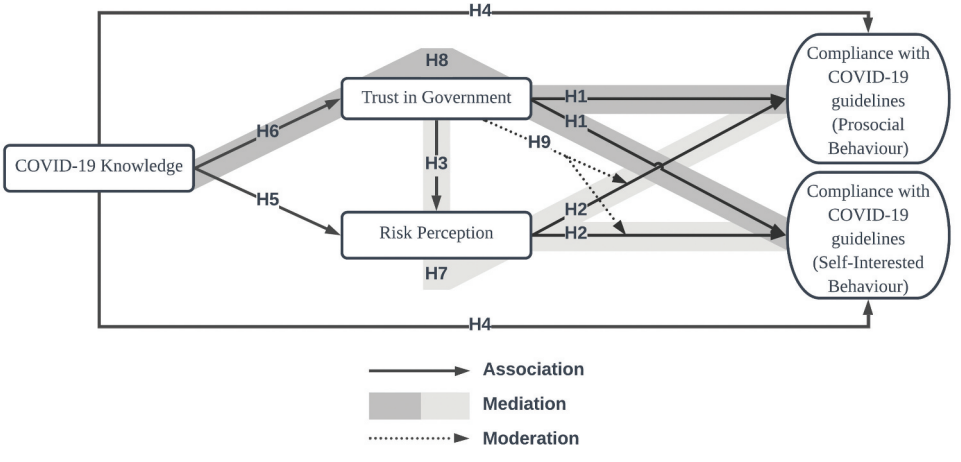

Figure 1. Conceptual model.

H8: Trust in government mediates the relationship between COVID-19 knowledge and compliance with health measures.

Given the central role of trust in government and risk perception in the model, we were also interested in whether these two factors interact in this relationship and its outcome; hence, we suggested the following final hypothesis:

H9: Trust in government moderates the association between risk perception and compliance with health measures.

Methodology

Sample and context

We used cross-sectional data from the survey 'Young people and COVID-19' (YAC+), which questioned a stratified random sample of all registered residents aged between 12 and 29 in Luxembourg (Schomaker et al., 2021). The survey was conducted in July 2020. At the time of data collection, social distancing measures such as maintaining a distance of 2 metres in public places and wearing masks in certain circumstances were still in place to prevent the spread of the virus in Luxembourg (Vukovich et al., 2020). The use of masks was mandatory on public transport and in places where social distancing of 2 metres could not be observed. Additionally, restaurants, drinking places, and other establishments were required to adhere to specific measures such as limiting the number of people per table and implementing physical barriers to reduce the risk of infection.

The return to school in May and June 2020 involved special procedures such as small group sizes and rotating shifts in primary and elementary schools. However, from 29th June, students in primary and elementary schools were united again in one classroom, and distancing and masks were not mandatory as long as hygiene rules were followed. Vulnerable students and teachers continued with home schooling, and support was provided to those without the necessary IT equipment or internet connection.

Most companies had begun a gradual return of employees to their offices, following the security measures established in the country during the crisis. Employers were required to provide employees with individual and collective protective equipment and products, such as masks and hydroalcoholic gel. They were also required to follow the rules set by the Grand Ducal Decree of 17 April 2020, which included limiting employees who may be exposed to risks, training employees on the possible risks and the precautions to be taken, and arranging workstations and other premises or workplaces according to the general security measures set in the country (RGD 2020). In general, Luxembourg's COVID-19 health measures were largely in line with those of neighbouring EU Member States, although there was noticeable variation in the specific policies adopted by each country (Gianino et al., 2021; Haug et al., 2020; OECD, 2022).

We analysed the data of respondents aged between 16 and 29 as the questionnaire answered by younger respondents did not include the key variables required for our analysis. After excluding responses of the 12 to 15 year olds and cases with missing values, our analytical sample comprised 2,455 respondents.

Measures

Trust in government

Trust in government classically and operationally comprises people's perceptions of the government's performance or competence. However, there is an ongoing debate on the number of dimensions that would theoretically measure people's trust in the government meaningfully (Fisher et al., 2010; Hooghe et al., 2017). For example, people may have significantly different levels of trust in different institutional actors. Poortinga and Pidgeon (2003) examined the dimensionality of trust in government and regulators and concluded that a global measure of people's trust in government provides an excellent overall measure. Therefore, we measured trust in government using a single item.

Risk perception

To measure risk perception, we adapted an item from the COVID-19 study 'Public Response to UK Government Recommendations on COVID-19' conducted at Imperial College (Ward & Atchison, 2020). Risk perception was defined and operationalised in this study in the context of infectious diseases as the affective dimension of risk perception, which assessed general emotional concern; unlike more objective measures, such as the probability of infection or knowledge of cases, the affective dimension of risk perception tends to be more stable over time, often importantly influences human risk-taking, and better predicts appropriate response behaviour (Leiserowitz, 2006; Savadori & Lauriola, 2022; Schneider et al., 2021; van der Linden, 2015).

Compliance with preventive health measures

To measure preventive health behaviours, we adapted 12 items from the COVID-19 study 'Public Response to UK Government Recommendations on COVID-19' conducted at Imperial College and integrated them into two self-developed scales (each with 12 items) (Ward & Atchison, 2020). The scales comprised questions about behaviours to prevent COVID-19 infection and transmission. The questions were asked twice – first, to measure behaviour to protect others, and second to measure behaviour to protect oneself – resulting in 24 items. The questions can be divided into three dimensions:

(1) Hygiene practices (wearing a mask, washing hands more often, using hand sanitiser more often, covering nose and mouth when coughing or sneezing, and disinfecting the home);
(2) Avoiding travel (travelling to infected areas inside and outside Luxembourg);
(3) Spatial distancing (avoiding the use of public transport, social events, and going out in general; avoiding crowds and contact with people with respiratory symptoms or fever).

Respondents answered in a binary fashion (yes/no). We calculated the goodness of fit of the two developed scales: the Cronbach's alphas of the first and second scales were .81 and .78, respectively.

Adjustments

We also included sociodemographic and economic characteristics such as gender, migration status, economic status, and age in our analysis. While they were not the focus of the analysis, they are known to be associated with health behaviours (Han et al., 2021; Lim et al., 2021; Plohl & Musil, 2021).

Analytical strategy

To empirically investigate the direct and indirect effects of the relevant variables, we employed structural equation modelling (SEM). This allowed us to test all the hypotheses at once while incorporating latent constructs as factors, resulting in a parsimonious model and efficient estimates (Bielby & Hauser, 1977; Iacobucci, 2009). Due to the binary scaling of the latent factor items, we calculated the model using the robust variant of diagonally weighted least squares (Brown, 2015).[2]

Researchers have found that while trust in government has a positive effect on citizen participation, in certain cases, this participation actually declines (Devine et al., 2020). For example, while a certain level of trust may have a positive effect, excessive trust may be accompanied by a false perception that state actors are containing the crisis itself, which makes participation in health interventions seem less necessary. As such, it was possible we would observe an inflection point in the relationship between these two factors, resulting in a u-shaped curve. Following this rationale, we modelled the relationship between trust in government and participation in health measures quadratically.

Similarly, a decreasing marginal utility for compliance with health measures can be observed for risk perception, so that excessively high perceptions of risk can undermine compliance (Leppin & Aro, 2009). Hence, we also modelled this effect quadratically. To test our hypotheses, we modelled the conceptual model with all the predictors and mediating effects present. We added the covariance of the two mediators – trust in government and risk perception – to the model and tested the contrasts of the indirect effects against the null hypothesis. Differences in estimates of the predictors for both outcomes, adherence to health measures for oneself and adherence to health measures for others, are reported below when they differ significantly. All statistical analyses were performed using *R* and the lavaan package (0.6–9).

Findings

Calculating bivariate correlations, we found that trust in government was significantly correlated with all other study variables, except for gender (Table 1). Similar results were observed for risk perception and COVID-19 knowledge. Interestingly, the correlation between COVID-19 knowledge and risk perception was not statistically significant (see Table 1).

Model diagnostics

The measures of goodness of fit describe a good fit of the model to the data (CFI =.95, TLI = .95; RMSEA = .03). The two latent outcomes were modelled accordingly through confirmatory factor analysis, and the latent measurement models were constrained to ensure a good fit for the factors (see Appendix Tables A4, Table A5). The full model included all mediation effects at once and was tested via an ANOVA ($\chi^2 = p < 0.001$)

Table 1. Descriptive statistics and correlation matrix of the predictors.

	Trust in Government	Risk Perception	COVID-19 Knowledge	Economic Status	Migration Status	Education	Gender	Mean	SD
Trust in Government								2.73	0.77
Risk Perception	0.06**							3.44	0.99
COVID-19 Knowledge	−0.28***	−.02						1.94	0.81
Economic Status	0.12***	−.12***	−0.03					5.91	1.88
Migration Status	0.16***	.15***	−0.08***	−0.25***				1.08	0.85
Education	0.15***	.03	−0.10***	0.04*	0.14***			0.33	0.47
Gender	0.02	−.13***	0.00	−0.02	−0.01	−0.06**		1.44	0.50
Age	0.05**	.05*	−0.07***	−0.15***	0.07***	0.57***	0.02	22.60	4.15

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$; $N = 2455$

against a baseline model without mediations (see Appendix Table A6). We calculated contrasts to test whether different estimates for the predictors and mediations in the conceptual model (Figure 1) were significantly different (see Appendix Table A6).

Main findings

In Table 2 we provide an overview of the findings of testing our hypotheses. Tables containing all estimates and fit measures can be found in the Appendix (Tables A1–A3). Adjusting for potential confounders in SEM, namely, gender, age, economic status, educational level, and migration status, we found that trust in government was strongly and positively associated with adherence to the health measures, thus supporting H1.

Testing the hypothesised inverted U-shaped relationship between trust in government and compliance with health measures, we found that the related quadratic term in the model was highly significant. We discovered, however, that the modelled curve resembled a more curvilinear saturation effect than an inverted U-shape (see Figure 2).

Regarding H2, we established a statistically significant quadratic effect of risk perception and its outcome. Moreover, we observed that the measurement effect in the range follows a curvilinear shape and not the inverted u-shape we had suspected (see Figure 3).

Turning to H3, we found that trust in government is strongly and positively associated with risk perception, thereby contradicting the hypothesis. Table 2 shows that trust in government indirectly affects compliance with health measures via risk perception, and the mediating effect of risk perception is significant (H7).

As for the hypotheses regarding COVID-19 knowledge, we observed that this predictor was strongly and positively associated with adherence to health measures (H4). Furthermore, it was, surprisingly, not associated with risk perception (H5) but was still strongly and positively associated with trust in government (H6). Considering our interest in an indirect effect of COVID-19 knowledge to explain health behaviours, we also tested the effect mediated by trust in government (H8), which was highly significant (see Table 2). While testing H9, we examined the moderating role of trust in government in health adherence to model the association between this variable and risk concern, the two strongest predictors in the model, in terms of a two-way interaction for the outcome (see Figure 4). In particular, we showed that in the case of a low level of risk perception, trust in the government very strongly moderated the effect. We found the association between risk perception and health behaviour to be strongest when trust in government was low and, conversely, weakest when trust was high.

Since we examined two differently oriented health behaviours in the model, they had varying degrees of strength in their associations with the predictors (see Appendix Table A2). We observed that trust in government was more strongly associated with pro-social behaviour; the difference was significant. We also found a stronger mediation effect through trust in government (H7) for this behaviour.

Discussion

In this study we have aimed to advance our understanding of the differences in compliance with COVID-19 prevention guidelines (for example, frequent handwashing and avoiding crowded spaces) among young people. We examined the role of trust in government and risk perception and their interplay. Our study contributes to the

Table 2. Parameter estimates of direct and indirect effects on health behaviour.

Paths	Type	Hypotheses	Estimates	Supported
Trust in Government → Compliance with Health Measures	Direct	H1	0.06 (0.01)***	Supported
Risk Perception → Compliance with Health Measures	Direct	H2	0.08 (0.01)***	Supported
Trust in Government → Risk Perception	Direct	H3	0.04 (0.01)***	(Not) Supported
COVID-19 Knowledge → Compliance with Health Measures	Direct	H4	−0.07 (0.02)***	Supported
COVID-19 Knowledge → Risk Perception	Direct	H5	0.00 (0.03)	Not Supported
COVID-19 Knowledge → Trust in Government	Direct	H6	0.32 (0.02)***	Supported
Trust in Government → Risk Perception → Compliance with Health Measures	Indirect	H7	−0.00 (0.00)*	Supported
COVID-19 Knowledge → Trust in Government → Compliance with health measures	Indirect	H8	0.02 (0.00)***	Supported
Trust in Government × Risk Perception → Compliance with Health Measures	Moderation	H9	−0.05 (0.02)**	Supported

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; Standardised Coefficients, $N = 2455$, Only estimates for Self-Interested Behaviour are shown. Estimates are regression slopes of the structural equation model presented in the appendix Tables A2 and A6.

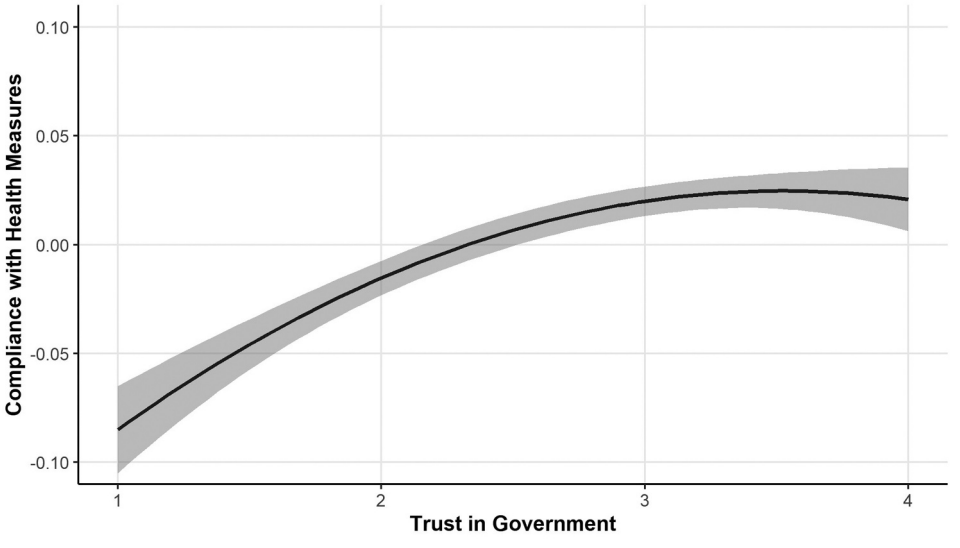

Figure 2. Significant ($p < .001$) quadratic fit for trust in government and compliance with health measures. Shaded areas are 95 per cent confidence intervals. Calculation of the total non-linear effect of trust in government on compliance with health measures, based on a separate multivariate model (containing the same predictors as the main SEM model and using factor scores).

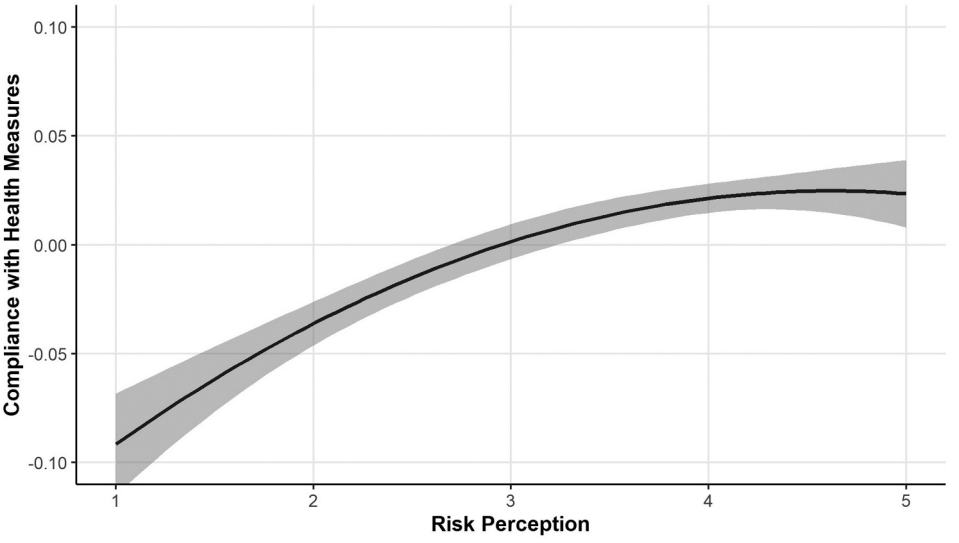

Figure 3. Significant ($p < .001$) quadratic fit for risk perception and compliance with health measures. Shaded areas are 95 per cent confidence intervals. Calculation of the total non-linear effect of risk perception on compliance with health measures, based on a separate multivariate model (containing the same predictors as the main SEM model and using factor scores).

literature, first, by focusing on the interplay of risk perception and trust in government in under-researched but heavily affected groups, and second, by examining the non-linear relationships of these factors and elaborating the non-additive or moderating influence of trust in government in explaining adherence to prevention measures.

We have demonstrated that higher levels of trust in government were significantly associated with taking health actions to protect others and oneself. Our findings are consistent with those in the research on similar issues (Devine et al., 2020; Lim et al., 2021). This relationship was even stronger with prosocial behaviour. However, comparing the findings with those of other studies, it is also clear that in the present study, trust in government was a stronger predictor of health behaviours among adolescents and young adults (Han et al., 2021; Lim et al., 2021). This finding can likely be explained by the relatively low actual and perceived likelihood of COVID-19 infection among young people (Yang et al., 2020; Zimmermann & Curtis, 2020).

Furthermore, we explored the non-linear relationship between trust in government and adherence to health measures. We found a curvilinear and diminishing return in the outcome, which supported our arguments above. Beyond this direct relationship, we also found evidence for an indirect effect of trust in government being mediated by risk perception. This finding is similar to the observation made by Ye and Lyu (2020) in their mediation analysis on the influence of trust in government on COVID-19 risk perception.

Another important finding was the positive and strong association was observed between the respondents' knowledge of COVID-19 and their adherence to the health measures. This finding aligns with those of recent empirical studies on adherence to preventive health behaviours (Han et al., 2021). Additionally, we observed an indirect effect of COVID-19 knowledge on health behaviour, which was indirectly mediated by trust in government. This mediation was even stronger with prosocial behaviour.

Although other studies have observed a positive association between COVID-19 knowledge and risk perception, this association was absent in our study (Dryhurst et al., 2020).

Risk perception was positively related to adherence to COVID-19 prevention guidelines. This finding corroborates those of previous studies (Dryhurst et al., 2020). Moreover, studies show that exaggerated risk perceptions can be an obstacle to compliance with health measures (Leppin & Aro, 2009). In our study we observed a curvilinear relationship that took the form of a saturation curve, meaning that a diminishing return on willingness to participate can be expected as the perception of risk increases. This observation could be further investigated to understand the influence of COVID-19 risk perception on adherence to health measures (Yang et al., 2020).

As we established that trust and risk perceptions are the two strongest predictors of health behaviour, it was of interest to further examine their interplay. We modelled trust in government as a significant moderator of the relation between risk perception and adherence to health measures. We found that the association between risk perception and health behaviour was strongest when trust in government was low and weakest when trust was strong. In other words, we observed a ceiling effect, meaning that the two factors should not be understood purely as an additional explanation of health behaviour since we found no noticeable correlation between risk perception and health behaviour among persons who had high levels of trust in the government (see Figure 4).

Moreover, contrary to our hypothesis, we found a positive association between trust in government and risk perception. This is remarkable given that trust and risk perception are often understood diametrically (Siegrist, 2021; Siegrist et al., 2005; Smith & Mayer, 2018). In his work, Simmel (1990) discusses the ambivalent theoretical relationships between trust and risk perception. He argues that trust is based neither on rational decisions nor hope, and that the perception of risk derives from a potential lack of trust or a divergent understanding of trust on different social levels (Simmel, 1990, p. 177, 181, 261, 485). This scenario is evident in a recent comparative study on the antecedents of COVID-19 risk perception, in

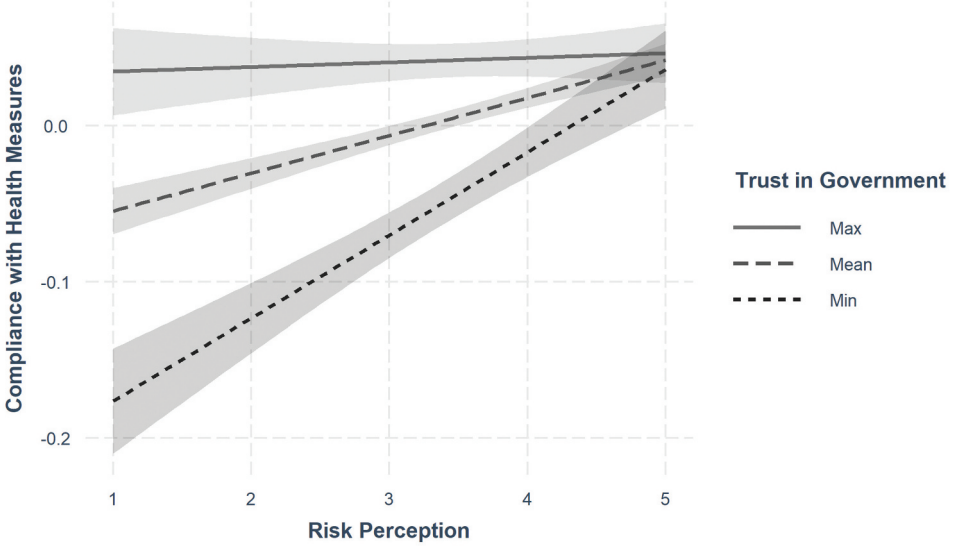

Figure 4. Moderation of trust on the relationship between concern and compliance with health measures. Shaded areas are 95 per cent confidence intervals. Calculation of the moderation effect, based on a separate multivariate model (containing the same predictors as the main SEM model and using factor scores).

which the authors (Dryhurst et al., 2020) noted a negative association between trust in government and risk perception in most of the countries studied. Similar results have been observed in other cross-sectional studies (Wong & Jensen, 2020). In summary, the literature has demonstrated a negative association between trust and risk perception in the general population; however, this association was not found in our analysis of young people. Contrastingly, we found a significant positive mediation effect between trust in government, risk perception, and health behaviour.

An explanation for this discrepancy is that risk perception plays a very different role among younger populations and should be considered in a more complex manner, rather than through a common one-dimensional measurement instrument (Johnson et al., 2002). A recent study shows that young people's risk perceptions during the COVID-19 pandemic were more influenced by factors such as the protection of their peers, their education, and their social lives (Dyregrov et al., 2021). Thus, regarding youth and the pandemic, risk perception should be understood as a multidimensional construct with dimensions of risk perception or individuals' assessments for themselves on a collective level. For example, young people are generally much less affected by the consequences of COVID-19; nevertheless, our data suggest that the young Luxembourgers perceived that the virus represents a threat on a societal and social level. Since very few studies have included a subgroup analysis of younger populations or of the interaction effects related to respondents' age, these effects have presumably been overlooked (Siegrist et al., 2005).

However, our study has some limitations. We relied on self-reported data on compliance with COVID-19 measures, which may have been biased by social desirability considering the subject matter. Nonetheless, we took great care to minimise priming effects related to COVID-19. Regarding other measurements, we measured the subjective level of COVID-19 knowledge, rather than the objective level, by asking questions connected to the circumstances of the spread of the virus, the period of being contagious, the symptoms, and the duration for the virus can remain on certain surfaces, and other aspects (for an example of a knowledge test, see Richardson & Bélanger, 2020). Moreover, the study was conducted at a stage of the pandemic when relatively few new cases were being reported; therefore, the presence of the threat was not overly ubiquitous. It should also be noted that Luxembourg is a small state with consistently high levels of administrative trust compared with other high-income OECD countries: the OECD (2021) reported in 2020 that 78 per cent of the country's population trusted the Luxembourg government, ranking among the highest of the OECD countries. Generalisations to other countries are subject to these considerations.

Conclusion

Although young people are less affected by the risks posed by COVID-19, they play an important role in curbing the spread of this virus by adhering to preventive measures. In this study we examined what motivates young people to concede much of their individual freedoms to protect the more vulnerable, often older, population groups, despite the lack of direct incentives. Our research determined three key factors in young people's compliance with health measures.

First, respondents' affective risk perceptions were the strongest predictor of adherence to health measures. Those with a strong perception of risk also reported more

adherence to health measures. Second, trust in government was an almost equally strong predictor of preventive health behaviours and had an equally positive relationship, such that respondents with higher trust in government also reported higher levels of adherence. Third, knowledge about COVID-19 was the third strongest predictor, indicating that young people who were apparently informed on the subject also reported more compliance with the health measures.

There was also evidence of the indirect effects of these factors in explaining health behaviour: the effect of COVID-19 knowledge on behaviour was mediated indirectly by trust in government. Thus, trust had not only a direct positive effect on health behaviour but also an indirect effect through the mediating effect of risk perception on health behaviours.

Although the two strongest predictors were strongly positively associated with health behaviour, we can clearly show that these effects are better modelled quadratically and interpreted in terms of curvilinear saturation effects. In other words, the effects of both predictors reached a plateau; that is, reported trust and risk perceptions above a certain level were not associated with greater participation in health measures.

Trust in government also emerged as a strong moderator of the relationship between risk perception and health behaviour. Interestingly, we noted ´bottlenecks´ in motivation as the relationship between risk perception and health behaviour was strongest when trust in government was lowest and weakest when trust was highest. In other words, the two factors are clearly not additive. Although they are both positively associated with each other and with the behavioural outcomes, they quickly show saturation effects in their associations with health behaviour.

Studies using longitudinal research are needed to investigate the causal mechanism underlying the relationship between trust, compliance with coordinative actions, and risk perception. We should also investigate young people's risk perceptions beyond purely cognitive aspects to include dimensions of societal perceptions of risk, for example, societal-level risks to social and economic stability or social risks such as the health of one's family and loved ones. Subsequently, it is important to explore why a relationship between COVID-19 knowledge and risk perception and the alternative antecedents relevant to young people was not observed and if this finding among young people is replicated. It would also be interesting to explore and examine the youth-specific determinants of trust in government and risk perception in order to shed light on how family, peers, and teachers influence young people.

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Notes

1. A detailed review of Luxembourg's response to the COVID-19 crisis in terms of risk preparation, crisis management, public health, education, and economic, social and labour market policies is provided by the OECD (2022).
2. To estimate the confidence intervals of the direct and indirect effects, we obtained the standard errors by non-parametric bootstrapping as indirect effect point estimates often follow a non-normal distribution and, therefore, are not easily derived analytically (Pesigan & Cheung, 2020).

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Appendix

Table A1. Estimation results of factor loadings.

	Mediation Estimate (Std. Err.)	Moderated Mediation Estimate (Std. Err.)
	Factor Loadings	
Self-Interested Behaviour		
Worn a face mask	1.00[+]	1.00[+]
Washed hands more frequently with soap and water	1.05(0.07)***	1.06(0.06)***
Used hand sanitiser more regularly	0.97(0.06)***	0.97(0.06)***
Covered nose and mouth with handkerchief or elbow when sneezing or coughing	0.89(0.05)***	0.89(0.06)***
Avoided contact with people who have fever or a respiratory symptom	0.90(0.06)***	0.90(0.06)***
Avoided touching one's face	0.75(0.06)***	0.76(0.06)***
Avoided going out in general	0.61(0.05)***	0.61(0.05)***
Avoided crowded areas	1.09(0.07)***	1.09(0.07)***
Kept a 2-metre distance when meeting people	0.87(0.06)***	0.87(0.06)***
Avoided going to the doctor, hospital, or healthcare settings	0.62(0.05)***	0.62(0.05)***
Avoided taking public transport	0.71(0.06)***	0.72(0.06)***
Avoided touching other people	1.08(0.07)***	1.09(0.07)***
Prosocial Behaviour		
Worn a face mask	1.00+	1.00+
Washed hands more frequently with soap and water	1.18(0.07)***	1.17(0.06)***
Used hand sanitiser more regularly	1.15(0.07)***	1.14(0.06)***
Covered nose and mouth with handkerchief or elbow when sneezing or coughing	1.01(0.06)***	1.00(0.06)***
Avoided contact with people who have fever or a respiratory symptom	1.00(0.07)***	0.99(0.06)***
Avoided touching one's face	0.94(0.06)***	0.93(0.06)***
Avoided going out in general	0.77(0.06)***	0.76(0.06)***
Avoided crowded areas	1.18(0.07)***	1.17(0.07)***
Kept a 2-metre distance when meeting people	0.98(0.06)***	0.97(0.06)***
Avoided going to the doctor, hospital, or healthcare settings	0.75(0.06)***	0.74(0.06)***
Avoided taking public transport	0.90(0.07)***	0.90(0.06)***
Avoided touching other people	1.17(0.07)***	1.16(0.06)***

[+]Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, Standardised estimates.

Table A2. Estimation results of regression slopes of the structural equation model.

	Regression Slopes	
	Mediation Estimate (Std.Err.)	Moderated Mediation Estimate (Std.Err.)
Risk Perception		
Trust in Government	0.04(0.01)**	0.05(0.02)*
COVID-19 Knowledge	0.00(0.03)	0.01(0.03)
Educational Level	0.01(0.05)	0.00(0.05)
Age	0.01(0.01)	0.01(0.01)
Gender	−0.29(0.04)***	−0.29(0.04)***
SES	−0.05(0.01)***	−0.05(0.01)***
Migration Status	0.29(0.04)***	0.29(0.04)***
Trust in Government		
COVID-19 Knowledge	−0.32(0.02)***	−0.32(0.02)***
Educational Level	0.25(0.05)***	0.25(0.05)***
Age	−0.00(0.01)	−0.00(0.01)
Gender	0.07(0.04)	0.07(0.04)
SES	0.08(0.01)***	0.08(0.01)***
Migration Status	0.28(0.04)***	0.28(0.04)***
Self-Interested Behaviour		
COVID-19 Knowledge	−0.07(0.02)***	−0.07(0.02)***
Trust in Government	0.06(0.01)***	0.19(0.05)***
Risk Perception	0.08(0.01)***	0.21(0.05)***
Educational Level	0.04(0.03)	0.04(0.03)
Age	0.01(0.00)*	0.01(0.00)*
Gender	−0.12(0.03)***	−0.12(0.03)***
SES	−0.01(0.01)	−0.01(0.01)
Migration Status	0.04(0.03)	0.04(0.03)
Trust in Government × Risk Perception		−0.05(0.02)**
Prosocial Behaviour		
COVID-19 Knowledge	−0.07(0.02)***	−0.07(0.02)***
Trust in Government	0.08(0.02)***	0.19(0.05)***
Risk Perception	0.09(0.01)***	0.21(0.05)***
Educational Level	−0.01(0.03)	−0.01(0.03)
Age	0.01(0.00)*	0.01(0.00)*
Gender	−0.12(0.02)***	−0.12(0.02)***
SES	−0.00(0.01)	−0.00(0.01)
Migration Status	−0.01(0.03)	−0.01(0.02)
Trust in Government × Risk Perception		−0.05(0.02)**

[+]Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, Standardised estimates.

Table A3. Estimation results of intercepts of the estimated equation model.

	Intercepts	
	Mediation Estimate (Std. Err.)	Moderated Mediation Estimate (Std. Err.)
Trust in Government		−0.12(0.19)
Worn a face mask		0.54(0.20)**
Washed hands more frequently with soap and water		0.57(0.21)**
Used hand sanitiser more regularly		0.53(0.20)**
Covered nose and mouth with handkerchief or elbow when sneezing or coughing		0.48(0.18)**
Avoided contact with people who have fever or a respiratory symptom		0.49(0.18)**
Avoided touching one's face		0.41(0.15)**
Avoided going out in general		0.33(0.13)**
Avoided crowded areas		0.59(0.22)**
Kept a 2-metre distance when meeting people		0.47(0.17)**
Avoided going to the doctor, hospital, or healthcare settings		0.33(0.13)**
Avoided taking public transport		0.39(0.15)**
Avoided touching other people		0.59(0.22)**
Worn a face mask		0.59(0.19)**
Washed hands more frequently with soap and water		0.69(0.22)**
Used hand sanitiser more regularly		0.67(0.21)**
Covered nose and mouth with handkerchief or elbow when sneezing or coughing		0.59(0.19)**
Avoided contact with people who have fever or a respiratory symptom		0.58(0.19)**
Avoided touching one's face		0.55(0.18)**
Avoided going out in general		0.45(0.14)**
Avoided crowded areas		0.69(0.22)**
Kept a 2-metre distance when meeting people		0.57(0.18)**
Avoided going to the doctor, hospital, or healthcare settings		0.43(0.14)**
Avoided taking public transport		0.53(0.17)**
Avoided touching other people		0.68(0.22)**
Risk Perception		0.31(0.19)
COVID-19 Knowledge		1.94^{+}
Educational Level		0.33^{+}
Age		22.61^{+}
Gender		1.44^{+}
SES		5.91^{+}
Migration Status		0.67^{+}
Trust in Government × Risk Perception		9.41^{+}

$^{+}$Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, Standardised estimates.

Table A4. Estimation results of residual variances.

	Residual Variances	
	Mediation Estimate (Std. Err.)	Moderated Mediation Estimate (Std. Err.)
Worn a face mask	0.71(0.04)***	0.71(0.04)***
Washed hands more frequently with soap and water	0.68(0.03)***	0.68(0.03)***
Used hand sanitiser more regularly	0.72(0.03)***	0.71(0.03)***
Covered nose and mouth with handkerchief or elbow when sneezing or coughing	0.77(0.02)***	0.77(0.03)***
Avoided contact with people who have fever or a respiratory symptom	0.76(0.02)***	0.76(0.02)***
Avoided touching one's face	0.84(0.02)***	0.84(0.02)***
Avoided going out in general	0.87(0.01)***	0.87(0.01)***
Avoided crowded areas	0.65(0.02)***	0.65(0.02)***
Kept a 2-metre distance when meeting people	0.77(0.02)***	0.77(0.02)***
Avoided going to the doctor, hospital, or healthcare settings	0.88(0.01)***	0.88(0.01)***
Avoided taking public transport	0.84(0.02)***	0.84(0.02)***
Avoided touching other people	0.64(0.02)***	0.64(0.02)***
Worn a face mask	0.76(0.04)***	0.75(0.04)***
Washed hands more frequently with soap and water	0.63(0.03)***	0.63(0.03)***
Used hand sanitiser more regularly	0.65(0.03)***	0.65(0.02)***
Covered nose and mouth with handkerchief or elbow when sneezing or coughing	0.73(0.02)***	0.73(0.02)***
Avoided contact with people who have fever or a respiratory symptom	0.72(0.02)***	0.72(0.02)***
Avoided touching one's face	0.77(0.02)***	0.77(0.02)***
Avoided going out in general	0.81(0.01)***	0.81(0.02)***
Avoided crowded areas	0.62(0.02)***	0.62(0.02)***
Kept a 2-metre distance when meeting people	0.74(0.02)***	0.74(0.02)***
Avoided going to the doctor, hospital, or healthcare settings	0.83(0.02)***	0.83(0.02)***
Avoided taking public transport	0.78(0.02)***	0.78(0.02)***
Avoided touching other people	0.64(0.02)***	0.64(0.02)***
Risk Perception	0.94(0.03)***	0.94(0.02)***
Trust in Government	0.87(0.03)***	0.87(0.02)***
COVID-19 Knowledge	0.65^{+}	0.65^{+}
Educational Level	0.22^{+}	0.22^{+}
Age	17.14^{+}	17.14^{+}
Gender	0.25^{+}	0.25^{+}
SES	3.53^{+}	3.53^{+}
Migration Status	0.22^{+}	0.22^{+}
Trust in Government × Risk Perception		15.18^{+}

$^{+}$Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, standardised estimates.

Table A5. Estimation results of residual covariances.

	Residual Covariances	
	Mediation Estimate (Std. Err.)	Moderated Mediation Estimate (Std. Err.)
Worn a face mask	0.23(0.03)***	0.23(0.03)***
Washed hands more frequently with soap and water	0.25(0.02)***	0.25(0.02)***
Used hand sanitiser more regularly	0.32(0.02)***	0.32(0.02)***
Covered nose and mouth with handkerchief or elbow when sneezing or coughing	0.38(0.02)***	0.38(0.02)***
Avoided contact with people who have fever or a respiratory symptom	0.37(0.02)***	0.37(0.02)***
Avoided touching one's face	0.51(0.02)***	0.51(0.02)***
Avoided going out in general	0.56(0.02)***	0.56(0.02)***
Avoided crowded areas	0.26(0.02)***	0.26(0.02)***
Kept a 2-metre distance when meeting people	0.42(0.02)***	0.42(0.02)***
Avoided going to the doctor, hospital, or healthcare settings	0.57(0.02)***	0.57(0.02)***
Avoided taking public transport	0.56(0.02)***	0.56(0.02)***
Avoided touching other people	0.25(0.02)***	0.25(0.02)***
Risk Perception w/Trust in Government	0.01(0.01)	
COVID-19 Knowledge w/Educational Level	−0.04+	−0.04+
COVID-19 Knowledge w/Age	−0.24+	−0.24+
COVID-19 Knowledge w/Gender	−0.00+	−0.00+
COVID-19 Knowledge w/SES	−0.05+	−0.05+
COVID-19 Knowledge w/migrant	−0.02+	−0.02+
Educational Level w/Age	1.12+	1.12+
Educational Level w/Gender	−0.01+	−0.01+
Educational Level w/SES	0.04+	0.04+
Educational Level w/migrant	0.02+	0.02+
Age w/Gender	0.04+	0.04+
Age w/SES	−1.13+	−1.13+
Age w/migrant	−0.00+	−0.00+
Gender w/SES	−0.02+	−0.02+
Gender w/migrant	−0.00+	−0.00+
SES w/migrant	−0.22+	−0.22+
COVID-19 Knowledge w/Trust in Government × Risk Perception		−0.63+
Educational Level w/Trust in Government × Risk Perception		0.24+
Age w/Trust in Government × Risk Perception		1.12+
Gender w/Trust in Government × Risk Perception		−0.15+
SES w/Trust in Government × Risk Perception		−0.08+
Migration Status w/Trust in Government × Risk Perception		0.35+

[+]Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, standardised estimates.

Table A6. Estimation results of latent variances, covariances, mediations, total effects, constructs and fit indices.

	Mediation Estimate (Std. Err.)	Moderated Mediation Estimate (Std.Err.)
	Latent Variances	
Self-Interested Behaviour	0.27(0.03)***	0.26(0.03)***
Prosocial Behaviour	0.25(0.03)***	0.25(0.03)***
	Latent Covariances	
Self-Interested Behaviour w/Prosocial Behaviour	0.20(0.02)***	0.20(0.02)***
	Constructed	
Mediation 1 (COVID-19 Knowledge → Trust in Government)	−0.02(0.00)***	0.06(0.02)***
Mediation 2 (Trust in Government → Risk Perception)	−0.00(0.00)*	0.01(0.01)
Total Effect (COVID-19 Knowledge)	−0.09(0.02)***	−0.13(0.02)***
Total Effect (Trust in Government)	−0.07(0.01)***	0.20(0.05)***
Contrast (COVID-19 Knowledge)	0.01(0.01)	
Contrast (Trust in Government)	0.03(0.01)*	
Contrast (Risk Perception)	0.01(0.01)	
Contrast (Mediation 1 w/different Outcomes)	0.01(0.00)*	
Contrast (Mediation 2 w/different Outcomes)	0.00(0.00)	
	Fit Indices	
χ^2	1602.82(417)***	9140.57(443)***
CFI	0.95	0.72
TLI	0.94	0.68
RMSEA	0.03	0.09

[+]Fixed parameter, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, $N = 2455$, standardised estimates.