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Emotions, crisis, and institutions: Explaining compliance with COVID-19 regulations

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Abstract

Amid the COVID-19 pandemic, citizens' compliance with government preventive measures was one of the top policy priorities for governments worldwide. This study engages with socio-legal and psychological theories on compliance and proposes an analytical framework to explore the role of different psychological factors on individual-level compliance during global health crises. Using the results of three national surveys, we argue that various negative emotional states, perceptions of the ongoing crisis, and of the institutional settings are major factors influencing individual compliance across countries. Most importantly, while increased panic, anxiety, and sadness lead to higher compliance, rising anger, loneliness, and impatience decrease compliance levels. Notably, perceptions of the COVID-19 crisis—especially health concerns and a worsening financial situation—tend to elicit anger among citizens across countries, thereby further hampering their obedience with pandemic regulations. Furthermore, perceptions of public institutions also influence individual compliance. Overall, in order to ensure compliance, we suggest that policymakers and those implementing government measures take individual psychological factors into account both within and beyond the public crisis context.

Keywords: compliance, COVID-19 measures, crisis perceptions, emotions, institutional perceptions.

1. Introduction

To contain the spread of COVID-19 and reduce the social and economic damage associated with it, governments worldwide have responded by rapidly enforcing a variety of restrictive public health measures that range from regional lockdowns and social distancing to mandatory mask-wearing and digital contact tracing. Despite variations in the kind, scope, and nature of the measures introduced, a common issue challenging all public health authorities is how to ensure that people adhere to anti-pandemic measures. The conventional wisdom in public policy and socio-legal studies has been that government actions alone often do not achieve the desired policy outcomes. Moreover, desired outcomes require compliance from all facets of target populations (Étienne, 2010; Meier & Morgan, 1982). In the context of the COVID-19 global health crisis, the success of ad hoc public health measures, therefore, depends on individual responses from all walks of life (Anderson et al., 2020; van Bavel et al., 2020). Thus, it is important to understand what makes people comply with emergency rules.

Against this backdrop, recent literature has shed light on the levels and patterns of compliance with COVID-19 measures among different population subgroups (Daoust, 2020; Nivette et al., 2021) and over time (Petherick et al., 2021; Six et al., 2021). Turning to the potential predictors of compliance behavior, a wide range of emotional states such as anxiety (Barari et al., 2020; Liu et al., 2020; Shiina et al., 2020), boredom (Martarelli & Wolff, 2020; Wolff et al., 2020), and fear (Harper et al., 2020; Jovančević & Miličević, 2020) were found to shape people's responses to government emergency health measures in several ways. Other predictors of compliance behavior include perceived threats to one's personal health (Romer & Jamieson, 2020; van Rooij et al., 2020) and financial situation (Howard, 2021; Wright et al., 2020), assessments of the nature (Allington et al., 2021; Imhoff & Lamberty, 2020) and duration of the pandemic (Briscese et al., 2020; Sobol et al., 2020), and trust in government institutions (Bargain & Aminjonov, 2020; Han et al., 2021).

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This emerging literature has brought new insights into how people respond to public health policies, particularly in times of crisis, and into the various drivers behind compliance behavior. However, several studies that employ a more integrated analytical approach have been confined to a single population (e.g., Barari *et al.*, 2020; Murphy *et al.*, 2020). Another group of studies that extend their empirical evidence across countries is constrained by one-dimensional explanations of compliance (e.g., Chan, Moon, *et al.*, 2020; Daoust, 2020; Han *et al.*, 2021). A small but growing number of studies have overcome these limitations with a broad consideration of predictors based on cross-country evidence (Clark *et al.*, 2020; Hensel *et al.*, 2022; Jørgensen *et al.*, 2021; Travaglino & Moon, 2021); however, most of these studies focus on Western democracies. Although extensive research has focused on the role of individual emotions on compliance behavior, limited efforts have been made to analyze multiple emotions simultaneously, thus overlooking the possibility of divergent effects among emotions with similar valences. Even fewer studies have addressed how emotional mechanisms operate between different perceptions and compliance or how various emotions and perceptions shape people's compliance.

To address these gaps, we propose an integrated analytical framework from a psychological perspective of individual compliance during a public crisis. Drawing on socio-legal and social psychological theories from public policy and criminology research, our framework encompasses three psychological aspects to account for human responses to government crisis management in the face of a severe public health crisis: enhanced emotional states, perceptions of the crisis, and perceptions of public institutions. We apply this framework to investigate individual compliance in three national contexts, including both democratic and nondemocratic settings (i.e., China, Germany, and the United States), based on online surveys conducted in these three countries in June 2020. By the time of our survey, all three countries were experiencing the outbreak of COVID-19 and had adopted a variety of restrictive measures. While the rapid and strict lockdown in Wuhan after the outbreak had significantly slowed down the spread in China, containment measures were still in place in most regions in the country (Dollar, 2020). Germany was also introducing several restrictive rules in public and private spheres (Robert Koch Institute, 2020). Meanwhile, the situation in the United States was deteriorating with infected cases doubling in 14 states as the measures varied greatly across state lines (Chan & Shumaker, 2020). Our case study allows us to fulfill two goals: first, to gain a first-hand assessment of citizen compliance during a global pandemic in different social and political contexts, and second, to understand whether and how—despite these contextual differences—individual-level factors such as emotions and perceptions of crisis and public institutions could influence individual compliance with government emergency rules.

Overall, our study contributes to compliance research in at least three ways. First, we offer an overview of individual compliance with government preventive measures in China, Germany, and the United States during the first wave of the COVID-19 pandemic. We find that while the level of compliance with COVID-19 measures is generally high across the three countries, it varies. China has the highest level of compliance, with 98% of citizens following all or most of the COVID-19 rules, compared with 88% of citizens in Germany and 76% in the United States. Second, our analysis points to the influential role that perceptions of institutions have on compliance behavior. We find that high trust in governmental institutions and belief in the effectiveness of government measures facilitate citizen compliance in all three countries, while conspiracy belief significantly reduces the likelihood of compliance, especially in Germany and the United States. Last and most importantly, we bridge findings from the compliance literature with research from social psychology and legal studies and demonstrate both the direct and the mediating effects of emotional states on compliance, thereby enriching the emotion regulation model (Gross, 1998) and the general strain theory (Agnew, 1992) with empirical evidence from the COVID-19 context. Specifically, our results show that negative emotions affect individual compliance differently (Bodenhausen *et al.*, 1994). While angry, impatient, and lonely citizens were more likely to break the rules, experiencing panic, anxiety, and sadness during the pandemic led to higher compliance. Most notably, the effect of various crisis perceptions on compliance is further mediated by emotions such as panic, anxiety, anger, and sadness. Overall, our results highlight the role of two emotional mechanisms that also commonly appear in other crises such as terrorist attacks, namely fear and anger (Matthes *et al.*, 2019), and refines our understanding of their impact on people's reactions to relevant government regulations.

We begin with a review of existing literature on citizen compliance within and beyond the COVID-19 pandemic context and construct an analytical framework with three sets of psychological factors: emotional states,

and crisis and institutional perceptions. We then introduce our research design, including data collection, measurement of key variables, and data analysis. Last, we present our essential findings and discuss these with critical reflections on current and future research and policy implications.

2. Literature review and analytical framework

2.1. Individual compliance with COVID-19 health measures

In political science and public policy literature, compliance is understood as an “acquiescence to expectations that can take a range of forms: rules, standards, proposal, entreaties, orders, suggestions etc.” (Étienne, 2010, p. 139) or where people act either voluntarily or mandatorily “in accordance with agency requirements” (Alford, 2009, p. 22). Thus, individual compliance in the context of the COVID-19 pandemic can refer to individual behavior that either voluntarily or passively conforms to prescribed public health measures.

Individual compliance during COVID-19 varies within and across countries, as well as across different population subgroups. Surveys conducted in the early phase of the pandemic reveal very high levels of compliance among Chinese citizens (Duan *et al.*, 2020; Lin *et al.*, 2022; Pan *et al.*, 2020; Xu *et al.*, 2021). People who are married and live in middle-income households with others comply more with government interventions (Xu *et al.*, 2021). In Germany, the level of acceptance of and compliance with the country’s AHA-L rules¹ is relatively high among rescue service personnel (Nohl *et al.*, 2021). The majority of Germans are more supportive of voluntary than forced measures. However, citizens who grew up in the coercive regime of the former East Germany are more accepting of forced implementation measures (Schmelz, 2021). In a study on compliance behavior in North America, over 70% of respondents seemed to strictly follow their states’ preventive measures during the pandemic (Wang *et al.*, 2021). Similarly, an online survey in 35 US states reveals high self-reported compliance rates with COVID-19 mitigation measures (van Rooij *et al.*, 2020).

Despite the high level of compliance and variation across subgroups of the population, little is known about what makes individuals shift their usual behavior toward compliance with highly fluctuating public health regulations. We argue that compliance with COVID-19 public health measures can be regarded as a behavioral response to enhanced emotional states, crises, and institutional perceptions. Furthermore, the emotional states mediate between crisis perceptions and compliance.

2.2. Emotional states and compliance

The COVID-19 outbreak, along with the prompt imposition of containment measures across the world, has not only limited individual freedom but also affected physical and psychological well-being across all age groups (Brooks *et al.*, 2020; Pan *et al.*, 2020; Pedrosa *et al.*, 2020; Rothe *et al.*, 2021). Numerous studies have tracked the impact of the pandemic and related restrictions on people’s emotional states. Among the most severe and widespread are increased worries, anxieties, and fear (Li *et al.*, 2021; Lu *et al.*, 2020; Zhong *et al.*, 2021), followed by high levels of stress, boredom (Martarelli & Wolff, 2020; Stogner *et al.*, 2020; Yan *et al.*, 2021), and anger (Brooks *et al.*, 2020).

People respond differently to these emotions. The process model of emotion regulation in psychology research suggests that people consciously or unconsciously regulate emotions by selecting which emotions to have, when to have them, and how to experience and express them (Gross, 1998, p. 275). In the context of the COVID-19 pandemic, the question of whether or not to follow the imposed public health rules can be understood as a type of emotional regulatory activity manifested in behavioral responses to emotions triggered by the sudden change in almost all aspects of living and working circumstances.

Emotional states may influence individual responses to government health regulations in various ways. A common practice in psychology distinguishes between positive and negative emotions, including the widely used Positive Affect and Negative Affect Schedule developed by Watson *et al.* (1988). Yet, social and political psychology studies reveal distinct impacts on attitude and behavior even among emotions with similar negative valence (Bodenhausen *et al.*, 1994). Recent COVID-19 studies report that fear elicits compliant behavior during the COVID-19 pandemic (Brouard *et al.*, 2020; Harper *et al.*, 2020; Jørgensen *et al.*, 2021; Jovančević & Miličević, 2020). In contrast to fear-related emotions that relate to aversive and withdrawal, other negative

emotions (e.g., anger and impatience) indicate a degree of forcefulness and relate to the motivational system (Carver & Harmon-Jones, 2009). Not surprisingly, the social psychology literature shows that while a happy mood increases compliance, perceived anger reduces compliance (Milberg & Clark, 1988). Recent studies further identify the impact of other negative emotions beyond fear and anger. For instance, those who feel constantly bored tend to find adherence to the rules harder than those who are less prone to boredom (Martarelli & Wolff, 2020; van Rooij et al., 2020; Wolff et al., 2020). Thus, we assume that *the level of compliance with COVID-19 health measures is higher among those who experience fear-related emotions such as panic and anxiety (H1.1) and among those with positive emotions such as inspiration and happiness (H1.2) but lower among those who experience anger and impatience, as well as other negative emotions such as sadness, loneliness, boredom, and tiredness (H1.3).*

2.3. Crisis perceptions and compliance

General strain theory from criminology research offers an interesting reading for the context of the COVID-19 pandemic. The theory depicts negative relationships in which individuals are not treated by others as they want to be treated. The outbreak of the pandemic and the imposition of restrictive measures have forced a majority of the population into negative relationships with their surroundings imbued with multiple “strains”: the risk of infection, health concerns about oneself and families, and the immediate financial trouble caused by pandemic-related unemployment. All these strains have disturbed normal productive activities of everyday life and prevented people from pursuing the goals they valued. Just as adolescents are mostly pressured into delinquency as a result of negative relationships (Agnew, 1992; Agnew & White, 1992), people may break mitigation rules resulting from a sudden surge of stress during the pandemic.

However, between actual stressors and behavioral responses, there is an important cognitive mechanism that evaluates, interprets, and adjusts to the perceived situation (Gross, 1998, 2002). Situation research and health behavior theories also suggest that individual behavior in health-related situations greatly depends on how individuals perceive and process the situations they are facing (Orbell et al., 2013; Rauthmann et al., 2015). Along with the above-mentioned “strains,” the COVID-19 pandemic creates a “crisis” that captures individuals within specific settings. Perceptions of the COVID-19 crisis reflect one’s knowledge, expectation, and assessment of the immediate development of the pandemic, including perceived local infection rates and the potential for a new wave of infections; they also reflect one’s judgment and feelings about one’s situation during the crisis (e.g., in terms of health and finances).

Recent studies show that perceptions of the immediate crisis affect individuals’ compliance behavior. Individuals’ risk attitudes are critical for predicting mobility reduction and social confinement behavior during the pandemic (Chan, Skali, et al., 2020). In particular, perceiving the COVID-19 crisis as a threat positively relates to individuals’ compliance with health rules (Zajenkowski et al., 2020). Furthermore, individuals who value the present were shown to be more likely to obey public health regulations than those who are more concerned about the past and the future (Sobol et al., 2020). As such, we assume that *compliance with COVID-19 health measures is higher among those who perceive their region to have a high infection rate (H2.1) and among those who believe the pandemic will last longer (i.e., expect a new wave) (H2.2).*

Perceived personal situations during the crisis also affect the adoption of precautionary measures. The pandemic as a threat to one’s health or to that of one’s close circle leads to greater compliance with preventive measures (Reinders Folmer et al., 2020; van Rooij et al., 2020; Zimmermann et al., 2022). As many restrictive measures also involve economic shutdowns, the inevitable economic costs have caused a substantial share of the population to develop strong negative attitudes about the restrictions (Howard, 2021). Communities deprived of economic sources and financial opportunities reportedly complied less with local shelter ordinances than their counterparts with much stronger economic endowments (Wright et al., 2020). As a result, we hypothesize that *compliance with COVID-19 health measures is higher among those with higher concerns about their own health or that of their loved ones (H2.3) and lower among those whose financial situation worsened during the pandemic (H2.4).*

The impact of crisis perceptions on compliance can further be mediated by different emotions. General strain theory argues that people who experience strain tend to be pushed into breaking the rules, which often occurs

through negative affective states, most notably anger and fear-related emotions (Agnew, 1992; Agnew & White, 1992). Procedural justice literature also suggests that negative emotions in response to perceived injustice result in noncompliance, whereas positive emotions are related to perceived justice promoting compliance with public directives (Barkworth & Murphy, 2015; Murphy & Tyler, 2008). Recent studies on compliance with COVID-19 measures look at psychological mechanisms such as fear, anxiety, anger, and sadness and their role between perceiving the pandemic as a threat to health or personal finances and compliance behavior. Specifically, perceptions of potential damage to health and loss of fortune could increase worries, anxieties, and fear (Shiina et al., 2020; Zhong et al., 2021), which in turn lead to support for government restrictive policies (Renström & Bäck, 2021). Given the potential mediating effect of emotional states, we assume that *the relationship between perceptions of the COVID-19 crisis and compliance is mediated by fear-related emotions such as panic and anxiety (H2.5) and by anger and sadness (H2.6).*

2.4. Institutional perceptions and compliance

Besides enhanced emotional states and crisis perceptions, institutional perceptions play an equally important role in influencing compliance behavior. Institutional perceptions incorporate and manifest multiple normative aspects of perceived institutional legitimacy—a central concept from compliance theories in criminology research that is crucial for securing law-abiding behavior apart from traditional means of threat and deterrence (Jackson et al., 2012; Tyler, 2006). While institutional legitimacy can be found in the expressed sense of duty to defer to the authorities (Murphy et al., 2020), three other aspects of institutional perceptions particularly reflect institutional legitimacy in the context of the COVID-19 pandemic.

First, the perceived effectiveness of institutions indicates the normative expectations of rule-makers to be competent at fulfilling their tasks (Bottoms & Tankebe, 2012; Tankebe, 2013). Under the health belief model, perceiving suggested treatments as beneficial to reducing one's susceptibility to or the severity of certain diseases is an important force to increase the likelihood of taking recommended preventive health actions (Rosenstock, 1974). In the context of a public health crisis, perceiving government health measures as effective could elicit people's willingness to follow the rules. The results of a recent large international survey indicate that regarding precautionary measures as effective in avoiding COVID-19 is a significant predictor of voluntary compliance among individuals across many countries (Clark et al., 2020).

Second, the public's trust in rule-making authorities reflects how legitimacy is recognized and justified among the public (Hough et al., 2010; Tyler, 2011). People's trust in governmental institutions is closely linked to compliance with government rules (Levi & Stoker, 2000). Empirical findings support this assumption in varied compliance contexts. High levels of political trust relate to lower support for law-breaking behaviors in areas like tax fraud (Marien & Hooghe, 2011). In public health, low trust in the government decreased compliance with government control policies during the Ebola outbreak (Blair et al., 2017), while trust in health ministries was associated with compliance behavior during the H1N1 pandemic in Italy (Prati et al., 2011). During the COVID-19 pandemic, political and institutional trust has been associated with a greater willingness to support COVID-related tax policies in Canada (Lachapelle et al., 2021) and in compliance with government containment policies in France and Italy (Lalot et al., 2020) and Serbia and Latin America (Jovančević & Miličević, 2020) and across several European countries (Bargain & Aminjonov, 2020; Chan, Brumpton, et al., 2020).²

Last, false beliefs led by misinformation such as beliefs in conspiracy theories could jeopardize the public's assessment of government transparency and further increases violent extremist intention (Lavigne et al., 2022; Rottweiler & Gill, 2020). Conspiracy beliefs tend to prevail in times of crisis and influence individual attitudes and behavior (van Prooijen & Douglas, 2017). The COVID-19 pandemic has also witnessed the emergence of conspiracy theories targeted at established public institutions and companies. The rapid dissemination of misinformation and disinformation on the Internet has given rise to the so-called "infodemic," causing confusion and disrupting public perceptions and responses to government measures (Gallotti et al., 2020; Hameleers et al., 2020). Research keeping track of the impact of conspiracy beliefs has found that individuals who reported beliefs in COVID-19 conspiracy narratives—despite differences in content—generally display universal resistance to preventive practices (Allington et al., 2021; Freeman et al., 2020; Oleksy et al., 2021; Romer & Jamieson, 2020; Roozenbeek et al., 2020). Therefore, we hypothesize that *compliance with COVID-19 health measures is higher*

among those who believe existing measures are effective (H3.1) and among citizens who trust their government (H3.2) and lower among those who hold conspiracy-based beliefs (H3.3).

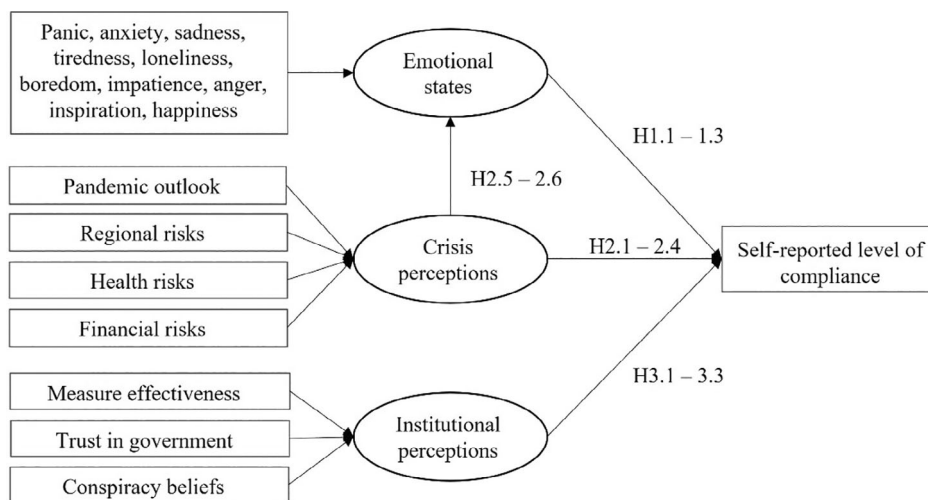
Drawing on the literature review above, Figure 1 summarizes our analytical framework on how emotional states, crisis perceptions, and institutional perceptions affect people’s compliance with government COVID-19 health measures.

3. Method

3.1. Participants and procedures

From 5 to 19 June 2020, we conducted three cross-sectional online surveys in China, Germany, and the United States through a Berlin-based survey company. Despite different social and political systems, all three countries had experienced the pandemic, along with the implementation of a variety of public health measures, by the time of our survey. The questionnaires were initially designed in English by the authors and translated into German and Chinese by the survey company. The translation was validated by native language speakers both after a preliminary test of the survey and after receiving our pilot data. Participants were recruited through a river-sampling approach from a base of 1 million to 3 million users of over 100 cooperating apps and websites where advertisements about the survey were posted.³ Multiple sources were employed to reduce coverage bias based on second-level digital divides, such as disparities in using style and frequency (Lehdonvirta et al., 2021; Räsänen, 2006). To minimize the topical self-selection bias inherent in the river-sampling recruitment process, the survey topic was not presented in the advertisements until respondents passed the pre-screening and landed on the survey page. Depending on the feature of the apps, the recruitment offered participants options to receive a certain format of rewards, including premium content, extra features, vouchers, and PayPal cash.

To mirror the national population of the respective countries, quotas based on age (18–65), gender, and residential location were generated and implemented in the sampling process. These quotas were created based on the available national and regional population statistics and Internet penetration data from Barro-Lee (2017), the Pew Research Center (2017), and Statista (2016). To ensure the sample’s representativeness, weights were used to adjust for minor discrepancies between the obtained samples and the quotas after the sampling processes. The maximum sampling weight that was allocated was 1.4, and the margins of error for estimates were 2.1% for China, 2.2% for Germany, and 2.1% for the United States at a 95% confidence level. Nevertheless, given the nature of the online survey, the results represent the Internet-connected population in the three countries even after these adjustments.



A social psychological framework of compliance in times of public health crisis

FIGURE 1 Analytical framework

After excluding invalid questionnaires (i.e., respondents who either failed to pass the two attention checks in the form of pre-screening and consent on survey information before the survey, did not complete the survey, or completed it in a very short time or with straight-line or inconsistent responses), we obtained a total sample size of 6464: 2201 from China, 2083 from Germany, and 2180 from the United States. The conversion rates were 66% (China), 70% (Germany), and 61% (the United States). Summary statistics of sociodemographic characteristics of each sample, as well as the pooled sample, are presented in Table 1.

3.2. Measures of key variables

3.2.1. Dependent variable

Our dependent variable is the self-reported level of compliance with government rules and regulations to contain the spread of COVID-19. Respondents were asked to assess the extent to which they followed them in general when they were answering the questionnaire. The options ranged from “*I follow all*” and “*I follow most*” to “*I follow some*” and “*I don’t follow at all.*” A similar measurement of compliance with government COVID-19 measures is used in Paul et al. (2021). In our nonexperimental survey design, respondents were allowed to choose the option that they “*Prefer not to answer.*”

3.2.2. Emotional states

To measure the status of individuals’ psychological well-being during the pandemic, respondents were given a set of emotions and asked to select whether they experienced an increase in any of them throughout the pandemic, that is, from 3 to 4 months after the outbreak of the pandemic until the time of the survey. The emotional indicators include mostly negative responses such as panic, anxiety, sadness, loneliness, tiredness, boredom, impatience, and anger, as well as a few rarer, possibly positive responses like *inspiration*, and *happiness*. We also take in one inclusive option (“*other*”) to capture an unspecified status that our respondents could have and one exclusive option (“*none of the above*”) to capture those who did not experience an increase in any specific emotional

TABLE 1 Summary of sociodemographic characteristics per sample

	China N = 2201	Germany N = 2083	United States N = 2180
Age			
18–35	1448 (66)	731 (35)	879 (40)
36–50	616 (28)	742 (36)	732 (34)
51–65	137 (6.2)	610 (29)	569 (26)
Gender			
Male	1189 (54)	1045 (50)	1084 (50)
Female	1012 (46)	1038 (50)	1098 (50)
Education level			
Low	120 (5.5)	129 (6.2)	81 (3.7)
Medium	1309 (59)	1499 (72)	1551 (71)
High	772 (35)	455 (22)	548 (25)
Household type			
Living with parents/grandparents	900 (41)	248 (12)	470 (22)
Living with children	846 (38)	708 (34)	828 (38)
Household income			
Low	289 (13)	239 (11)	363 (17)
Medium	527 (24)	977 (47)	594 (27)
High	1167 (53)	567 (27)	830 (38)
Prefer not to say	218 (9.9)	300 (14)	392 (18)
Residential location			
Rural	776 (35)	772 (37)	839 (39)
City	1425 (65)	1311 (63)	1340 (61)

Note: Weighted frequency, percentage in parentheses.

reaction.⁴ We used binary coding for each of the emotional states: “0” for absent and “1” for present. Rather than grouping emotions into a general construct, we decided to analyze the effects of discrete emotions because certain emotions, even with similar valences, can have different causes and functions and may result in distinct or opposing behaviors (Li et al., 2021).

3.2.3. Crisis perceptions

Perceptions of the COVID-19 crisis cover two aspects: the subjective assessment of the pandemic and the perceptions of personal situations within the pandemic. We measure the perceptions of the pandemic situation with two items: *perception of regional risk* and *pandemic outlook*. The first item measures the perception of local pandemic severity compared with the country’s average in terms of the number of COVID-19 infections on a five-point Likert-type scale ranging from “*much fewer (1)*” to “*much more (5)*” (local COVID-19 cases compared with the country), with the possible option of “*do not know.*” The item *pandemic outlook* incorporates the emerging temporal perspective in the current compliance literature (Briscese et al., 2020; Sobol et al., 2020). Respondents were asked whether they agree with the statement “*There will be a second wave of the pandemic*” from “*strongly disagree (1)*” to “*strongly agree (5)*.” The second aspect of crisis perceptions can be approached through two immediate risks posed to individuals: personal health and financial situation (Habich-Sobiegalla & Habich-Sobiegalla, 2022; Kostka & Habich-Sobiegalla, 2022). We use the item *health concern* to measure perceived health risks about *oneself, family members, and/or friends* catching COVID-19. We generated three sets of dummy variables to indicate personal health concerns, health concerns about others, and no health concerns. For personal financial situation, we used a five-point scale item that displays the change in household monthly income since the outbreak of the pandemic in ascending order. “1” refers to *a significantly worsened financial situation*, while “5” means *a significant improvement*. Respondents were allowed to opt out by selecting the option answer “*do not know/prefer not to say.*”

3.2.4. Institutional perceptions

Institutional perceptions contain perceptions of multiple aspects of governments’ role during the pandemic. We measure this aspect with the following items: *perceived effectiveness of existing measures*, *trust in government*, and *conspiracy beliefs*. *Perceived effectiveness of existing measures* was examined by one item asking respondents’ evaluation of existing government measures against the pandemic: a general assessment of the effectiveness of measures is measured from “*very ineffective (1)*” to “*very effective (5)*.” *Trust in government* contains the question “*how much do you trust the government institutions of your country?*” with answer options ranging from “*a lot*” to “*somewhat*,” “*very little*,” or “*not at all*,” as well as “*prefer not to answer.*” We assess *conspiracy belief* by testing the degree of agreement with the idea that “*the COVID-19 pandemic is a conspiracy (e.g., engineered deliberately by humans)*.” Respondents were asked to select one of the following options: “*yes*,” “*maybe*,” “*no*,” and “*do not know.*”

3.2.5. Control variables

Apart from the explanatory variables illustrated above, we include sociodemographic variables such as *age, gender, education, household income, residential location, and household type* as control variables. Detailed measurements of these and other variables and the corresponding hypotheses are presented in Table A1 in the appendix.

4. Results

Our study finds that self-reported compliance levels vary across the three countries. As shown in Figure 2, Chinese respondents were the most compliant, with 98% of the population following all or most of the prescribed health measures during the pandemic. The remaining 2% consists of those who follow none or some of the measures and those who refused to answer. By contrast, over one-fifth of the US population does not comply (6.5%) or only selectively complies (16%) with government COVID-19 measures. Among the three countries, the proportion of those who follow all or most related measures is the lowest in the United States (73%). Germany is in the middle, with 88% following all or most of the COVID-19 measures (Table A2 in the appendix).

Our study further finds that anxiety and boredom are the two most prevalent emotional states people experience in the initial phase of the pandemic in all three countries. As illustrated in Figure 3, almost half of the US

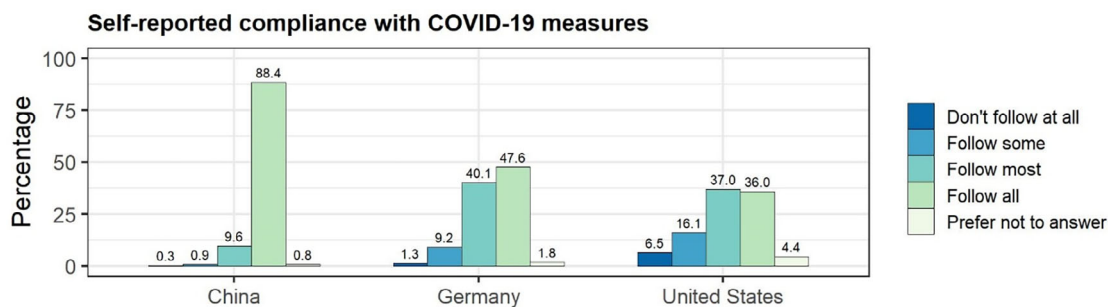


FIGURE 2 Self-reported compliance with COVID-19 measures by country (weighted)

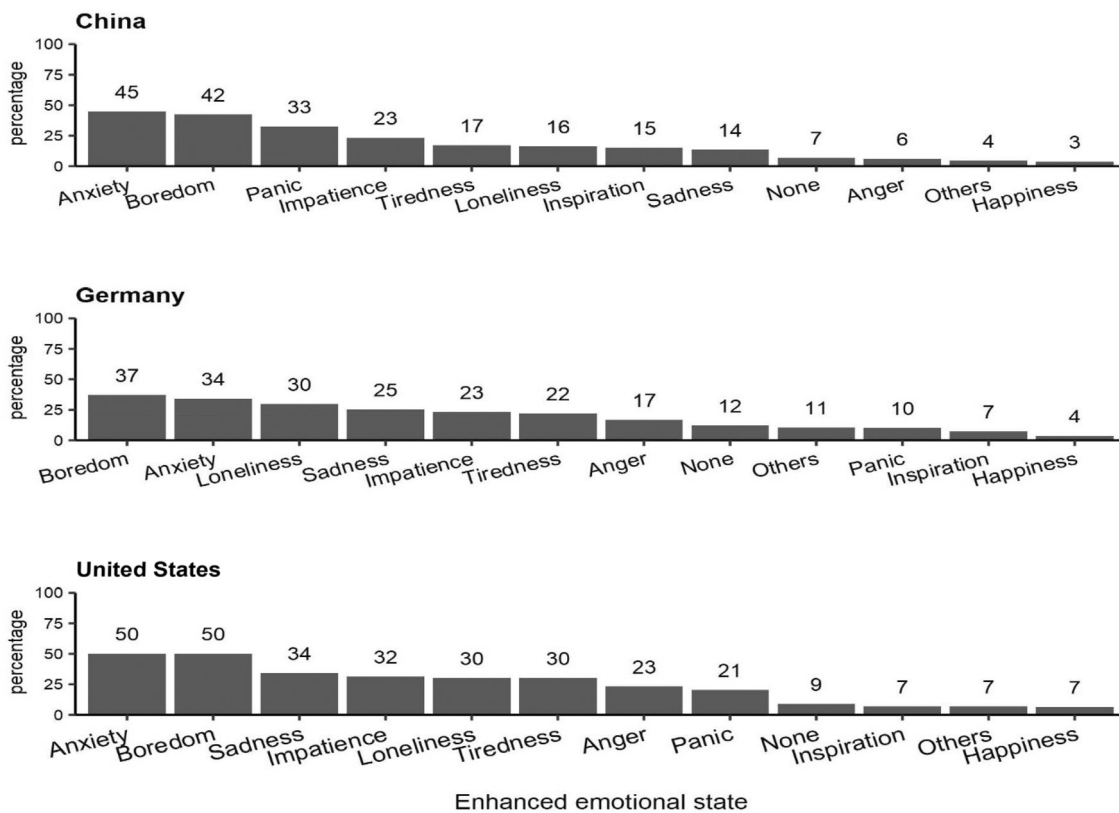


FIGURE 3 Levels of enhanced emotion during COVID-19 pandemic by country

citizens reported increased feelings of anxiety and boredom. Similarly, over 40% of the population in China and more than one-third of the population in Germany experienced a rise of the same two emotions. Among other negative emotions, more people felt lonely in Western countries (around 30% in Germany and the United States) than in China (17%). By contrast, panic was experienced by significantly more Chinese citizens (33%) than their German (10%) and American (20%) counterparts. Unsurprisingly, positive emotional states such as *happiness* were the least reported emotional increase in all three countries. Another positive emotional state, *inspiration*, also increased only slightly in Germany (8%) and the United States (7%), while a significantly larger part of the population in China (15%) experienced it during the pandemic.

Using ordered logistic regression, we ran three models to test the effect of three sets of hypothesized factors on compliance in China, Germany, and the United States (see Fig. 4). Model 1 is built on discrete enhanced emotional states after adjusting for sociodemographic factors. To overcome the potentially confounding issue between

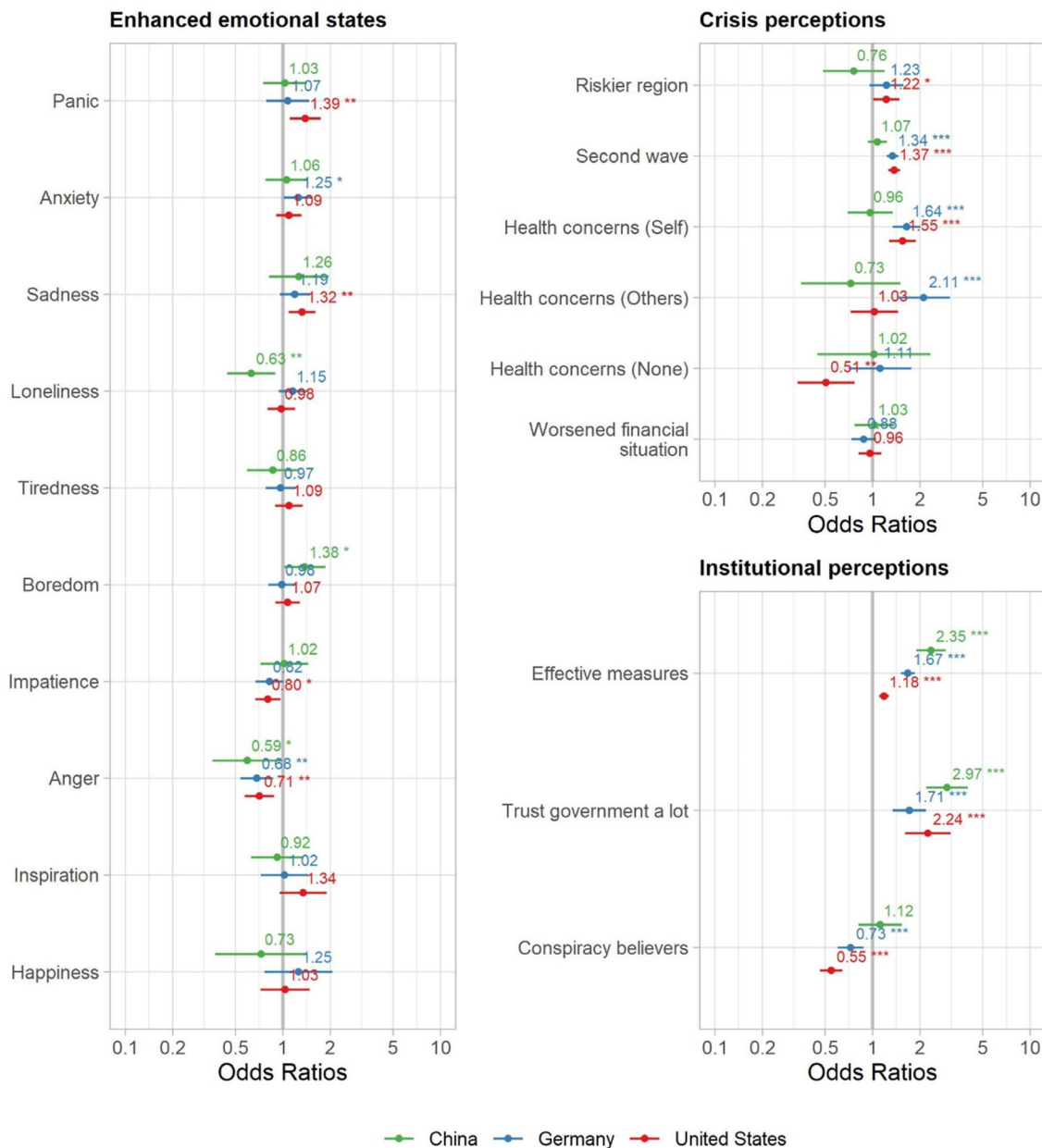


FIGURE 4 Estimates of effects of emotions and crisis and institutional perceptions on compliance. Odds ratios are estimated at 95% confidence intervals and plotted against log scales. All control variables are omitted in the plot. An overall model combining all hypothesized factors can be found in Figure A1 in the appendix. The result of likelihood ratio test of joint coefficients for H1.1–H1.3 is demonstrated in Table A3 in the appendix.

emotions and compliance introduced by various aspects of crisis perceptions, we included crisis perceptions as additional control variables for this model. Model 2 tests the effect of crisis perceptions on compliance, and Model 3 the effect of institutional perceptions on compliance, both adjusting for sociodemographic factors. We report the results estimated in Odds Ratio (hereafter referred to as “OR”). Generally, OR = 1 implies no relationship, OR < 1 implies a negative, and OR > 1 a positive relationship.

Our result in Model 1 suggests that experiencing increased panic during the pandemic has a strong positive effect (OR = 1.39) on compliance in the United States. At the same time, anxiety facilitates individual compliance behavior in Germany (OR = 1.25). Hence, our hypothesis H1.1, which states that the level of compliance with COVID-19 health measures is higher among those who experienced panic or anxiety, is supported for the

German and US populations. However, this does not apply to the Chinese population. Moving to the effect of positive emotions such as happiness and inspiration (H1.2), our model shows that holding all other emotional states, sociodemographic factors, and crisis perceptions constant, neither of the positive emotions have a significant effect on compliance in any of the countries; thus, H1.2 cannot be supported. H1.3 focuses on the effect of other negative emotions beyond fear-related emotions. The most prominent is the significant negative effect of anger on compliance in all three countries (OR = 0.59, 0.68, and 0.71 for China, Germany, and the United States, respectively), meaning those who felt increased anger during the pandemic are on average 30% to 40% less likely to comply than those who did not feel so, regardless of country context. The effect of other negative emotions is more country-specific. For instance, loneliness is mainly a driver of significantly less compliance among Chinese citizens (OR = 0.63), suggesting that those who experienced loneliness in China are almost 40% less likely to comply with COVID-19 measures than those who did not feel so. Impatience hinders individual compliance, particularly among US citizens, among whom the impatient are 20% less likely to comply with COVID-19 measures. Surprisingly, the results of boredom in China (OR = 1.38) and sadness in the United States (OR = 1.32) exhibit positive effects on compliance, in contrast to the hypothesis. The result of tiredness is not significant in any of the three countries. In sum, with significant adverse effects of anger, loneliness, and impatience in part of the samples, H1.3 is partially supported.

The result of Model 2 suggests that citizens who believed there would be a new wave of the pandemic at the time of the survey (OR = 1.34 for Germany, OR = 1.37 for the United States) and those who had greater concern about their own health status (OR = 1.64 for Germany and OR = 1.55 for the United States) were significantly more likely to comply with the existing public health measures. The same effect applied to US citizens who believed their localities had higher infection rates than the national average (OR = 1.22). Also, among the US population, those who have no health concerns are half less likely to comply with the rules (OR = 0.55), which stands in stark contrast to those who are concerned with the health of their family and friends in Germany, who are twice as likely to comply (OR = 2.11). Hence, H2.2 on the positive effect of the pandemic outlook and H2.3 on health concerns are supported in Germany and the United States, while H2.1 on perceived regional risk is supported only in the United States. There is little evidence supporting the hypothesis of the worsened financial situation (H2.4).

The last aspect of the analysis looks at the effect of institutional perceptions on individual compliance (Model 3). Those who regarded the existing measures as effective are around 135%, 67%, and 18% more likely to obey regulations in China, Germany, and the United States, respectively, than those who do not share the opinion. We also find robust positive effects of high trust in government on compliance in all three countries. Specifically, those with great trust in government institutions are around 197%, 70%, and 124% more likely to comply with the COVID-19 measures in China, Germany, and the United States, respectively, than those who trust their government less. Our findings suggest that conspiracy theorists are significantly less likely to comply with the COVID-19 measures in Germany (OR = 0.73) and the United States (OR = 0.55). Hence, our results greatly support H3.1 on perceived effective measures and H3.2 on trust in government for all countries and H3.3 on conspiracy beliefs for Germany and the United States.

We used the R “mediation” package developed by Tingley et al. (2014) to run our mediation analysis and examine whether and how fear-related emotions and anger and sadness mediate the relationship between crisis perceptions and compliance. The result in Table A4 and Table A5 in the appendix suggests that increased anger negatively mediates the effect of crisis perceptions (as manifested in health concerns in all and worsened financial situation in the German and US populations) on compliance. Fear-related emotions also mediate various crisis perceptions in Germany (through anxiety) and the United States (through panic), both in positive ways. Also, in these two countries, all kinds of health concerns lead to increased sadness, increasing the likelihood of compliance behavior. Therefore, H2.5 and H2.6 can be largely supported.

Based on the results above, we ran an additional pooled model with a country dummy to test the significance of coefficients across country groups and explore the potentially unobserved country-level effect on compliance. Overall, the result (see Fig. A2 in the appendix) suggests the country-level factor does not affect most emotional states much—except for loneliness, which exhibits a comparatively more positive effect on compliance in Germany (OR = 1.81) and the United States (OR = 1.55); and for boredom, with more negative effect among German citizens (OR = 0.67). However, the country-level factor significantly enlarges the effect of crisis

perceptions on compliance, especially that effect of believing in a second wave and concerns about one's health in Germany and the United States, both in a more positive way. The country-level effect is also prominent in institutional perceptions: Conspiracy theorists in Germany and the United States are 34% and 52% less likely to comply than their Chinese counterparts. Surprisingly, the country-level effect becomes so strong that it turns the initial positive effect of belief in the effectiveness of health measures (Germany OR = 0.65, United States OR = 0.54) and trust in government (Germany OR = 0.49) into a negative direction. In other words, German and US citizens are less likely to comply under these circumstances than Chinese citizens who believe that government measures are effective and trust the government a lot.

5. Discussion

Our study engages with social psychological theories on citizens' compliance with public policies during crises. We focus on three sets of psychological factors as the central aspects of our empirical inquiry and employ a comparative perspective to investigate cross-country similarities and divergences. Based on three national online surveys from China, Germany, and the United States, our findings bring multiple insights to compliance research.

First, our analysis supports the argument that individual compliance depends on a plurality of motivations operating simultaneously (Étienne, 2010). From the perspective of social psychology, we find that enhanced emotional states, crisis perceptions, and institutional perceptions all shape people's compliance with COVID-19 health measures. Furthermore, our cross-country samples allowed us to factor in the country-level aspect and investigate psychological effects from a comparative perspective. Overall, we find that the country-level factor influences the effect of institutional perceptions on individual compliance most strongly, yet it is limited regarding the effect of most emotional states. In other words, the effect of emotional states on compliance does not vary significantly across countries, but the effect of the crisis and institutional perceptions on compliance does.

Second, among a wide spectrum of emotions examined in our study, the top-ranked emotional statuses found in our country samples not only confirm the psychological stress citizens commonly experience in a crisis, such as fear and anxiety (Li *et al.*, 2021; Lu *et al.*, 2020; Zhong *et al.*, 2021), but also highlight the prevalence of increased boredom, which is typical for the COVID-19 pandemic with widespread lockdown policies (Martarelli & Wolff, 2020; Wolff *et al.*, 2020). Our study further reveals that emotional states, even with similar valence, could exert the opposite effect on citizens' compliance (Bodenhausen *et al.*, 1994; Gross, 1998). Fear-related emotions like panic and anxiety, as well as boredom and sadness, increase the likelihood of compliance with COVID-19 rules. However, other negative emotions, such as anger and impatience, decrease the likelihood of compliance. While the findings on fear reflect prior research on compliance (Brouard *et al.*, 2020; Harper *et al.*, 2020; Jørgensen *et al.*, 2021; Jovančević & Miličević, 2020), the positive effect of boredom in our China sample contrasts with studies finding that people who constantly feel bored tend to perceive adhering to rules as more difficult (Martarelli & Wolff, 2020; van Rooij *et al.*, 2020; Wolff *et al.*, 2020). The inconsistent effect of boredom on compliance between our study and others certainly merits further investigation. Given that boredom is studied based on different country populations, we assume the divergence may be explained by certain macro-level contextual factors such as collective culture.

Third, with regard to emotional mechanisms, we find that the direct, negative effect of anger on compliance and the mediating role anger plays between crisis perceptions and compliance are culturally uniform across the three countries. Specifically, citizens who are financially disadvantaged or have greater health concerns are more likely to experience increased anger, which in turn reduces the tendency to comply. This finding is in line with general strain theory (Agnew, 1992) and procedural justice theory (Barkworth & Murphy, 2015; Murphy & Tyler, 2008), both of which assume emotions triggered by negative situations could lead to deviant, law-breaking behavior. Fear-related emotions and sadness also mediate crisis perceptions on compliance, but they do so positively and only in the cases of Germany and the United States. This further suggests that crisis perceptions may trigger a mixture of emotions, such as anger and anxiety, with different effects on compliance.

Last, besides the role of emotions and emotional mechanisms, our results indicate the influential roles of both crisis and institutional perceptions on compliance behavior during a global health crisis. Subjective assessments of crises and personal conditions during crises constitute cognitive mechanisms occurring between the situation

imbued with “strains” and resulting behavioral reactions (Orbell *et al.*, 2013; Rauthmann *et al.*, 2015), which are often transmitted through elicited emotions (Agnew, 1992; Gross, 1998). Institutional perceptions largely reflect perceived institutional legitimacy, which is essential for securing law-abiding behavior (Jackson *et al.*, 2012; Tyler, 2006) and can be discerned in perceived effectiveness of implemented measures, high trust in government, and disbelief in conspiracy theories in the context of COVID-19 pandemic. Overall, both types of perceptions constitute individual attitudes on the perceived benefits and costs of compliance and noncompliance (Meier & Morgan, 1982).

Our study is not exempt from limitations. The most noticeable limitation is that it relies exclusively on self-reported compliance extracted from an online survey. This approach inevitably has at least three major drawbacks. First, we measured our dependent variable based solely on one single question item. Without further distinguishing compliance with different types of measures, we could only measure it on the most general level. Although this may be justified for a cross-national study where preventive measures vary significantly, particularly at the beginning of the pandemic due to great uncertainty, we noticed that recent COVID-19 literature has developed sophisticated compliance indices and scales that capture compliance with multiple health measures in cross-country cases (Brouard *et al.*, 2020; Daoust *et al.*, 2020; Jørgensen *et al.*, 2021). This can serve as guidance for a more refined measurement of compliance in future research.

Second, the sensitivity of compliance issues during a global public crisis makes responses susceptible to social desirability bias. In this regard, our result is likely to be biased upward (i.e., the estimated compliance level is inflated). However, given that such bias is homogeneous across populations (Daoust *et al.*, 2020, 2021), it is still possible for us to study the key predictors of compliance. Nevertheless, to reduce social desirability bias in similar situations, future research should consider implementing alternative techniques such as list experiments, cross-wise models, or a guilt-free strategy with face-saving survey designs (Daoust *et al.*, 2020, 2021; Jensen, 2020; Larsen *et al.*, 2020; Munzert *et al.*, 2021). At this stage, we take additional note of our China sample, among which around 88% of respondents reported having followed all measures. This very high rate of compliance could have resulted from social desirability bias but may also be attributable to other country-specific effects such as the stringency of the rule and its enforcement, as well as cultural factors such as high obedience among the population. Nonetheless, the very small amount of noncompliers in the Chinese sample may indicate that we have missed some effects of key explanatory variables, despite variations among them. Here again, using the aforementioned strategies could partially correct the estimates of inflated self-reported compliance.

Third, even though we employed techniques to reduce volunteer bias in our online method, such as using multiple sources to reduce coverage bias and not reveal the survey topic to avoid topic-selection bias, we cannot exclude the possibility that other unobserved factors might have caused certain groups of online populations to react to our survey (e.g., economically driven selection bias). We encourage future survey design to attend to all potential setbacks that could arise from an online environment.

A further limitation of our study could be that our emotional states were measured on a binary scale. Although it could capture the change of individual emotions in our study, it might fall short of fully reflecting the extent of such change. Further research could utilize the established scales to measure emotions along a continuum and pay attention to how the extent of change in emotion relates to the compliance response (see Broodryk & Robinson, 2021).

6. Conclusion

Our study examined three sets of psychological factors that shaped individual compliance with government COVID-19 measures during the first wave of the COVID-19 pandemic in China, Germany, and the United States. Our cross-country surveys show that individual compliance is related to various negative emotions elicited during the pandemic. The most prominent one that leads to low compliance is anger, an emotion commonly triggered by health concerns, and exhibits a culturally uniform effect across countries. By contrast, other negative emotions such as panic, anxiety, and sadness are associated with a higher level of compliance in times of crisis, especially in Germany and the United States. Also in these two countries, health concerns and a belief in the advent of a new wave are significant drivers of compliance with government COVID-19 measures. Equally

importantly, in all three countries, people with high trust in the government and those who believe in the effectiveness of existing measures tend to comply more.

The findings have numerous policy implications. To foster compliance behavior during crises, public authorities need to pay attention to crisis-induced emotions among citizens, including compliance-fostering emotions such as anxiety, panic, and sadness, as well as compliance-hampering emotions such as anger, loneliness, boredom, and impatience. Overall, during crises, governments should use policy tools to balance different effects of negative emotions triggered by the crisis event. For example, government recovery plans should be promptly made available to citizens. Public funding dedicated to individuals and businesses to address immediate financial burdens should also be allocated to support mental health professions whose practices could be of great importance. Experiences from a volunteer healthcare professionals' network in Wuhan and a crisis mental health support program at a Hungarian university show that psychological counseling and crisis intervention can be used to make such services more visible, accessible, and affordable to the public through digital support (Cheng *et al.*, 2020; Szlamka *et al.*, 2021). Furthermore, psychological training should be provided to law enforcement officers and regulators, who are under extreme pressure with their daily missions, particularly during a public crisis. With sufficient training, they could show more understanding, empathy, and mental support for common citizens. Such a realistic understanding of individual responses would result in more feasible and effective containment measures in terms of compliance.

Moreover, government communication about health measures during the pandemic could emphasize the broad scope of potential victims of COVID-19 and the severe health consequences. Official messages calling for prevention behaviors should highlight both personal and public benefits instead of focusing on a single aspect (Jordan *et al.*, 2021). To appease irritated citizens, the promotion of restrictive measures during the crisis should inform the public about the open and realistic assessment of the short-, medium-, and long-term perspectives of the pandemic development. Finally, fighting the spread of COVID-19-related conspiracy theories is crucial to sustaining citizens' compliance. For example, timely and adequate risk communication initiated by the government can help reduce the tendency toward conspiracies among the public (Chan *et al.*, 2021). On the whole, regulators should pay more practical attention to the constant linkage between psychological (especially emotional) reactions and compliance behavior when devising and implementing government measures in times of crisis and beyond.

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DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Endnotes

- ¹ The AHA-L rules are the restrictions introduced in Germany since the outbreak of the COVID-19 pandemic in the country. It stands for keeping a distance of at least 1.5 m (Abstand halten), being mindful of hygiene by regularly washing one's hands (Hygiene beachten), and wearing a mask (Alltagsmaske tragen) and is supplemented with an "L" for keeping indoor areas well ventilated (Lüften). Another "A" was later added as a supplement for using the government-approved contact tracing apps (e.g., Corona-Warn-App).
- ² Besides political trust, emerging studies are also looking at social trust and compliance behavior during the pandemic, see Woelfert and Kunst (2020).
- ³ River sampling is an online recruitment technique for survey research. Invitations to the survey are placed on websites, in applications, and in e-mails with high traffic flow, where they are likely to be noticed by Internet users. Internet users

become potential respondents on a voluntary basis through self-selection. Potential respondents are profiled at the time of recruitment and are directed to a one-off survey in the context of river sampling (Callegaro et al., 2014; Lehdonvirta et al., 2021; Mercer et al., 2017). Compared with conventional commercial online panel sampling, river sampling can not only reach a much larger and more diverse pool of respondents but also avoid issues such as panel attrition typical for a long-term panel (Callegaro et al., 2014; Mercer et al., 2017).

- ⁴ Exclusive options are those that, once selected, lock out all other options. By contrast, when inclusive options are selected, it is still possible to select other options as well.

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APPENDIX

TABLE A1 Measurements and hypotheses of key variables

Category	Measurement	Hypothesis
Dependent variable		
Self-reported level of compliance with government COVID-19 measures	1 = Do not follow at all, 2 = Follow some, 3 = Follow most, 4 = Follow all, 5 = Prefer not to answer	
Psychological status	Individual psychological status: No = 0, Yes = 1	
Increase in any of the following: Panic, anxiety, loneliness, sadness, tiredness, boredom, impatience, anger, inspiration, happiness, other, none		H1.1 Compliance with COVID-19 health measures is higher among those who experienced panic or anxiety. H1.2 Compliance with COVID-19 health measures is higher among those who experienced inspiration or happiness. H1.3 Compliance with COVID-19 health measures is lower among those who experienced sadness, loneliness, boredom, impatience, anger, or tiredness.
Situational perceptions		
Pandemic situation		
Perceived risk region	1 = much fewer, 2 = somewhat fewer, 3 = about the same, 4 = somewhat more, 5 = much more, 6 = do not know Dummy: 0 = "same/fewer/do not know," 1 = "more"	H2.1 Compliance with COVID-19 health measures is higher among those who perceive their region to have a higher infection rate.
Pandemic outlook (second wave)	1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = strongly agree	H2.2 Compliance with COVID-19 health measures is higher among those who believe there is a second wave.
Personal situation		
Health concern	1 = catching the virus myself, 2 = family catching the virus, 3 = friends catching the virus, 4 = None of the above Dummies: 0 = No, 1 = Yes for the following: Health concern (own, 1) Health concern (others, 2 or 3), Health concern (none, 4) Mediation analysis: sum score 0–3	H2.3 Compliance with COVID-19 Health measures is higher among those who have broader health concern about oneself and/or close others.
Financial situation	1 = worsened significantly, 2 = worsened somewhat, 3 = stayed the same, 4 = improved somewhat, 5 = improved significantly, 6 = do not know/prefer not to say Dummy: "better/do not know" = 0, "worsened" = 1	H2.4 Compliance with COVID-19 health measures is higher among those whose financial situation worsened.

(Continues)

TABLE A1 Continued

Category	Measurement	Hypothesis
Mediating effect		<p>H2.5 The relationship between perceptions of COVID-19 crisis and compliance with government health measures is mediated by fear-related emotions like panic or anxiety.</p> <p>H2.6 The relationship between perceptions of COVID-19 crisis and compliance with government health measures if mediated by other negative emotions, for example, anger, sadness.</p>
Institutional perceptions		<p>H3.1 Compliance with COVID-19 health measures is higher among those who believe existing measures are effective.</p> <p>H3.2 Compliance with COVID-19 health measures is higher among citizens who have more trust in the government.</p>
Measure effectiveness	<p>1 = very ineffective, 2 = somewhat ineffective, 3 = neither effective nor ineffective, 4 = somewhat effective, 5 = very effective</p>	
Trust in the state	<p>1 = a lot, 2 = somewhat, 3 = neither trust nor distrust, 4 = not much, 5 = not at all, 6 = Prefer not to answer</p> <p>Dummy: 0 = "neutral/not much/not at all/somewhat/no answer," 1 = "a lot"</p> <p>1 = yes, 2 = maybe, 3 = no, 4 = do not know</p> <p>Dummy: 0 = "no/do not know," 1 = "yes/maybe"</p>	
Conspiracy belief		<p>H3.3 Compliance with COVID-19 health measures is higher among those who hold conspiracy believes.</p>
Control variables		
Age	In years (open box)	
Gender	0 = male, 1 = female	
Household type	Living with parents/grandparents: 0 = No, 1 = Yes	
	Living with children: 0 = No, 1 = Yes	
Household income (monthly, gross)	<p>1 = under 250, 2 = 250–500, 3 = 500–1000, 4 = 1000–2000, 5 = 2000–3000, 6 = 3000–4000, 7 = 4000–6000, 8 = 6000–8000, 9 = 8000–10,000, 10 = 10,000–12,000, 11 = 12,000–15,000, 12 = more than 15,000, 13 = prefer not to say</p> <p>Regroup: China: 1 = Low (1–4, <2000), 2 = Medium (5–6, 2000–4000), 3 = High (7–12, >4000)</p> <p>Germany: 1 = Low (1–4, <2000), 2 = Medium (5–7, 2000–6000), 3 = High (8–12, >6000)</p> <p>United States: 1 = Low (1–5, <3000), 2 = Medium (6–10, 3000–12,000), 3 = High (11–12, >12,000)</p>	
Education	<p>1 = no formal education, 2 = high school diploma or equivalent, 3 = vocational training, 4 = bachelor's degree, 5 = master's or doctorate's degree</p> <p>Regroup: 1 = low (1), 2 = medium (2–3), 3 = high (4–5)</p> <p>0 = Rural, 1 = City</p>	
Residential location		

TABLE A2 Self-reported compliance with COVID-19 measures by country

	Country		
	China, $N = 2201^a$	Germany, $N = 2083^a$	United States, $N = 2180^a$
Level of compliance			
Do not follow at all	6 (0.3%)	27 (1.3%)	142 (6.5%)
Follow some	20 (0.9%)	191 (9.2%)	350 (16%)
Follow most	212 (9.6%)	835 (40%)	807 (37%)
Follow all	1945 (88%)	992 (48%)	784 (36%)
Prefer not to answer	18 (0.8%)	37 (1.8%)	97 (4.4%)

^a n (%).**TABLE A3** Likelihood ratio tests of joint coefficients for H1.1–H1.3

	H1.1		H1.2		H1.3	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
China						
Res. Df	2155.8	2153.8	2155.8	2153.8	2159.8	2153.8
Df		2		2		6
χ^2		0.1638		1.1813		15.471
Pr(> χ^2)		0.9213		0.554		0.0169*
Germany						
Res. Df	2019	2017	2019	2017	2023	2017
Df		2		2		6
χ^2		5.3468		0.8937		18.469
Pr(> χ^2)		0.06902		0.6396		0.0051**
United States						
Res. Df	2055.8	2053.8	2055.8	2053.8	2059.8	2053.8
Df		2		2		6
χ^2		9.8523		3.4924		23.581
Pr(> χ^2)		0.0073**		0.1744		0.000***

Note: Model 1 is the restricted model with target coefficients set to zero, Model 2 is the full model. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

TABLE A4 Mediation effect (indirect effect, complete)

Mediator	Indirect effect		
	Compliance		
	China	Germany	United States
Panic	Riskier region	Riskier region	Riskier region
	-0.00004 [-0.0022 to 0.00]	0.00036 [-0.00378 to 0.01]	0.0078 [0.00038 to 0.02]
	Second wave	Second wave	Second wave
	-0.00001 [-0.00088 to 0.00]	0.00004 [-0.00122 to 0.00]	0.0035 [0.0004 to 0.01]
	Health concern self	Health concern self	Health concern self
	-0.00009 [-0.00423 to 0.00]	0.00045 [-0.00713 to 0.01]	0.017 [0.00546 to 0.04]
	Health concern others	Health concern others	Health concern others
	-0.00011 [-0.00521 to 0.00]	0.00029 [-0.00439 to 0.01]	0.00914 [-0.0004 to 0.02]
	Health concern none	Health concern none	Health concern none
0.00057 [-0.00279 to 0.00]	0.00014 [-0.0048 to 0.01]	0.00838 [-0.00568 to 0.03]	
Worsened financial situation	Worsened financial situation	Worsened financial situation	
-0.00008 [-0.0049 to 0.00]	0.00039 [-0.0036 to 0.00]	0.00821 [0.00275 to 0.02]	
Anxiety	Riskier region	Riskier region	Riskier region
	0.00058 [-0.00101 to 0.00]	0.0037 [-0.00056 to 0.01]	-0.00025 [-0.00523 to 0.00]
	Second wave	Second wave	Second wave
	0.00039 [-0.00074 to 0.00]	0.00105 [-0.00128 to 0.00]	0.00205 [-0.00138 to 0.01]
	Health concern self	Health concern self	Health concern self
	0.00255 [-0.00347 to 0.00]	0.0193 [0.00268 to 0.04]	0.0101 [-0.0082 to 0.03]
	Health concern others	Health concern others	Health concern others
	0.00214 [-0.00316 to 0.01]	0.01252 [0.00157 to 0.02]	0.00881 [-0.00882 to 0.03]
	Health concern none	Health concern none	Health concern none
0.00126 [-0.00179 to 0.01]	-0.00337 [-0.01367 to 0.01]	0.00397 [-0.00315 to 0.02]	
Worsened financial situation	Worsened financial situation	Worsened financial situation	
0.00294 [-0.00379 to 0.01]	0.00693 [0.00101 to 0.02]	0.00656 [-0.00589 to 0.02]	
Anger	Riskier region	Riskier region	Riskier region
	-0.00155 [-0.0068 to 0.00]	-0.00274 [-0.01182 to 0.01]	-0.00761 [-0.01621 to 0.00]
	Second wave	Second wave	Second wave
	-0.0009 [-0.0018 to 0.00]	0.00366 [-0.00194 to 0.01]	0.00379 [-0.00641 to 0.00]
	Health concern self	Health concern self	Health concern self
	-0.00298 [-0.0079 to 0.00]	-0.00506 [-0.01152 to 0.00]	-0.0229 [-0.0404 to -0.01]
	Health concern others	Health concern others	Health concern others
	-0.00522 [-0.03114 to 0.00]	-0.0152 [-0.0321 to 0.00]	-0.0245 [-0.0424 to -0.01]
	Health concern none	Health concern none	Health concern none
-0.00746 [-0.0699 to 0.00]	-0.0285 [-0.0697 to -0.01]	-0.0442 [-0.0814 to -0.02]	
Worsened financial situation	Worsened financial situation	Worsened financial situation	
0.00058 [-0.0017 to 0.00]	-0.0133 [-0.0221 to 0.00]	-0.0184 [-0.032 to -0.01]	
Sadness	Riskier region	Riskier region	Riskier region
	0.00103 [-0.00089 to 0.00]	0.00082 [-0.00419 to 0.00]	0.00321 [-0.00471 to 0.01]
	Second wave	Second wave	Second wave
	0.00049 [-0.00063 to 0.00]	0.00286 [-0.00113 to 0.00]	0.00444 [-0.00128 to 0.01]
	Health concern self	Health concern self	Health concern self
	0.00182 [-0.00166 to 0.01]	0.01038 [0.00024 to 0.02]	0.02 [0.0069 to 0.04]
	Health concern others	Health concern others	Health concern others
	0.00264 [-0.00236 to 0.01]	0.00904 [0.0002 to 0.03]	0.02088 [0.00632 to 0.04]
	Health concern none	Health concern none	Health concern none
0.0041 [-0.00428 to 0.02]	0.01072 [0.00012 to 0.03]	0.01432 [0.00153 to 0.03]	

(Continues)

TABLE A4 Continued

Mediator	Indirect effect		
	Compliance		
	China	Germany	United States
	Worsened financial situation 0.00201 [−0.00144 to 0.00]	Worsened financial situation 0.00661 [−0.000003 to 0.01]	Worsened financial situation 0.0133 [0.00387 to 0.03]

Note: Unstandardized coefficients of indirect effect are reported with 95% confidence intervals in square brackets. Significance is tested with nonparametric bootstrapping procedures with 1000 samples. Indirect effect depicts the effect of individual variables under crisis perceptions on compliance that goes through the hypothesized emotions. In other words, it is the mediating effects. Significant results are highlighted in bold.

TABLE A5 Mediation analysis (direct effect)

Predictors	Path a												Path b					
	Compliance			Panic			Anxiety			Anger			Sadness			Compliance		
	China	Germany	United States	China	Germany	United States	China	Germany	United States	China	Germany	United States	China	Germany	United States	China	Germany	United States
	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios	Odds ratios
Do not follow at all	0.001***	0.130***	0.449*	0.042***	0.057***	0.042***	0.048***	0.049***	0.050***	0.006***	0.219***	0.086***	0.024***	0.040***	0.124***	0.001***	0.113***	0.441*
Follow some	(0.001)	(0.052)	(0.170)	(0.022)	(0.033)	(0.022)	(0.020)	(0.020)	(0.021)	(0.006)	(0.111)	(0.041)	(0.015)	(0.018)	(0.053)	(0.001)	(0.045)	(0.168)
Follow some	0.004***	1.265	2.151*													0.004***	1.109	2.137*
Follow most	(0.002)	(0.449)	(0.808)													(0.002)	(0.396)	(0.805)
Follow most	0.037***	13.817***	13.572***													0.038***	12.305***	13.741***
Follow all	(0.024)	(4.953)	(5.148)													(0.025)	(4.432)	(5.234)
Panic																1.009	1.106	1.405***
Anxiety																(0.160)	(0.175)	(0.160)
Anger																1.035	1.254*	1.082
Sadness																(0.158)	(0.133)	(0.101)
																0.559*	0.667***	0.698***
																(0.140)	(0.080)	(0.073)
																1.144	1.210	1.333***
																(0.247)	(0.131)	(0.129)
																Path c		
Riskier region	0.760	1.226	1.222*	1.237	1.572*	1.419**	1.176	1.314	0.894	1.465	1.090	1.208	1.208	1.251	1.014	0.767	1.203	1.219*
	(0.173)	(0.155)	(0.120)	(0.199)	(0.289)	(0.179)	(0.187)	(0.184)	(0.102)	(0.404)	(0.184)	(0.148)	(0.148)	(0.252)	(0.150)	(0.176)	(0.153)	(0.120)
Second wave	1.073	1.337***	1.371***	1.070	1.056	1.329***	1.183***	1.102	1.210***	1.315***	0.887*	1.044	1.044	1.059	1.104	1.081	1.321***	1.344***
	(0.076)	(0.058)	(0.060)	(0.052)	(0.080)	(0.086)	(0.055)	(0.056)	(0.060)	(0.126)	(0.050)	(0.057)	(0.057)	(0.069)	(0.058)	(0.077)	(0.057)	(0.059)
Health concern (self)	0.965	1.645***	1.549***	1.686***	2.372***	2.613***	2.360***	3.318***	2.760***	2.154***	1.180	2.247***	2.247***	2.193***	2.023***	0.978	1.516***	1.453***
	(0.162)	(0.170)	(0.154)	(0.191)	(0.415)	(0.378)	(0.265)	(0.382)	(0.319)	(0.488)	(0.168)	(0.309)	(0.309)	(0.353)	(0.246)	(0.168)	(0.163)	(0.150)
Health concern (others)	0.727	2.108***	1.026	1.906**	1.574	1.584*	2.039***	2.239***	2.769***	5.448*	2.261*	2.319**	2.319**	3.592**	2.813***	0.751	2.009***	0.987
	(0.269)	(0.415)	(0.181)	(0.432)	(0.519)	(0.370)	(0.440)	(0.485)	(0.540)	(3.997)	(0.800)	(0.595)	(0.595)	(1.461)	(0.764)	(0.281)	(0.399)	(0.176)
Health concern (none)	1.020	1.115	0.506**	0.743	0.907	1.372	1.426	0.816	1.758*	3.558	3.293*	4.220***	4.220***	3.871**	2.375**	1.041	1.112	0.508**
	(0.430)	(0.260)	(0.108)	(0.202)	(0.406)	(0.424)	(0.359)	(0.237)	(0.421)	(2.833)	(1.288)	(0.1281)	(1.281)	(1.753)	(0.761)	(0.441)	(0.260)	(0.109)
Worsened financial situation	1.028	0.878	0.963	1.830***	1.454*	1.654***	2.375***	1.615***	2.054***	0.936	1.692***	1.876***	1.876***	1.779***	1.622***	1.007	0.868	0.933
	(0.153)	(0.080)	(0.082)	(0.194)	(0.217)	(0.193)	(0.237)	(0.168)	(0.204)	(0.183)	(0.205)	(0.203)	(0.203)	(0.260)	(0.172)	(0.153)	(0.081)	(0.081)
Control variables	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2182	2045	2082	2184	2046	2083	2184	2046	2083	2184	2046	2083	2184	2046	2082	2182	2045	2082
R ² Nagelkerke	0.040	0.136	0.129	0.101	0.051	0.117	0.126	0.155	0.167	0.029	0.023	0.053	0.053	0.038	0.062	0.045	0.145	0.142

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

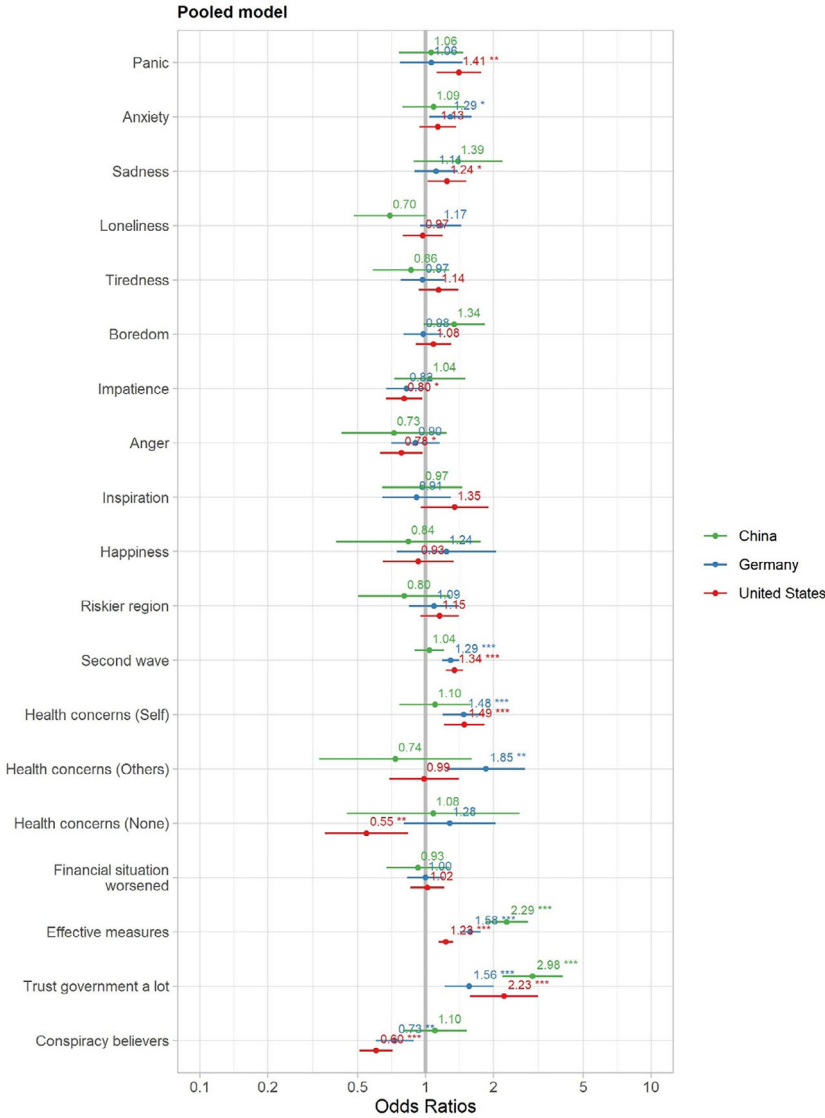


FIGURE A1 Pooled model. Model is pooled from all hypothesized variables, as well as sociodemographic control variables. Odds ratio estimated at 95% confidence intervals.

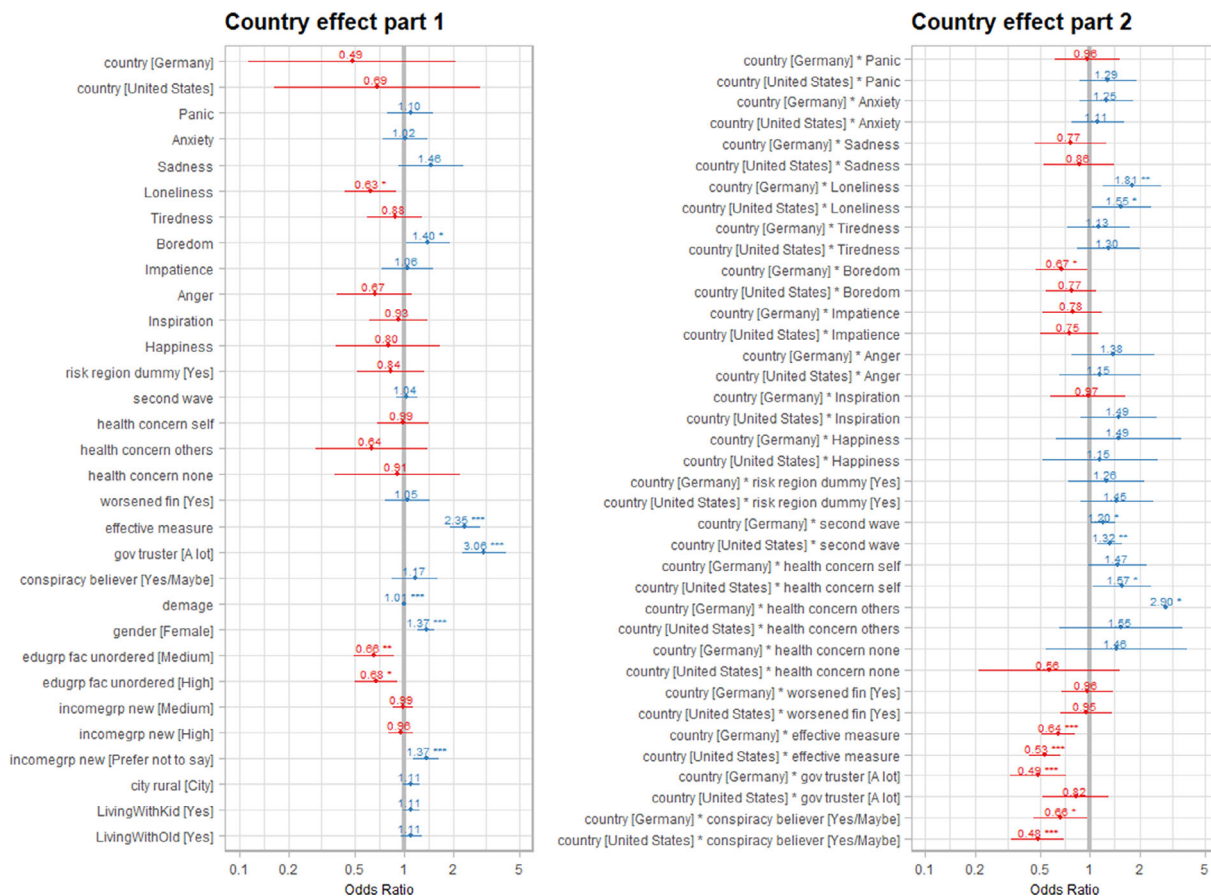


FIGURE A2 Country effect. Country fixed effect model includes country dummy (China as the reference group) and interaction between country dummy and explanatory variables. Odds ratio estimated at 95% confidence intervals.