RESEARCH ARTICLE

Explaining compliance with COVID-19 regulation in China and the United States: cultural biases, political trust, and perceptions of risk and protective actions

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Abstract
How do cultural biases, trust in government, and perceptions of risk and protective actions influence compliance with regulation of COVID-19? Analyzing Chinese ($n = 646$) and American public opinion samples ($n = 1,325$) from spring 2020, we use Grid–Group Cultural Theory and the Protective Action Decision Model to specify, respectively, cultural influences on public risk perceptions and decision-making regarding protective actions. We find that cultural biases mostly affect protective actions indirectly through public perceptions. Regardless of country, hierarchical cultural biases increase protective behaviors via positive perceptions of protective actions. However, other indirect effects of cultural bias via public perceptions vary across both protective actions and countries. Moreover, trust in government only mediates the effect of cultural bias in China and risk perception only mediates the effect of cultural bias in the United States. Our findings suggest that regulators in both countries should craft regulations that are congenial to culturally diverse populations.

Introduction

How do cultural biases, trust in government, and perceptions of risk and protective actions influence compliance with regulation of COVID-19? Strict regulatory policies such as lockdowns and quarantines may increase regulatory compliance and contain the spread of infectious disease (Li et al., 2020). However, when the public tires of severe restrictions, perceptions of risk (Brewer et al., 2004) and support for them decline (Siegrist & Bearth, 2021). Public fatigue with efforts to control COVID-19 has contributed to a resurgence of infections and mortality in many countries, including the United States and China (Zhou et al., 2022; Ngonghala et al., 2020). As of October 2023, COVID-19 has afflicted 771+ million

and killed 6.9+ million worldwide (WHO, 2023). The World Health Organization (WHO) expects the virus to be with us for a long time and advises governments to take this opportunity to prepare for future public health emergencies. It is therefore important to gain a better understanding of the factors that influence public perceptions of and compliance with protective policies during a pandemic.

Incorporating cultural and value differences in analysis of regulatory compliance is particularly important to explaining national variation in the context of public health crises (Zhang et al., 2022; Zhang, 2021; Dryhurst et al., 2020; Wang & Liu, 2018; Cornia et al., 2016). Individualism is a prominent feature of American culture that undermines collective action, contributing to less social distancing and mask use as well as weaker governmental efforts to control the virus (Bazzi et al., 2021). Individualistic and egalitarian cultures (e.g., United States) produce higher COVID-19 death rates than hierarchical cultures (e.g., China; Güss & Tuason, 2021), although experience with autocratic regimes increases distrust in vaccination as a solution (e.g., Europeans who lived under Communism; Boese-Schlosser et al., 2023). The United States, with less than a fourth of China's population (332 vs. 1414 million), has had over a million deaths, to China's 121,722 by October 18, 2023 (WHO, 2023).[1]

Cultural variation can manifest in the form of national cultural differences. For example, Hofstede's Cultural Orientations help characterize country-level cultural differences (Yu & Shen 2013; Wang & Liu, 2018; Zhang et al., 2022). Chinese often have a higher power distance (i.e., they are more hierarchical) and are more masculine, collectivistic, and long-term-oriented than Americans, who have greater uncertainty avoidance, and are more indulgent and individualistic than Chinese (Zhang et al., 2022; Wang & Liu, 2018).

Cultural variation also express itself in national subcultures (Elazar, 1994) and individual differences (Zhang, 2021). Individual cultural differences can influence public risk perceptions (Song et al., 2014; Kahan, 2015; Xue et al., 2016; Johnson, 2017; Mayorga & Johnson, 2019; Yuan et al., 2022), trust (Johnson, 2017; Tumlison et al., 2017; Yuan, 2021), and support for protective responses (Yuan & Swedlow, 2022). However, relationships between cultural biases and public perceptions and behaviors across countries need to be better understood.

Grid–Group Cultural Theory (GGCT) can potentially help advance this understanding. GGCT has been applied to characterize and explain both country-level and individual-level cultural differences. GGCT provides a parsimonious model of four ways of life or cultures – hierarchism, individualism, egalitarianism, and fatalism – based on two dimensions of social relations: Grid and Group (Douglas, 1999; Johnson & Swedlow, 2021; Ripberger et al., 2014; Thompson et al., 1990; Wildavsky, 2006). GGCT allows us to hypothesize and examine how cultural biases in the public influence their perceptions and behaviors with respect to risks (Thompson et al., 1990; Douglas, 1999; Johnson & Swedlow, 2021; Johnson et al., 2020; Xue et al., 2016). At the country level, CT scholars have found that China, where the majority of the population is of Han ethnicity, is predominantly hierarchical (i.e., high grid and

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[1]The gap between two countries might not be as large as the official figures indicate as the true numbers of hospital admissions and deaths in China may be unavailable since China lifted its containment, COVID-19 testing, and tracking policies across cities in November 2022.

group; Chai et al., 2009). By contrast, as a heterogeneous country with various ethnicities, the United States is predominantly individualistic (i.e., low grid and group; Chai et al., 2009).

At the individual level, the existence of four subcultures proposed by GGCT within a country has been supported in Western countries including the United States (Grendstad, 2003; Johnson & Swedlow, 2021; Olli & Swedlow, 2022) and Asian countries including China where there is only one political party and ideological differences are often unexpressed (Xue et al., 2016; Yuan et al., 2022). However, cultural studies also find that Western hierarchists and egalitarians are more concerned about risks of infectious disease and are more likely to accept public health policies (Bi et al., 2021; Johnson, 2017; Johnson & Mayorga, 2021b; Mayorga & Johnson, 2019), while Western individualists and fatalists are less concerned about these health risks and less likely to accept such measures (Bazzi et al., 2021; Dryhurst et al., 2020; Liu & Yang, 2021; Song et al., 2014). Moreover, these studies also find that the positive effect of egalitarianism on public compliance with public health measures does not extend to China (Yuan et al., 2022; Yuan & Swedlow, 2022).

In addition to cultural and value influences, previous research on protective behaviors has identified a set of public perceptions, including trust in the government (Bargain & Ulugbek, 2020; Brouard et al., 2020), fear of the hazard (Harper et al., 2020), pro-social attitudes (Pfattheicher et al., 2020), risk perception (Reinders Folmer et al., 2021), and perceived efficacy of protective behaviors (Johnson, 2019; Wang et al., 2018) that affect protective behaviors. Most formal models of protective behaviors focus on risk perceptions and beliefs about behavioral attributes as predictors. The Protective Action Decision Model (PADM; Lindell & Perry, 2012; Terpstra & Lindell, 2013) has added a third predictor other models lack, perceptions of stakeholders (Earle & Siegrist, 2008; White & Johnson, 2010).

While there is a great deal of research that focuses on cross-cultural differences or protective behaviors, few studies combine these interests. Comparative research has found cross-national disparities in risk perceptions, emotions, perceptions of stakeholders, and protective actions (Zhang et al., 2022; Li et al., 2021; Zhang, 2021; Dryhurst et al., 2020; Wang & Liu, 2018; Wei et al., 2018; Cornia et al., 2016; Rohrmann & Chen, 1999). Some find relationships between risk perception (Li et al., 2021; Zhang et al., 2022), efficacy perceptions (Zhang, 2021), stakeholder characteristics, and protective action perceptions (Wei et al., 2018) and behaviors in China and the United States. For example, Chinese perceived COVID-19 to be riskier and planned to take more preventive measures against it than Americans (Zhang et al., 2022). Chinese also tended to comply more with the authorities and have more positive feelings toward the COVID-19 vaccine than did Americans (Luo et al., 2021). But others find lower compliance among Chinese than Americans and no difference in perceived efficacy of preventive behaviors between them (Zhang, 2021). Moreover, existing research has not compared the effects of all factors proposed by PADM on protective behaviors in these two countries.

Meanwhile, while some CT scholars have begun to study how individual-level cultural differences within countries interact with perceptions of risk (Bi et al., 2021; Yuan, 2021) or fear of risk (Liu & Yang, 2021), trust (Siegrist & Bearth, 2021; Yuan, 2021), value congruence (Yuan & Swedlow, 2022; Johnson, 2022), and perceptions of protective actions (Yuan, 2021; Wang et al., 2023) to influence protective

behaviors, none have studied similarities and differences across cultural biases and/or countries in these association patterns.

These are gaps in both GGCT and PADM research that our study seeks to fill. We identify both the direct effects of culture on protective behaviors and culture's indirect effects in the United States and China. We compare these associations guided by GGCT (Thompson et al., 1990) and the PADM (Lindell & Perry, 2012; Terpstra & Lindell, 2013), approaches better-known in risk than regulatory studies and in GGCT's case used more in the United States and Europe than Asia (Johnson & Swedlow, 2021). For both China and the United States, we investigate whether (1) respondents differ in cultural biases, perceptions of COVID-19 risk and protective actions, trust in government, and behavioral intentions; (2) cultural biases correlate significantly with intentions to undertake protective behaviors; and (3) relationships between cultural biases and protective intentions are mediated by perceptions of risk and protective actions, and trust in government. We also seek to help scholars and practitioners in public policy and risk communication craft COVID-19 regulations that are congenial to culturally diverse populations to increase voluntary compliance with regulatory policy responses.

Background

Comparing protective behaviors and perceptions of risk and protective actions

Comparative research on different crises has found cross-national disparity in risk perceptions, emotions, perceptions of stakeholders, protective actions (e.g., Cornia et al., 2016; Dryhurst et al., 2020; Li et al., 2021; Rohrmann & Chen, 1999; Wang & Liu, 2018; Wei et al., 2018; Zhang et al., 2022) and protective behaviors (Lindell et al., 2016; Wang & Liu, 2018; Wei et al., 2018). Some comparative research on infectious disease found higher perceived risk, perceived efficacy of protective actions, reliance on official information, and adoption of protective actions in China than the United States (Rohrmann & Chen, 1999; Wang & Liu, 2018; Wei et al., 2018; but compare Li et al., 2021; Zhang et al., 2022). Relationships between protective action perceptions and behaviors also may vary across countries. Wang & Liu (2018) found resource-related action perceptions correlated negatively with behavior in the United States but positively in China, despite unvarying effects of stakeholder perception and reliance on official information sources. Wei et al. (2018) found behaviors in China more influenced by authorities' perceived expertise and trustworthiness, but in the United States more influenced by information sources (e.g., local news media, social media, and family). Zhang et al. (2022) found long-term orientation, one of Hofstede's (2001, 2011) cultural dimensions, increased COVID-19 risk perception and the intent to take protective actions in both the United States and China, but Hofstede's four other cultural dimensions have different influences on intentions. Cross-national research has not investigated whether GGCT subcultures influence such intentions similarly across countries. For example, while egalitarianism increases environmental concern across countries, including the United States and China (Liu, 2018; Xue et al., 2016), and individualism and hierarchy decrease environmental concern among Americans, they do not consistently do so among Asians (Kim & Kim, 2019; Liu, 2018; Xue et al., 2016).

Factors influencing COVID-19 regulatory compliance

The extent of, and factors in, regulatory compliance and "beyond compliance" behavior have been major foci of regulatory studies, including the COVID-19 pandemic. Consistent with prior regulatory research, COVID-19 regulatory compliance is influenced by trust in the government (Bargain & Ulugbek, 2020; Brouard et al., 2020; Devine et al., 2020; Jørgensen et al., 2021), fear of the hazard (Harper et al., 2020), pro-social attitudes (Pfattheicher et al., 2020), risk perception, capacity to adhere, and moral agreement (Reinders Folmer et al., 2021). Goal Framing Theory (Lindenberg et al., 2020) posits that regulatees are motivated by: normative goals, such as pro-socialness, trust in government, and observed respect for rules and rule legitimacy; hedonic goals, such as fear and opportunities for fun and happiness; and gain goals, such as improved (or worsened) economic position due to compliance. Six et al. (2021) find temporal change in the relative influence of these goals during COVID-19.

Despite significant effort to apply theories of regulatory compliance to understanding and explaining compliance with COVID-19 risk regulation, other theoretical candidates are available, including the GGCT and PADM concepts we propose for greater use in studies of regulatory compliance. To put our discussion of these concepts into the context of the pandemic, Figure 1 provides a timeline of selected COVID-19 events including regulatory responses in the United States and China (Bergquist et al., 2020; Christensen & Ma, 2021).

COVID-19 was detected in Wuhan in December 2019, but people were not widely informed until late January–early February 2020, when Wuhan was locked down, and a major effort began to reduce the likelihood of large COVID-19 outbreaks elsewhere in China. By the end of April, lockdowns ended in Wuhan and in most other provincial units. Compared to China, US regulatory responses were more decentralized at the state level. In March, after President Trump declared a nationwide emergency, 40 states closed nonessential business and national social distancing recommendations were released, but by May protests urged reopening of the economy, which occurred in 17 states, but mask mandates appeared in 13 states.

The Protective Action Decision Model

All explanations of the public's protective behaviors regarding hazards posit relationships between behavioral intentions, perceptions of risk, and protective actions (e.g., Fishbein & Ajzen, 2010; Tikir & Lehmann, 2011), although they differ in how they define these factors and structure their relationships. The PADM (Lindell & Perry, 2012; Terpstra & Lindell, 2013) adds a third predictor other models lack: perceptions of stakeholders, including trust in government, a major perception shaping public hazard responses (Earle & Siegrist, 2008; White & Johnson, 2010), leading to our use of the PADM here.

People perceiving greater risk adopted increased protective actions during infectious outbreaks, although COVID-19 risk perception may have only been important initially among Americans and not at all among Chinese (e.g., Bearth et al., 2021; Johnson, 2019; Johnson & Mayorga, 2021a; Kim et al., 2015; Li et al., 2021; Siegrist & Bearth, 2021; Wei et al., 2020). Yet these findings may also depend on the measures used: cognitive risk perceptions (e.g., perceived likelihood of or
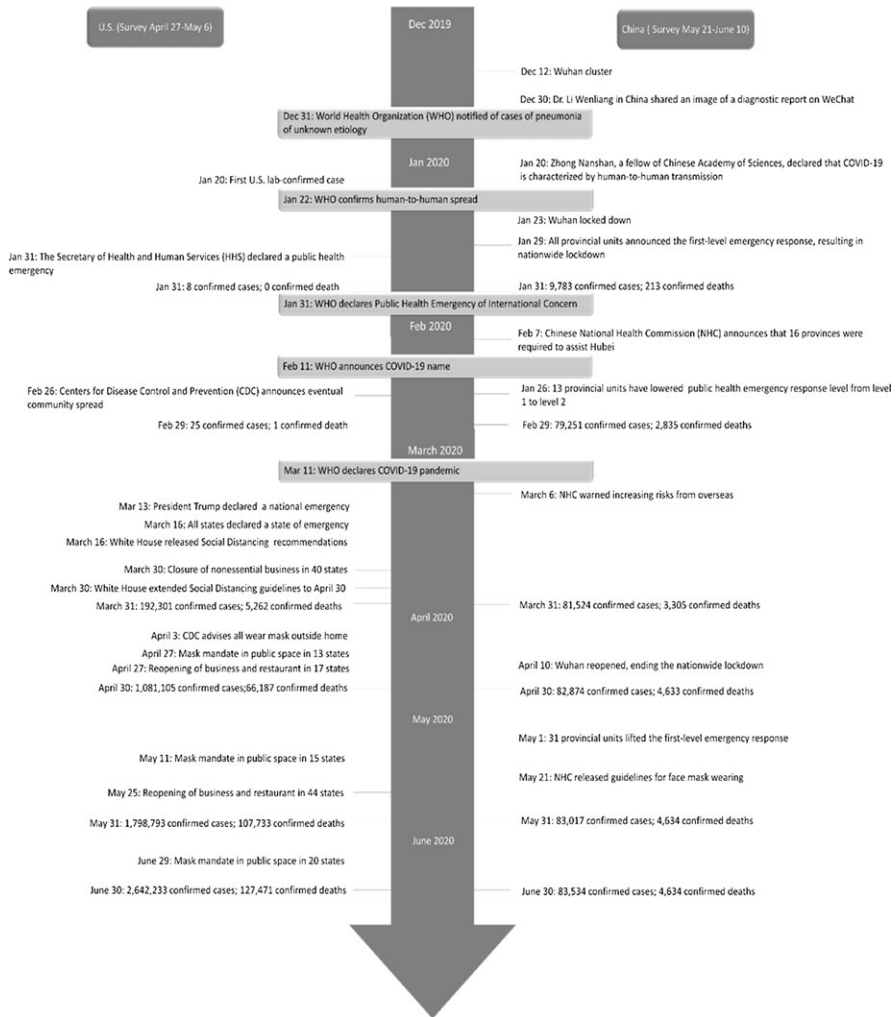
Figure 1. Timeline of selected COVID-19 events in the United States and China.

vulnerability to becoming infected) versus affective risk perceptions (e.g., concern, fear, and worry about being infected). Types of protective actions also vary, as can whether they are assessed separately or in aggregate (Johnson, 2019; Kim et al., 2015). Therefore, we assess both affective and cognitive risk perceptions and four protective actions: wearing face masks, washing hands, avoiding gatherings, and getting vaccinated.

People intend to protect themselves when they believe their self-protective behavior has response efficacy (i.e., will have expected effects, such as risk reduction) and personal efficacy (i.e., one is able to enact the protective behavior; Johnson, 2019; Wang et al., 2018). Some studies even found that these perceived behavioral attributes influence intentions more than risk perception and influence risk perceptions themselves (e.g., Fishbein & Ajzen, 2010). We consequently test

perceived personal efficacy (whether the household has the time, money, skills, and/ or other resources to enact the behavior) and response efficacy (whether people think the behavior will reduce risk) for each of the four actions.

Higher public trust in government, scientists, medical professionals, universities, and other actors is associated with protective intentions and regulatory compliance (Johnson, 2019; Johnson & Mayorga, 2021a; Wang et al., 2018; Wei et al., 2018). Effects of trust on intentions may be positive, negative, or none, depending on the trust type (e.g., general vs. social trust; Siegrist et al., 2021; see also Siegrist & Zingg, 2014) and the actor judged. We consequently probe how much respondents trust the governments of their political subdivisions (Chinese province/US state) and national governments (Chinese central government/US president and executive agencies) to protect people within their jurisdictions from COVID-19.

Thus we propose that

H1. *Heightened COVID-19 risk perceptions, positive perceptions of protective actions, and trust in government increase protective actions and behavioral intentions.*

Cultural bias effects

GGCT proposes four patterns of social relations – hierarchism, individualism, egalitarianism, and fatalism – yielding compatible cultural biases influencing public risk perceptions and regulatory compliance, among other effects (Thompson et al., 1990). Hierarchists live in highly structured collectives where everyone is bound by externally proscribed rules and expected to play particular roles, valuing order, and respecting decisions made by the proper authority or authorities. Egalitarians rely heavily on communal participative decision-making, valuing equality within their collectives. Individualists rely on individual choices to create spontaneous, fluid relations, valuing freedom. Finally, fatalists are constrained by external rules and prescribed roles without being part of a collective, leaving them socially isolated, valuing good luck, but resigned to their fates.

GGCT has helped explain sources of variation in regulation across diverse risks, sectors, and countries (Johnson & Swedlow, 2021). Most GGCT research has emphasized culture's direct effects on risk perceptions versus indirect effects via mediation by one or more factors. For example, egalitarians are concerned about environmental risk (Kahan, 2015) and risk of Ebola and Zika (Johnson, 2017; Mayorga & Johnson, 2019; Johnson & Mayorga, 2021b) but perceive less risk of vaccination (Song et al., 2014). By contrast, individualists are less concerned about risks of Ebola and Zika (Johnson, 2017; Johnson & Mayorga, 2021b; Mayorga & Johnson, 2019) and COVID-19 (Dryhurst et al., 2020; Siegrist & Bearth, 2021) and more concerned about vaccine safety, while hierarchists are less concerned about vaccine safety (Song et al., 2014).

Davy (2021) argues that public reactions to COVID-19 social distancing measures (e.g., staying at least 2 m from others, mask wearing in public, working and schooling from home, and avoiding social gatherings) can be explained by GGCT. Hierarchists should be more willing to accept regulators' protective recommendations, egalitarians preferring local cooperation to formal institutions, and individualists and fatalists feeling little sense of social duties and (whenever

possible) avoiding socially imposed demands. Individualism decreases people's acceptance of COVID-19 regulations (Moyer et al., 2021; Siegrist & Bearth, 2021); fatalism can dampen public concern and protective actions regarding climate change (Mayer & Smith, 2019), cancer (Powe & Finnie, 2003), and HIV prevention (Kwiringira et al., 2019).

Recent studies have assessed the indirect effects of culture on environmental behavioral intentions as mediated by risk perceptions (Xue et al., 2016; Zeng et al., 2020) and attitudes toward pro-environmental behaviors (e.g., taking public transportation; Tikir & Lehmann, 2011). Moyer et al. (2021) found that perceived COVID-19 threat moderated the relationship between cultural biases and mask wearing intentions.

Cultural bias also can affect another PADM factor influencing protective behaviors, political trust (e.g., Johnson, 2017; Mayorga & Johnson, 2019; Singleton & Lidskog, 2018; Tumlison et al., 2017). People see as true and unbiased information provided by organizations they trust (Earle & Siegrist, 2008). Hierarchists trust authorities including government (Tumlison et al., 2017; Shi, 2015; Yuan, 2021), while individualists distrusted official information from CDC in the Ebola epidemic (Mayorga & Johnson, 2019) and distrusted government on COVID-19 in China (Yuan, 2021), although individualists also depend less on the government for risk management (Cornia et al., 2016). Fatalists tend to be anti-institutional (Entwistle, 2021). Thus, we expect that:

H2. Hierarchism increases risk perception, trust in government, positive perceptions of protective actions, the intention to take protective actions, and protective actions.

H3. Egalitarianism increases risk perception, positive perceptions of protective actions, the intention to take protective actions, and protective actions. It is less clear whether egalitarianism fosters trust in government – while egalitarians share with hierarchists a strong group identity, they oppose other distinctions between people that might affect trust (e.g., expertise, social status, etc.) – so we take this as a research question.

H4. Individualism and fatalism decrease risk perception, trust in government, positive perceptions of protective actions, protective actions, and the intention to take protective actions.

Figure 2 summarizes our hypotheses about cultural bias effects within the PADM.

Methods

Sampling

Chinese respondents were recruited through a Tencent questionnaire, which has a database of one million users in China.[2] Members who registered in Tencent's pool

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[2]Administratively, China is divided into 23 provinces, 5 autonomous regions (Inner Mongolia, Guangxi Zhuang, Tibet, Ningxia Hui, and Xinjiang Uyghur), 4 municipalities (Beijing, Tianjin, Shanghai, and Chongqing), and 2 Special Administrative Regions (Hong Kong and Macao). Our sample includes all provinces, municipalities, and autonomous regions but excludes the two Special Administrative Regions as no one in these two regions has registered in Tencent's pool servers.
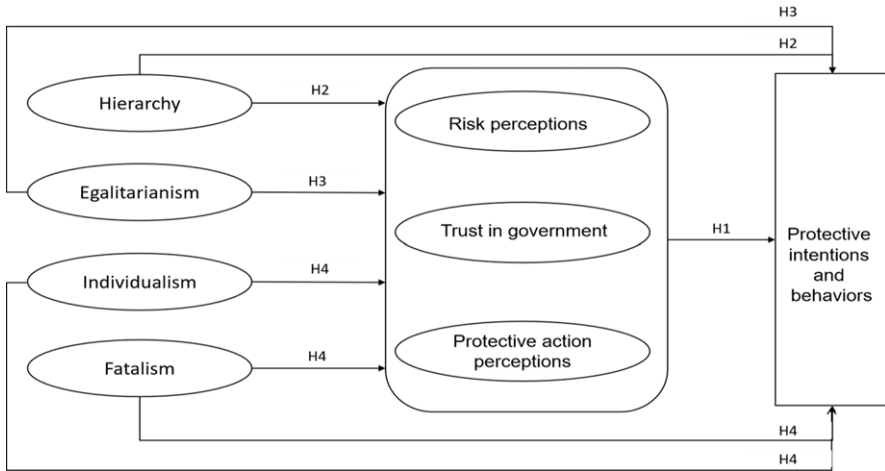
Figure 2. The role of cultural bias in PADM.

servers through QQ or Wechat comprise our sampling frame. We adopted simple random sampling because it is the least biased sampling method as every member of the target population has an equal chance of being chosen (Hayes, 2021). Chinese respondents were recruited from May 21 to June 10, 2020 ($n = 1,301$), about 2 months after China ended nationwide lockdowns, 3 weeks after 31 provincial units lifted the first-level emergency response and reopened public spaces, and right after China National Health Council (NHC) released face mask guidelines (see Figure 1). American respondents were recruited from April 27 to May 5, 2020 ($n = 1,613$), as the second wave in a 6-wave longitudinal panel survey about 6 weeks after WHO declared COVID-19 a pandemic, 4 weeks after the White House extended social distancing recommendations to April 30, and 2 weeks before the Chinese survey launched, with a mixed state-level pattern of business reopening and mask mandates (see Figure 1). Data came from a random sample of a national opt-in online panel (Prolific) and included respondents from 50 states and Washington, D.C.

To handle potential inattention among survey respondents, we removed laggards, speeders, and straightliners (people offering similar answers across questions). First, we removed the 5% slowest (65 Chinese over 1,786.25 seconds; 80 Americans over 2,947.60 seconds) and the 5% fastest (65 Chinese under 189.30 seconds; 80 Americans under 663.40 seconds) in each sample. The median of that new distribution (603 seconds China; 1,349.05 seconds United States) was calculated, and then those below the median were cut (120 Chinese under 301.5 seconds; 11 Americans under 674.53 seconds). Second, straightliners who selected the same answer for nearly every question in the respective instruments were removed (7 Chinese; 4 Americans). We also removed all respondents who answered with options 5–6 from our analyses of the vaccine mandate as it is illogical to choose "has taken this action" when vaccination was not yet available. We also removed these responses from analyses for washing hands, wearing a face mask, and avoiding public gatherings in cases these people also answered those questions in nonsensical

Table 1. Study samples

	China	United States
N	646	1325
Female gender	58%	52%
Age		
M (SD)	2.60 (1.04)	36.62 (13.35)
Median	30–39 years old	33
<30	48%	35%
>50	4%	19%
Education		
High school degree or less	23%	15%
Bachelor's degree or more	54%	57%

Note: On age, Chinese respondents were asked to select the group by age range (1 = under 20, 2 = 20–29 years old, 3 = 30–39 years old, 4 = 40–49 years old, 5 = over 50 years old), while American respondents were asked to report their own age.

ways. Thus, our data analyzed below includes 646 Chinese and 1,325 Americans. Demographic characteristics of each sample appear in Table 1 after trimming of speeders and straightliners. Compared with China Census 2010 data and US Census data (2019 American Community Survey estimates), respectively, samples in both countries were equally female as, younger than, and more educated than each nation's adult populations. Sample distributions across Chinese provinces and US states appear in Supporting Information (SI) A (Tables A-1 and A-2).

Measures

Survey questionnaires in China and the United States included identically worded questions (or nearly identical for trust) to measure the four cultural biases, perceptions of risk and protective actions, trust in government, and intentions regarding protective behaviors (below). The survey instrument was originally developed in English by adapting existing measures (e.g., Johnson, 2019; Johnson et al., 2020; Johnson & Swedlow, 2021; Mayorga & Johnson, 2019; Swedlow et al., 2020; Wang et al., 2018). The instrument was then translated into Chinese and back-translated into English to ensure consistency and cross-cultural equivalence (Cheung et al., 2020).

We elicited protective actions and behavioral intentions for four actions:

- **Washing hands** with soap and warm water many times a day.
- **Wearing a face mask** when going out in public.
- **Avoiding large public gatherings** including formal organized events such as concerts, sports events, or fairs, or informal gatherings like going to the mall, school, work, or other places where lots of people happen to be.
- **Getting vaccinated** when a coronavirus vaccine becomes available.

For each protective action, respondents in both countries were asked to choose whether "My household: 1 = never considered taking this action; 2 = is considering it; 3 = decided against taking this action; 4 = decided to take this

Table 2. Measurements of public perceptions

Variables	Questions
Risk perception	*Risk to self*: How much risk does the coronavirus pose to you or your family? (1 = No risk, 2 = Little risk, 3 = Slight risk, 4 = Moderate risk, 5 = High risk, 6 = Very high risk) *Risk to country*: How much risk does the coronavirus pose to China/the United States? (1 = No risk, 2 = Little risk, 3 = Slight risk, 4 = Moderate risk, 5 = High risk, 6 = Very high risk) *Risk to globe*: How much risk does the coronavirus pose to the world? (1 = No risk, 2 = Little risk, 3 = Slight risk, 4 = Moderate risk, 5 = High risk, 6 = Very high risk) *Dread of risk:* How much you feel dread of coronavirus? (1 = No dread, 2 = Slight dread, 3 = Some dread, 4 = Moderate dread, 5 = High dread, 6 = Very high dread)
Protective action perceptions	For each of four protective actions, respondents in both countries were asked to choose whether they agree or disagree that *Efficacy for household*: This action will keep coronavirus risks low for my household. *Efficacy for community*: This action will keep coronavirus risks low for vulnerable people in my community not in my household. *Resource sufficiency*: My household has the time, money, skills, and/or other resources needed to take this action. (1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Somewhat agree, 5 = Agree, 6 = Strongly agree)
Trust in government	*Trust in local government:* Please rate how much you trust your local government (municipal or lower level government) to protect local residents from the coronavirus? *Trust in provincial government/state government:* Please rate how much you trust your provincial government/*state government* to protect provincial residents from the coronavirus? *Trust in central government/president:* Please rate how much you trust your central government to protect people from the coronavirus? *Trust in CDC:* Please rate how much you trust Chinese/the US Centers for Disease Control and Prevention to help protect Chinese/Americans from the coronavirus. (1 = No trust at all, 2 = Slight trust, 3 = Moderate trust, 4 = High trust)

action; 5 = has taken this action; or 6 = has taken this action and will continue to take this action as needed." These items were adapted from a stages-of-behavioral-change model proposed by Weinstein (1988; Weinstein & Sandman, 1992).

Three perception types (Table 2) were hypothesized mediators between cultural biases and intentions: 1) threat perceptions were represented by three cognitive general-risk perception items and one affective measure of risk perception; 2) protective action perceptions by two response efficacy (risk reduction) and one personal efficacy (resource sufficiency) items; and 3) trust in government by four questions in each country (three levels of government and two items each on the central government).

Cultural bias measures (Table 3) were adapted from scales used in previous survey research in the United States and China (Jenkins-Smith & Smith, 1994; Johnson & Swedlow, 2021; Jones, 2014; Ripberger et al., 2014; Swedlow, et al. 2020; Xue et al., 2016).

Table 3. Cultural biases

Variables	Questions
Hierarchism	H1: Society would be much better off if the people in charge imposed strict and swift punishment on those who break the rules.
	H2: Society is in trouble because people do not obey those in authority.
	H3: The best way to get ahead in life is to work hard to do what you are told to do.
Individualism	I1: We are all better off when we compete as individuals.
	I2: Even the disadvantaged should have to make their own way in the world.
	I3: Even if some people are at a disadvantage, it is best for society to let people succeed or fail on their own.
Egalitarianism	E1: Society works best if power is shared equally.
	E2: What society needs is a fairness revolution to make the distribution of goods more equal.
	E3: It is our responsibility to reduce differences in income between the rich and the poor.
Fatalism	F1: No matter how hard we try, the course of our lives is largely determined by forces beyond our control.
	F2: It would be pointless to make serious plans in such an uncertain world.
	F3: The most important things that take place in life happen by chance.

Note: Answers: 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = somewhat agree, 5 = agree, 6 = strongly agree. On cultural biases, Chinese respondents were asked "whether you agree or disagree with each of three survey items for four types of cultural bias," while American respondents were asked "How strongly do you agree or disagree with each of these statements?"

Data analyses

Confirmatory factor analysis (CFA) assessed measurement properties of scales. Model fit was evaluated using χ^2, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and the Tucker–Lewis index (TLI). Independent sample *t* tests were used to compare results. Eight structural equation models (SEMs) tested mediation of relationships between cultural biases and four protective behaviors by risk perception, protective action perception, and trust in government in each country. *Lavaan* package in R was used to analyze covariance-based SEMs. Coefficients were standardized to assess relative strengths of predictors (H2–4), and the two countries' results then compared.

Results

Results of measurement model

Convergent validity and internal consistency reliability
Convergent validity and internal consistency reliability of our measurement model is reported in Table 4. Convergent validity is assessed by outer loading and average variance extracted (AVE). All the observable variables on each concept have standardized factor loadings above 0.45 except that the items of *Risk to self* ($P < 0.05$) and *Dread of risk* ($P > 0.05$) are less than 0.45. The values of AVE for trust in government and avoiding gatherings exceeded recommended criteria of 0.50 (Fornell & Larcker 1981) for China, indicating adequate convergent validity, but the

Table 4. Internal consistency reliability and convergent validity

Variables	Questions	Outer loadings		Average variance extracted		Cronbach's alpha		McDonald's omega		Skewness		Corrected item-total correlations		Mean inter-item correlation	
		China	United States	China	United States	China	United States	China	United States	China	United States	China	United States	China	United States
Hierarchism	H1	0.48***	0.72***	0.33	0.51	0.60	0.75	0.60	0.76	−0.68	0.38	0.37	0.58	0.34	0.5
	H2	0.63***	0.80***							−0.89	0.44	0.43	0.64		
	H3	0.63***	0.65***							−1.06	−0.14	0.42	0.5		
Individualism	I1	0.81***	0.75***	0.43	0.59	0.66	0.80	0.68	0.82	−0.02	0.18	0.56	0.58	0.39	0.58
	I2	0.61***	0.90***							−0.36	0.02	0.48	0.65		
	I3	0.50***	0.61***							0.34	0.23	0.39	0.73		
Egalitarianism	E1	0.63***	0.75***	0.33	0.67	0.59	0.85	0.57	0.85	−0.42	−0.69	0.46	0.68	0.33	0.65
	E2	0.56***	0.83***							−0.34	−0.63	0.42	0.75		
	E3	0.54***	0.85***							−0.1	−0.78	0.32	0.74		
Fatalism	F1	0.50***	0.70***	0.48	0.33	0.72	0.58	0.73	0.57	0.18	−0.07	0.44	0.45	0.45	0.31
	F2	0.72***	0.45***							0.87	0.42	0.57	0.33		
	F3	0.81***	0.56***							1.1	0.08	0.6	0.39		
Risk Perception	*Risk to self*	0.28***	0.53***	0.18	0.54	0.35	0.83	0.38	0.82	−0.02	−0.07	0.2	0.56	0.13	0.56
	Risk to country	0.74***	0.96***							−1.12	−0.9	0.26	0.77		
	Risk to globe	0.43***	0.93***							−2.95	−0.95	0.22	0.75		
	Dread of risk	0.07	0.55***							−0.55	0.2	0.1	0.58		
Protective action perceptions	Wash hands:			0.37	0.55	0.63	0.72	0.64	0.76					0.39	0.48
	Efficacy for household	0.63***	0.82***							−1.55	−1.46	0.53	0.65		
	Efficacy for community	0.50***	0.75***							−0.93	−1.56	0.4	0.61		
	Resource sufficiency	0.72***	0.53***							−1.07	−2.23	0.4	0.44		
	Wear mask:			0.29	0.56	0.51	0.76	0.53	0.79					0.31	0.51
	Efficacy for household	0.53***	0.76***							−2.52	−0.88	0.32	0.64		
	Efficacy for community	0.39***	0.87***							−1.45	−1.18	0.37	0.69		
	Resource sufficiency	0.73***	0.55***							−1.55	−1.53	0.33	0.48		
	Avoid gatherings:			0.73	0.53	0.88	0.76	0.89	0.76					0.72	0.52
	Efficacy for household	0.95***	0.82***							−.2.02	−2.01	0.84	0.65		
	Efficacy for community	0.92***	0.76***							−2.04	−1.98	0.82	0.61		

Table 4. (*Continued*)

Variables	Questions	Outer loadings		Average variance extracted		Cronbach's alpha		McDonald's omega		Skewness		Corrected item-total correlations		Mean inter-item correlation	
		China	United States	China	United States	China	United States	China	United States	China	United States	China	United States	China	United States
	Resource sufficiency	0.69***	0.59***							−1.48	−2.13	0.66	0.52		
	Get vaccinated:														
	Efficacy for household	0.65***	0.93***	0.37	0.68	0.62	0.85	0.63	0.86	−1.93	−1.43	0.49	0.8	0.38	0.66
	Efficacy for community	0.51***	0.87***							−1.55	−1.48	0.4	0.76		
	Resource sufficiency	0.70***	0.65***							−1.19	−1.26	0.45	0.61		
Trust in government	Trust in local government	0.90***	0.85***	0.65	0.56	0.86	0.6	0.84	0.73	−0.88	−0.29	0.8	0.57	0.61	0.3
	Trust in provincial government/state government	0.91***	0.83***							−0.85	−0.33	0.8	0.6		
	Trust in central government/ president	0.76***	0.09**							−1.06	1.2	0.72	0.09		
	Trust in CDC	0.57***	0.46***							−0.86	−0.52	0.55	0.35		

Note: **$p < .01$, ***$p < .001$.

values of AVE for other latent variables are less than 0.50. For the United States, all measures except those for fatalism exceeded recommended criteria of 0.50.

As for reliability, McDonald's omega is preferred to Cronbach's alpha given the latter's sensitivity to scale length and often-untrue factor structure assumptions (Trizano-Hermosilla & Alvarado, 2016), but we report both here for comparison across studies, as alpha is commonly used. US reliability was good (> .70 or better) for all three perceptions, whereas Chinese scale reliability was good only for protective action perceptions about avoiding gatherings and for trust. Table 4 also shows the skewness, corrected item-total correlations (de Vaus, 2002; Traub, 1994; Lounsbury et al., 2005; Brcka-Lorenz et al., 2013), and mean inter-item correlations (MIICs) (Briggs & Cheek, 1986; Clark & Watson, 1995), measuring internal consistency of both public perceptions and cultural biases. Skewness statistics (deeming values < 0.2 as indicating normality) suggest that reliability may be underestimated for all three types (only personal risk perception met this normality criterion in both countries). Corrected item-total correlations measure whether an item measures something different from the overall scale, with proposed criteria suggesting minima of r > .3 (de Vaus, 2002; Traub, 1994), $r > .4$ (Lounsbury et al., 2005), and $r > .5$ (Brcka-Lorenz et al., 2013). Table 4 shows that US results exceeded all such criteria for risk perceptions, for all but two of 12 protective action perception items, for all but one of the four trust items, and for all cultural items except for fatalism. Chinese results met none of these item-total correlation criteria for risk perceptions, met all criteria only for 5 of the 12 protective action perception items, all criteria for trust items, and were more mixed for cultural items but did better on fatalism ($r > .4$). MIICs in general have been recommended in the $r = .2–.4$ (Briggs & Cheek, 1986) or $r = .15–.50$ ranges, but decrease to $r = .15–.20$ for broader constructs (Clark & Watson, 1995). The aim is to avoid correlations too low to indicate good relationships among items supposedly measuring a single construct and correlations so high as to indicate redundancy and failure properly to measure variability in aspects of that construct. In neither country did risk perception MIICs meet the Briggs and Cheek (1986) criterion, whereas Chinese but not US results met the Clark and Watson (1995) criterion. For protective action perception, all but one MIIC for China met both criteria, while none of the US MIICs met the Briggs and Cheek criterion and only one of four the Clark and Watson criterion. The China trust MIIC failed both criteria, while the US results (with or without excluding trust in then-President Trump) met both. All MIICs for cultural items for the United States exceeded that proposed criterion ($r = .15–.20$), implying redundancy (Clark & Watson, 1995), but Chinese results were less redundant than US results excluding fatalism.

Model fits of measurement model
Table 5 reports model fit statistics. CFA showed that the four cultural biases replicated in both countries, with good model fit in the United States (CFI/TLI > 0.95; SRMR < 0.08; RMSEA < 0.05 [0.045, 0.058]) and adequate model fit in China (CFI/TLI > 0.90, RMSEA < 0.080 [0.060, 0.076]) but good for SRMR (< 0.08). Standardized factor loadings of all cultural bias items exceeded 0.45. CFA tested configural invariance, whether specified measurement models fit well, for the

Table 5. Model fit statistics of measurement models

		χ^2	RMSEA	SRMR	CFI	TLI
Wash hands	Configural invariance model (initial model)	1977.285*	0.062	0.079	0.903	0.882
	Configural invariance model (revised model)	1031.436*	0.046	0.046	0.945	0.931
	Metric invariance model	1243.493*	0.051	0.051	0.925	0.915
	Scalar invariance model	2122.745*	0.070	0.064	0.860	0.839
Wear mask	Configural invariance model (initial model)	1999.626*	0.045	0.045	0.903	0.883
	Configural invariance model (revised model)	1057.403*	0.047	0.047	0.944	0.930
	Metric invariance model	1252.544*	0.051	0.052	0.930	0.916
	Scalar invariance model	2110.535*	0.070	0.065	0.865	0.844
Avoid gatherings	Configural invariance model (initial model)	1964.152*	0.061	0.079	0.911	0.892
	Configural invariance model (revised model)	1020.769*	0.045	0.046	0.950	0.938
	Metric invariance model	1187.577*	0.049	0.050	0.939	0.927
	Scalar invariance model	1857.226*	0.065	0.060	0.892	0.875
Get vaccinated	Configural invariance model (initial model)	2094.618*	0.064	0.082	0.904	0.884
	Configural invariance model (revised model)	1114.484*	0.049	0.050	0.944	0.930
	Metric invariance model	1305.212*	0.053	0.055	0.932	0.918
	Scalar invariance model	1983.385*	0.067	0.064	0.884	0.866

Note: Four measurement models for each of four protective actions, including four cultural biases, risk perception, trust in government, and protective action perception, are measured by their associated multiple indicators. The maximum likelihood method was used and all latent variables were allowed to freely correlate.
Revised model excludes trust in central government and global risk item.

two countries. The initial measurement model including all indicators was suboptimal. Modification indices indicated that two observed indicators had high cross-loadings – trust in central government and global risk – which we dropped to improve model fit and re-estimated the measurement model.

Except for χ^2 (usually disregarded when sample size exceeds ~200), indicators of model fit demonstrated adequate (CFI/TLI > 0.9) or good fit (SRMR < 0.08; RMSEA < 0.05), suggesting that the factor structure was optimally represented in both countries, and these revised models could be the final measurement models. We tested two more constrained models, for metric invariance and scalar invariance. The metric invariance model's fit was either adequate (CFI/TLI > 0.9; RMSEA < 0.08) or good (RMSEA < 0.05; SRMR < 0.08), indicating invariant factor loadings across countries. However, the scalar invariance model's fit was much poorer, implying dissimilar item intercepts across countries. We accepted the metric invariance model for parsimony, with all latent means freely estimated in each group (Milfont & Fischer, 2015).

Results of structural models

National contrasts

Table 6 shows descriptive statistics for all variables and results of independent sample *t* tests to assess differences between Chinese and American samples'

Table 6. Descriptive statistics

Variables	Mean ± SD		*t*	Min	Max
	China (*n* = 646)	United States (*n* = 1,325)			
Egalitarianism	11.85 ± 2.71	13.13 ± 3.86	7.60***	3	18
Fatalism	8.06 ± 3.07	9.52 ± 3.02	9.94***	3	18
Hierarchism	13.91 ± 2.25	9.05 ± 3.52	−32.12***	3	18
Individualism	11.91 ± 2.90	11.72 ± 3.12	−6.41***	3	18
Risk perception	11.72 ± 3.12	11.91 ± 2.90	−1.31	3	18
Trust in government	13.90 ± 2.62	11.11 ± 3.27	−18.96***	3	18
Protective action perception of					
Wash hands	14.12 ± 2.64	16.14 ± 2.09	18.44***	3	18
Wear mask	15.54 ± 2.30	14.70 ± 2.80	−6.56***	3	18
Avoid gatherings	15.03 ± 3.28	16.19 ± 2.23	9.20***	3	18
Get vaccinated	15.03 ± 2.44	14.90 ± 3.39	−0.88	3	18
Behavioral intention of					
Wash hands	4.55 ± 1.55	5.77 ± 0.77	23.35***	1	6
Wear masks	5.09 ± 1.33	5.07 ± 1.50	−0.22	1	6
Avoid gatherings	4.57 ± 1.53	5.60 ± 0.95	18.30***	1	6
Get vaccinated	3.02 ± 1.07	2.78 ± 1.13	−4.64***	1	4

Note: The United States is coded as group 1 and China as group 2 in independent sample *t* test. *$p < .05$, **$p < .01$, ***$p < .001$.

responses on these variables.[3] Chinese respondents rated significantly higher in hierarchism and individualism, and trust in government; they also were higher in protective action perceptions regarding masks and behavioral intentions of getting vaccinated. American respondents rated higher in fatalism and egalitarianism and in protective action perceptions and intentions regarding washing hands and avoiding gatherings. The countries did not significantly differ in risk perception.

Pairwise correlations appear in Table 7. Behavioral intentions of protective actions correlated positively with trust in government and protective action perceptions in both countries but only correlated positively with risk perception among Americans. Correlations of cultural biases with public perceptions and behavioral intentions varied across countries.

Model fits of structural models
As Table 8 shows, model fit statistics of four multigroup SEMs[4] show that except for χ^2, model fit was either acceptable (CFI/TLI > 0.90; RMSEA < 0.08) or good (SRMR < 0.08).

Mediation models
Our covariance-based SEMs use a Wald test (*z* test) for the parameters in determining significance, using a normal distribution. For more robust estimates of confidence intervals, we used bias-corrected bootstrapping (5,000 re-samples) (Hair et al., 2011). Table 9 reports coefficients (B), P values, and Z statistics. Table 9 shows that in China, 5 of 18 sub-hypotheses were supported across all protective actions, 4

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[3]The mean values of behavioral intentions for four actions in each Chinese province and American state appear in SI B (Figures B-1 and B-2).

[4]Model fit statistics for the full untrimmed sample appear in SI C (Tables C-1 and C-2).

Table 7. Pairwise correlation

Variables (United States/China)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Egalitarianism		.25***	.41***	.37***	.16***	−.02	.13**	.10*	−.00	.11**	−.06	−.15***	−0.12**	.10*
2 Fatalism	.15***		−.04	.38***	.22***	−.32***	−.12**	−.10*	−.09*	−.09*	−.23***	−.36***	−.27***	−.01
3 Hierarchism	−.34***	.17***		.21***	.08	.23***	.21***	.23***	.11**	.25***	.02	−.02	.02	.13**
4 Individualism	−.59***	02	.50***		.24***	−.04	.10*	.06	−.11**	.08*	−.13***	−.25***	−.22***	.04
5 Risk perception	.39***	.14***	−.02	−.27***		−.05	.10*	.05	.04	.04	.01	−.05	−.05	.03
6 Trust in government	.14***	−.08**	.02	−.12***	.16***		.25***	.16***	.13**	.23***	.24***	.24***	.23***	.18***
Protective action perception of														
7 Wash hands	.12***	−.03	−.02	−.07*	.20***	.16***		.50***	.24***	.35***	.36***	.25***	.14***	.14***
8 Wear masks	.25***	−.01	.02	−.17***	.34***	.27***	.40***		.30***	.53***	.19***	.27***	.15***	.07
9 Avoid gatherings	.18***	−.05	−.03	−.14***	.27***	.29***	.48***	.51***		.27***	.17***	.21***	.54***	.07
10 Get vaccinated	.22***	−.04	−.07**	−.22***	.30***	.34***	.23***	.40***	.45***		.18***	.22***	.14***	.25***
Behavioral intention of														
11 Wash hands	.15***	−.04	−.07*	−.16***	.19***	.10***	.36***	.19***	.22***	.12***		.61***	.46***	.24***
12 Wear masks	.21***	.00	−.08**	−.23***	.32***	.15***	.15***	.54***	.28***	.25***	.26***		.60***	.24***
13 Avoid gatherings	.17***	−.07*	−.07*	−.16***	.26***	.21***	.19***	.30***	.47***	.25***	.39***	.34***		.23***
14 Get vaccinated	.22***	−.05	−.12***	−.25***	.27***	.20***	.08**	.21***	.16***	.49***	.08**	.19***	.13***	

Note: The lower left off-diagonal is the correlation matrix for the American sample, and the upper right off-diagonal is the correlation matrix for the Chinese sample. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 8. Model fit statistics of structural models

	χ^2	RMSEA	SRMR	CFI	TLI
Wash hands	1372.582*	0.051	0.054	0.924	0.909
Wear mask	1474.886*	0.054	0.057	0.920	0.904
Avoid gatherings	1392.624*	0.052	0.056	0.931	0.916
Get vaccinated	1508.435*	0.055	0.061	0.922	0.907

Note: *$p<0.05$, **$p<0.01$, ***$p<0.001$.

partly supported (i.e., regarding some protective actions), and 9 unsupported. Among Americans, 11 were supported across all protective actions, 2 partly supported, and 5 unsupported.

The standardized path coefficients appear in Figures 3–6 (China) and Figures 7–10 (United States), for each of four protective actions; shaded coefficients indicate expected associations.[5] The variance explained (R^2) in the dependent constructs for each model (Hair et al., 2011) is also reported in Figures 3–10. Except for R^2 in trust in government and protective action perception for the American model of washing hands and R^2 in protective action perceptions for the Chinese model of avoiding gatherings, R^2 in risk perceptions, trust in government, and protective action perceptions surpassed the 0.10 minimum threshold (Falk & Miller, 1992; Hair et al., 2017) across models.

Effects of protective action perceptions did not significantly differ between the two countries, with positive perceptions positively associated with behavioral intentions across all protective actions (H1) (the range of coefficient r is 0.33 to 0.54 for China; $r = [0.39,0.54]$ United States). However, positive effects of risk perception (H1) were supported only for the United States ($r = [0.12,0.21]$, and positive effects of trust in government (H1) were only supported across actions in China ($r = [0.12,0.17]$). H1 was only partly consistent with the data.

Partly consistent with H2, hierarchism in both countries is positively associated with trust in government ($r = [0.43,0.50]$ China; $r = [0.24,0.30]$ United States) and positive perceptions of protective actions ($r = [0.29,0.64]$ China; $r = [0.19,0.43]$ United States). Hierarchism is positively associated with risk perception (r = [0.32,0.39]) among Americans but not Chinese. In both countries, direct effects of hierarchism on intentions are limited. Contrary to H2, hierarchism is negatively associated with the intention to avoid gatherings in China ($r = -0.25$).

Partly consistent with H3, egalitarianism is positively associated with risk perception ($r = [0.53, 0.57]$) and positive perceptions of protective action ($r = [0.26, 0.45]$) among Americans, but not Chinese. Egalitarianism's association with trust in government was positive among Americans (r = [0.23, 0.26]) but negative among Chinese ($r = [-0.33, -0.41]$). In both countries, direct effects of egalitarianism on intentions were limited. Contrary to H3, egalitarianism is negatively associated with mask wearing intention among Americans ($r = -0.21$).

Partly consistent with H4, individualism is negatively associated with risk perception ($r = [-0.18, -0.23]$) and trust in government ($r = [-0.13, -0.15]$) among Americans. Unexpectedly, individualism is positively associated with risk

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[5]Results for the full untrimmed sample appear in SI D (Figures D-1 to D-8).

Table 9. Hypothesis testing results

Hypotheses	Sub-hypotheses	Protective actions	Coefficients (B)		Z statistics		Hypotheses confirmed (Yes = Y; No = N)?	
			China	United States	China	United States	China	United States
H1. *Heightened COVID-19 risk perceptions, protective action perceptions, and trust in government increase intentions of and actually taking protective actions.*	**H1.1.** *Heightened COVID-19 risk perceptions increase intentions of and actually taking protective actions.*	Wash hands	0.07	0.12**	1.11	3.20	N	Y
		Wear mask	−0.03	0.21***	−0.57	5.58	N	Y
		Avoiding gatherings	−0.03	0.17***	−0.58	4.46	N	Y
		Get vaccinated	0.07	0.13***	1.06	3.55	N	Y
	H1.2. *Heightened protective action perceptions increase intentions of and actually taking protective actions*	Wash hands	0.50***	0.39***	9.93	13.11	Y	Y
		Wear mask	0.44***	0.54***	7.17	16.32	Y	Y
		Avoiding gatherings	0.54***	0.47***	14.13	14.61	Y	Y
		Get vaccinated	0.33***	0.44***	5.15	15.07	Y	Y
	H1.3. *Heightened trust in government increases intentions of and actually taking protective actions*	Wash hands	0.12*	0.01	2.31	0.47	Y	N
		Wear mask	0.12*	0.01	2.44	0.38	Y	N
		Avoiding gatherings	0.17***	0.07*	3.78	2.52	Y	Y
		Get vaccinated	0.15*	0.02	2.67	0.77	Y	N
H2. *Hierarchism increases risk perception, trust in government, protective action perceptions, and behavioral intentions of and actually taking protective actions.*	**H2.1.** *Hierarchism increases risk perception*	Wash hands	0.10	0.32***	0.61	6.24	N	Y
		Wear mask	0.08	0.39***	0.58	7.29	N	Y
		Avoiding gatherings	0.10	0.37***	0.67	6.95	N	Y
		Get vaccinated	0.10	0.37***	0.63	6.93	N	Y
	H2.2. *Hierarchism increases trust in government*	Wash hands	0.46**	0.24***	3.20	4.65	Y	Y
		Wear mask	0.43**	0.30***	3.34	5.50	Y	Y
		Avoiding gatherings	0.43**	0.30***	3.22	5.53	Y	Y
		Get vaccinated	0.50***	0.30***	3.51	5.51	Y	Y
	H2.3. *Hierarchism increases protective action perceptions*	Wash hands	0.29**	0.19***	2.19	3.67	Y	Y
		Wear mask	0.56**	0.43***	3.40	7.62	Y	Y
		Avoiding gatherings	0.33**	0.33***	2.63	6.04	Y	Y
		Get vaccinated	0.64***	0.28***	3.71	5.65	Y	Y
	H2.4. *Hierarchism increases behavioral intentions of and actually taking protective actions.*	Wash hands	−0.14	−0.01	−1.10	−0.24	N	N
		Wear mask	−0.28	−0.10	−1.97	−1.89	N	N
		Avoiding gatherings	−0.25*	−0.09	−2.18	−1.76	N, sign reversed	N
		Get vaccinated	−0.15	−0.03	−0.91	−0.67	N	N
		Wash hands	−0.01	0.53***	−0.05	9.02	N	Y

(Continued)

Table 9. (*Continued*)

Hypotheses	Sub-hypotheses	Protective actions	Coefficients (B)		Z statistics		Hypotheses confirmed (Yes = Y; No = N)?	
			China	United States	China	United States	China	United States
H3: Egalitarianism increases risk perception, protective action perceptions, and behavioral intentions of and actually taking protective actions.	**H3.1**: Egalitarianism increases risk perception	Wear mask	−0.01	0.57***	−0.09	9.49	N	Y
		Avoiding gatherings	−0.02	0.55***	−0.11	9.29	N	Y
		Get vaccinated	−0.01	0.53***	−0.08	9.04	N	Y
	H3.2: Egalitarianism increases protective action perceptions	Wash hands	−0.05	0.26***	−0.30	4.57	N	Y
		Wear mask	−0.30	0.45***	−1.70	7.51	N	Y
		Avoiding gatherings	−0.18	0.35***	−1.34	5.93	N	Y
		Get vaccinated	−0.33	0.27***	−1.81	5.13	N	Y
	H3.3: Egalitarianism increases behavioral intentions of and actually taking protective actions	Wash hands	0.04	0.01	0.31	0.17	N	Y
		Wear mask	0.13	−0.21***	0.93	−3.62	N	N, sign reversed
		Avoiding gatherings	0.17	−0.04	1.34	−0.63	N	N
		Get vaccinated	0.21	−0.02	1.28	−0.34	N	N
H4. Individualism and fatalism decrease risk perception, trust in government, protective action perceptions, and behavioral intentions of and actually taking protective actions.	**H4.1**. Individualism decreases risk perception	Wash hands	0.28*	−0.18**	2.57	−3.06	N, sign reversed	Y
		Wear mask	0.26*	−0.21**	2.51	−3.46	N, sign reversed	Y
		Avoiding gatherings	0.26*	−0.21**	2.49	−3.38	N, sign reversed	Y
		Get vaccinated	0.27*	−0.23***	2.53	−3.72	N, sign reversed	Y
	H4.2. Individualism decreases trust in government	Wash hands	0.20**	−0.11	2.64	−1.74	N, sign reversed	N
		Wear mask	0.19*	−0.13*	2.49	−2.01	N, sign reversed	Y
		Avoiding gatherings	0.18*	−0.13*	2.41	−2.03	N, sign reversed	Y
		Get vaccinated	0.19*	−0.15*	2.51	−2.37	N, sign reversed	Y
	H4.3. Individualism decreases protective action perceptions	Wash hands	0.18*	−0.03	2.17	−0.41	N, sign reversed	N
		Wear mask	0.13	−0.18**	1.39	−2.89	N	Y
		Avoiding gatherings	−0.16*	−0.17**	−2.16	−2.61	Y	Y
		Get vaccinated	0.11	−0.30***	1.25	−5.15	N	Y
	H4.4. Individualism decreases behavioral intentions of and actually taking protective actions	Wash hands	−0.15*	−0.07	−2.04	−1.33	Y	N
		Wear mask	−0.10	−0.16**	−1.40	−3.00	N	Y
		Avoiding gatherings	−0.03	0.02	−0.50	0.37	N	N
		Get vaccinated	−0.10	−0.09	−1.36	−1.64	N	N

(*Continued*)

Table 9. (*Continued*)

Hypotheses	Sub-hypotheses	Protective actions	Coefficients (B)		Z statistics		Hypotheses confirmed (Yes = Y; No = N)?	
			China	United States	China	United States	China	United States
H4.5. *Fatalism decreases risk perception*		Wash hands	0.25*	−0.01	2.07	−0.31	N, sign reversed	N
		Wear mask	0.24*	−0.07	2.07	−1.59	N, sign reversed	N
		Avoiding gatherings	0.26*	−0.06	2.18	−1.47	N, sign reversed	N
		Get vaccinated	0.26*	−0.04	2.12	−1.00	N, sign reversed	N
H4.6. *Fatalism decreases trust in government*		Wash hands	−0.33***	−0.23***	−3.75	−4.89	Y	Y
		Wear mask	−0.33***	−0.27***	−3.81	−5.60	Y	Y
		Avoiding gatherings	−0.32***	−0.28***	−3.79	−5.71	Y	Y
		Get vaccinated	−0.29**	−0.26***	−3.32	−5.53	Y	Y
H4.7. *Fatalism decreases protective action perceptions*		Wash hands	−0.30**	−0.12**	−3.23	−2.77	Y	Y
		Wear mask	−0.19	−0.23***	−1.78	−4.83	N	Y
		Avoiding gatherings	0.03	−0.24***	0.34	−5.00	N	Y
		Get vaccinated	−0.08	−0.18***	−0.79	−4.21	N	Y
H4.8. *Fatalism decreases behavioral intentions of and actually taking protective actions*		Wash hands	−0.09	−0.08	−1.12	−2.00	N	N
		Wear mask	−0.28***	0.03	−3.60	0.72	Y	N
		Avoiding gatherings	−0.23**	−0.05	−3.21	−1.26	Y	N
		Get vaccinated	0.04	−0.07	0.45	−1.83	N	N

Note: *p < .05, **p < .01, ***p < .001.
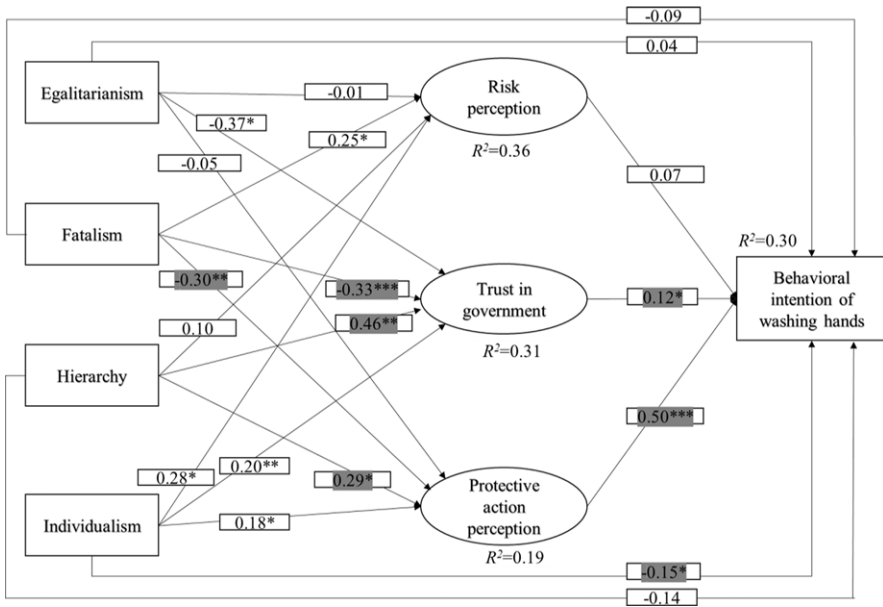
Figure 3. SEM of behavioral intention of washing hands (China).
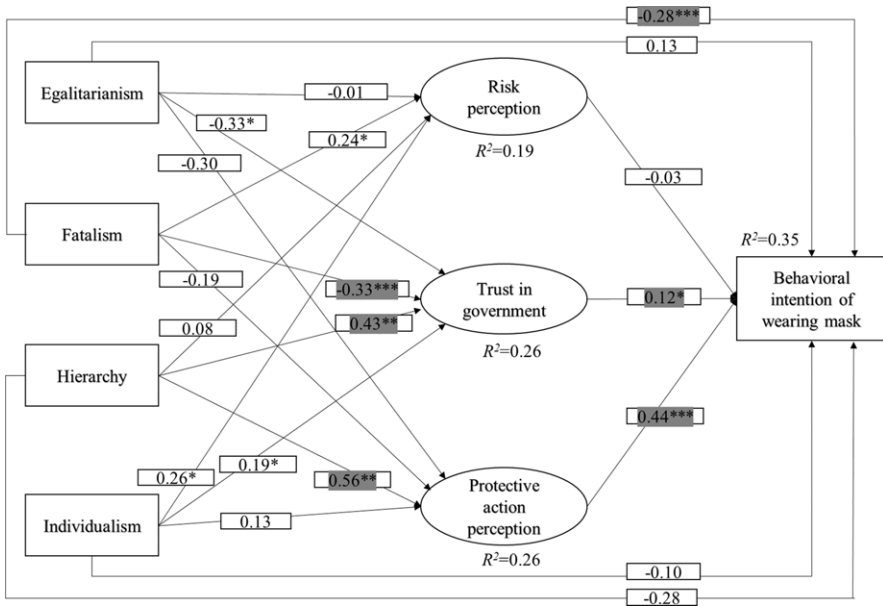
Figure 4. SEM of behavioral intention of wearing mask (China).

perception ($r = [0.26, 0.28]$) and trust in government ($r = [0.18, 0.20]$) in China. Expectation of individualism's negative association with positive perceptions of protective action is supported for wearing masks ($r = -0.18$), avoiding gatherings
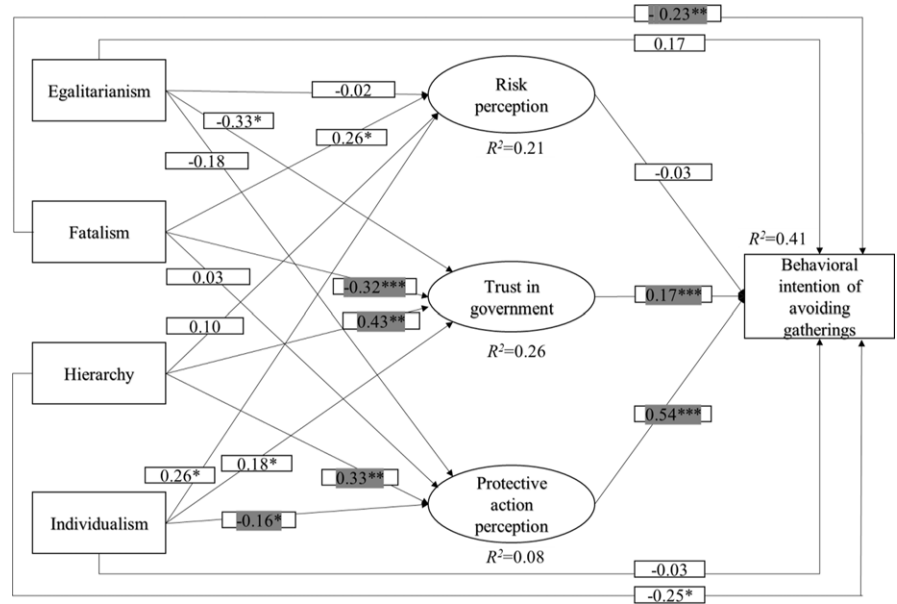
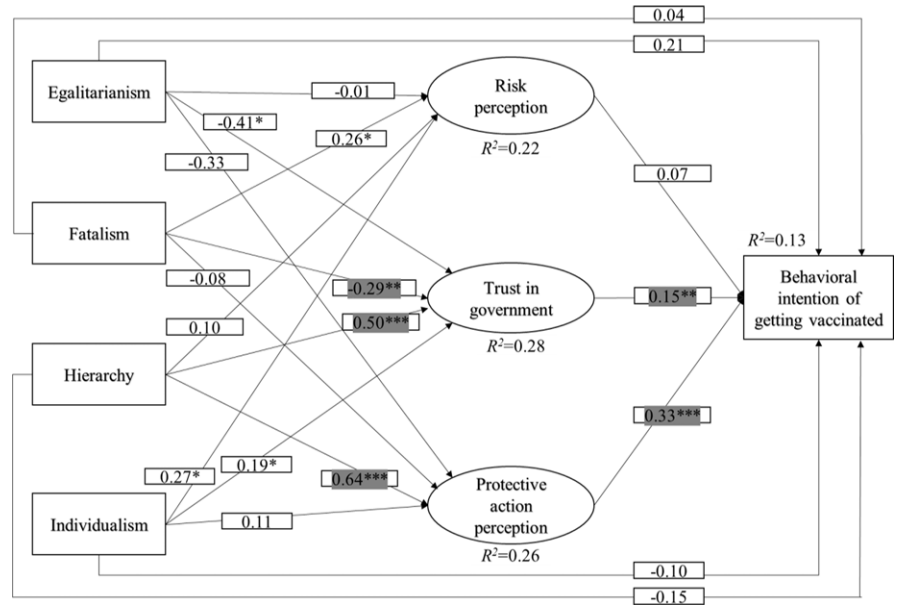**Figure 5.** SEM of behavioral intention of avoiding gatherings (China).

Figure 6. SEM of behavioral intention of getting vaccinated (China).

($r = -0.17$), and getting vaccinated ($r = -0.30$) among Americans and for avoiding gatherings ($r = -0.16$) in China. Contrary to our expectations, individualism is positively associated with positive Chinese perceptions of washing hands ($r = 0.18$).
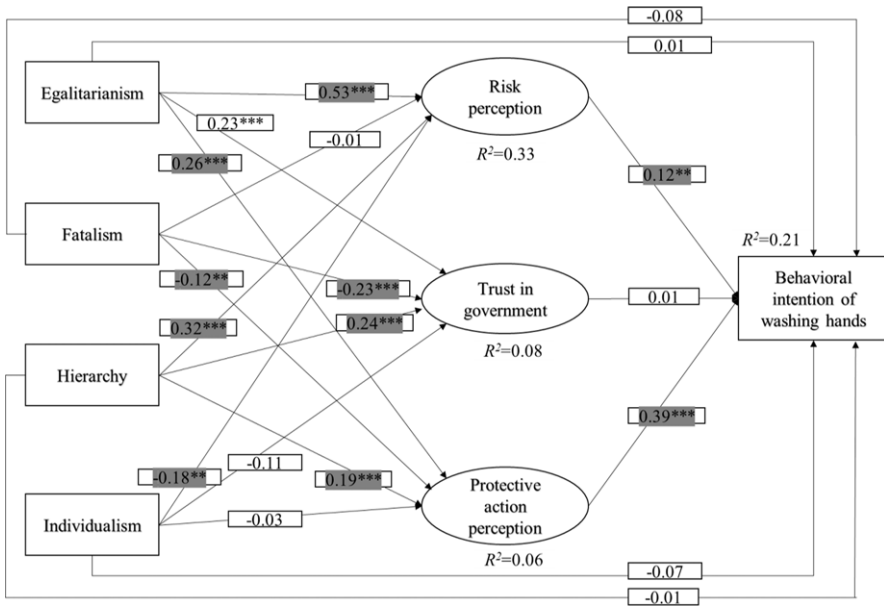
Figure 7. SEM of behavioral intention of washing hands (United States).
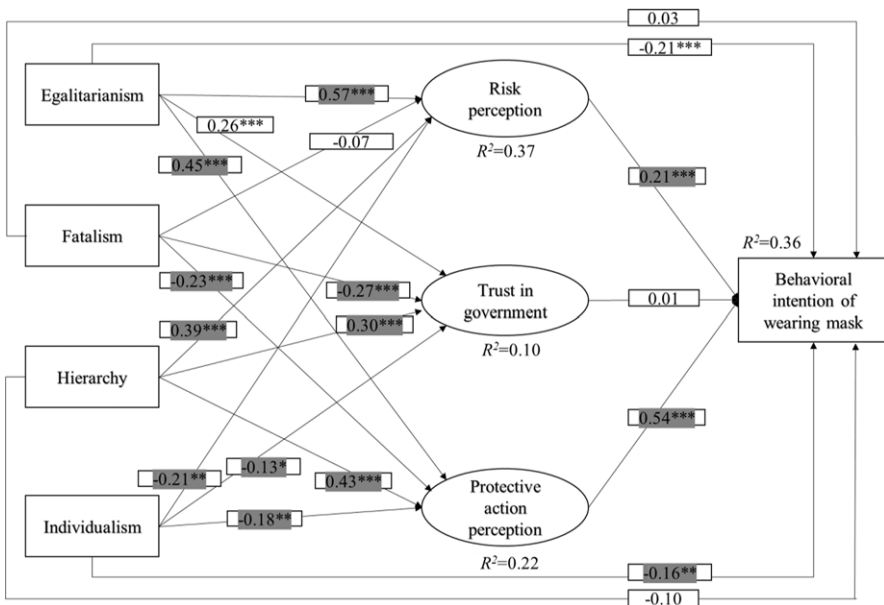
Figure 8. SEM of behavioral intention of wearing mask (United States).
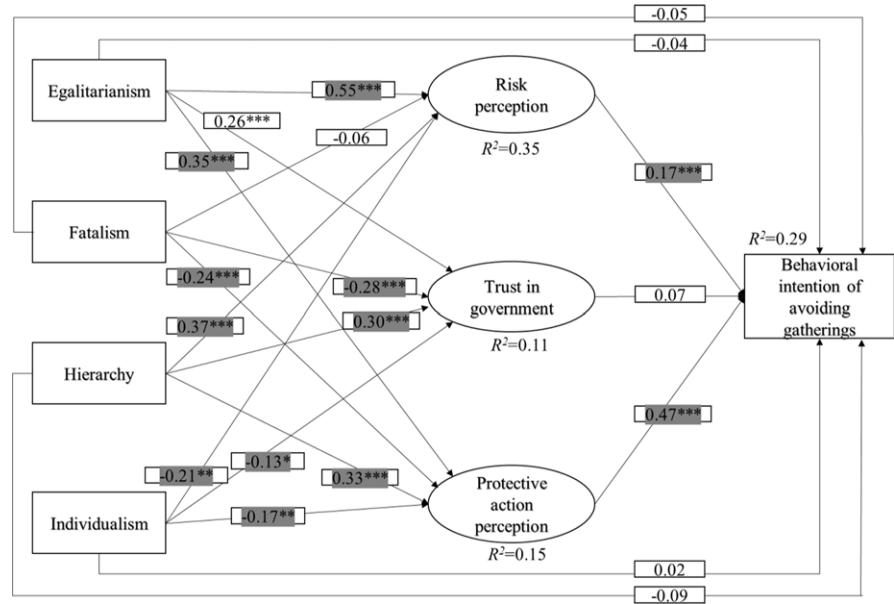
Figure 9. SEM of behavioral intention of avoid gatherings (United States).
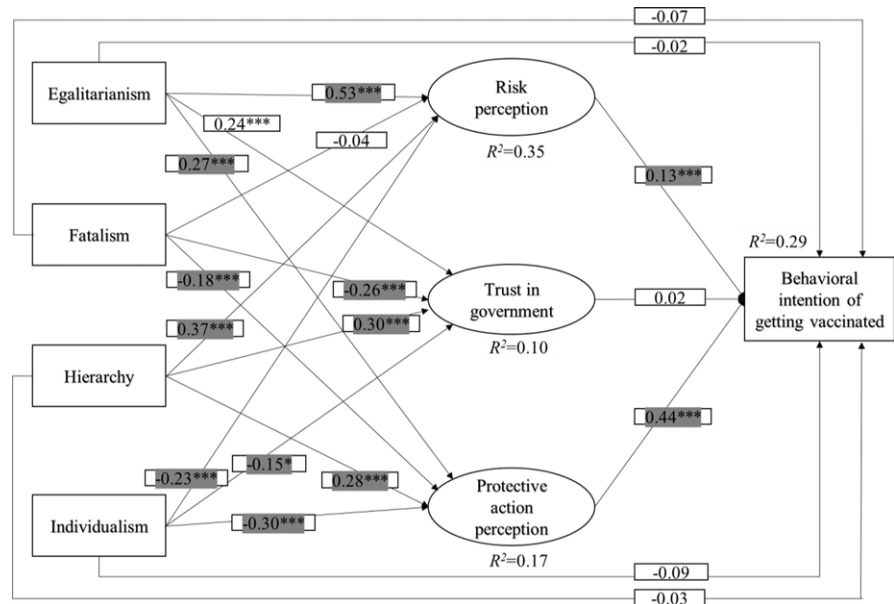
Figure 10. SEM of behavioral intention of getting vaccinated (United States).

Expectations of individualism's negative effects on intentions are supported for Chinese handwashing ($r = -0.15$) and American mask wearing ($r = -0.16$).

Partly consistent with H4, fatalism is negatively associated with trust in government in both countries ($r = [-0.29, -0.33]$ in China; $r = [-0.23, -0.28]$ among Americans). Expectation of fatalism's negative effects on positive perceptions of protective action ($r = [-0.12, -0.24]$) is supported among Americans and for positive perceptions of washing hands in China ($r = -0.30$). Expectation that fatalism would negatively affect behavioral intentions is supported for wearing masks ($r = -0.28$) and avoiding gatherings ($r = -0.23$) among Chinese but not Americans.

Both countries exhibited positive effects of hierarchism on trust in government and positive perceptions of protective actions and negative effects of fatalism on trust in government. However, they exhibited many different associations of cultural bias with risk perception and trust in government, and – depending on the type of protective action – of cultural bias with positive perceptions and intentions regarding protective actions.

Discussion

This research examined direct and indirect effects of individuals' cultural biases on perceptions and behavioral responses to COVID-19 in China and the United States, with different national cultures and COVID-19 death rates.

Major findings and theoretical implications

Protective action perceptions drive protective behaviors in both countries, but effects of risk perception and trust in government vary

Findings that positive perceptions of protective action are significantly related to behavioral intentions in both countries are consistent with the PADM and previous studies (Dai et al., 2020; Johnson, 2019; Johnson & Mayorga, 2021a; Wei et al., 2020). This work continues to underline that the PADM can apply broadly to natural hazards, both infectious agents (e.g., Wang et al., 2018 and Johnson, 2019, as well as the current study) and its original focus on geophysical/meteorological hazards (e.g., hurricanes and earthquakes). Our research also underlines the value of the PADM's inclusion of other perceptions of threat and of stakeholders (the latter unique to this specific model of risk-related behavior), but with intriguing differences across nations. Behavioral intentions among Americans are more influenced by people's perceived risk of COVID-19 (but only initially; Li et al., 2021), whereas in China they are more influenced by trustworthiness of authorities, consistent with prior research on China (Wei et al., 2018). This research also was consistent with the argument that assessing PADM associations with each behavior on its own, versus a summary index of protective actions as is common in natural hazard research, can reveal illuminating differences (Johnson, 2019).

Unlike previous research suggesting that Chinese often perceive more risk (Wang & Liu, 2018; Wei et al. 2018), we found nonsignificant differences in risk perception. The Chinese had stronger intentions to get vaccinated (cf. Rohrmann & Chen, 1999; Wang & Liu, 2018; Wei et al., 2018), while Americans had stronger intentions to wash hands and avoid gatherings.

These findings indicate that the PADM can apply across societies while yielding for some behaviors quite different associations between factors. Future PADM research should look to build up evidence on whether, and under what circumstances, one kind of perception may be more influential than others. Conducting prior qualitative field research to ensure that the measures of threat, protective action, and stakeholder perceptions from PADM are appropriate for use in all contexts may be useful to ensure that any comparisons (e.g., of societies) are valid.

Hierarchism increases protective behaviors via protective action perceptions in both countries, but other indirect effects of cultural bias on protective behaviors via public perceptions vary

Our comparison of China and the United States is still rare in risk analysis, building on Wang & Liu (2018) in applying the same model of risk responses, and overlapping Li et al. (2021) in risk perceptions and behaviors investigated. Differences in national cultures are widely recognized: according to Hofstede's Cultural Orientations, the United States is highly individualistic, has strong uncertainty avoidance, and is a short-term oriented culture (Yu & Shen 2013; Zhang et al., 2022), while China is collectivist, has weak uncertainty avoidance, is long-term-oriented, and restrained/rule-oriented (Hofstede, 2011; Wang & Liu, 2018). Consistent with previous cross-cultural research using GGCT (Chai et al., 2009), Chinese respondents are more hierarchical and exhibit higher trust in government (Shi, 2015).[6]

Despite challenges in measuring these biases within (e.g., Johnson & Swedlow, 2021) or across cultures (e.g., see Section 4.2), our novel investigation of the influence of individuals' cultural bias on public perceptions and behavioral intentions in culturally different countries found the direct effect of cultural bias limited in both China and the United States. However, cultural bias may influence intentions indirectly through influencing public perceptions. Regardless of country, mediating effects of protective action perceptions on the relationship between hierarchical cultural bias and intentions are supported for all behaviors. This aligns in China with findings of parallel research in February 2020 (Yuan, 2021). Our findings regarding cultural influences on US mask wearing contrast with those of a nationally representative survey in September 2020, Moyer et al. (2021) found hierarchism negatively correlated with mask wearing.[7] Wang et al. (2023) also found that hierarchical worldviews, aligning with individualistic worldviews, negatively correlated with perceived benefits of COVID-19 vaccination and public support for COVID-19 mandatory vaccination. Other indirect effects of cultural biases via public perceptions differ across countries and protective actions. In China, for all behaviors, hierarchism and individualism increase intentions to take protective actions via increasing trust in government, while fatalism and egalitarianism

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[6]However, King et al. (2004) found that an anchoring vignette method reveals that high raw political efficacy scores among Chinese are much lower when adjusted for differences in how people in different groups – for example, across countries – use ordinal response categories such as "strongly agree."

[7]Unpublished results from Waves 3 (August 2020) and 4 (October) of the US survey, which bracket the Moyer et al. (2021) field dates, also found such a negative correlation with the Wave 2 hierarchical measure ($r = -.09$, $p = .003$, $n = 1193$, and $r = -.07$, $p = .021$, $n = 1026$).

decrease intentions via decreasing trust in government. Moreover, individualism increases the intention to wash hands but decreases the intention to avoid gatherings via perceptions of protective actions, while fatalism decreases intentions via perceptions of protective actions only for washing hands. Among Americans, hierarchism increases intentions via increasing risk perception, egalitarianism increases intentions via increasing risk perception and positive protective action perceptions, individualism decreases intentions via decreasing risk perception and positive protective action perceptions (excluding perceptions regarding hand washing), and fatalism decreases intentions via decreasing positive protective action perceptions.

The opposite effects of individualism and egalitarianism between the two countries are worth noting. This is a more complex relationship than found in previous research on infectious disease or environmental risk, contrasting individualism's varied associations with risk perception to egalitarianism's often positive association with risk perception (Johnson, 2017; Johnson et al., 2020; Johnson & Swedlow, 2021; Liu, 2018; Xue et al., 2016). These differences between countries might reflect larger between-culture differences. For example, although individualists are deemed less likely to rely on governments generally (Cornia et al., 2016), and we found them less likely to take COVID-19 protective behaviors via lower risk perception and positive perception of protective actions (aligning with Moyer et al.'s, 2021, findings regarding mask wearing), their stance within a collectivist society may differ (e.g., the concept of "interdependent competitors" seems illogical in Western nations and is objectively less frequent there, but occurs in non-Western nations; Green et al., 2005).

Chauvin and Chassang (2021) argue that hierarchism and individualism are so strongly correlated in France that they should be collapsed into a single scale, but this correlation also has been found elsewhere, including the United States (Johnson & Swedlow, 2021; Kahan, 2012). Hierarchical culture is dominant in France, as in China, so the hierarchism–individualism relation may be more similar in these countries. In the United States, hierarchism and individualism form The Establishment (Douglas & Wildavsky, 1983) are generally allied in the contemporary Republican Party and among conservatives but historically often have opposed each other (with individualism instead forming a coalition with egalitarians against hierarchy; Favre et al., 2019; Johnson & Swedlow, 2021). As in France and among US conservatives, Republicans, and The Establishment, Chinese individualists who benefit from economic development and opportunity may ally with hierarchists when hierarchists help create the conditions for the latter things to occur. Meanwhile, our finding in spring 2020 that American hierarchists were more likely to wear and intend to wear masks (and intend to and take other protective behaviors) may be explained by their deference to CDC messaging at that time, while Moyer et al.'s finding that hierarchists were likely to oppose mask wearing by September 2020 may be explained by the fact that they were at that point deferring to messaging by President Trump, Republicans, conservatives, and their individualistic coalition partners.

Still, it bears noting that in February 2020, Chinese individualists were, as hypothesized in both studies, distrustful of government (Yuan, 2021). Perhaps some combination of their alliance with hierarchy and them being reassured, persuaded, or pressured by government action on COVID-19 caused them to report being trustful of government by the time we surveyed them. This still leaves as an open

question, in both Chinese and in much Western research employing GGCT, how individualists might respond to survey items measuring support for civil liberties or items critical of state restriction of civil liberties.

A further anomaly that remains to be explained is that by late May/early June 2020, about 2 months after China ended its lockdown, Yuan and Swedlow (2022) find that individualistic biases decreased public support for and compliance with social distancing and the vaccine mandate both directly and (indirectly) through lack of value congruence. So, at this point in the pandemic in China, individualistic support for the same COVID-19 control policies we study here was as hypothesized in both studies. This suggests that individualists initially distrusted government as hypothesized, then said they supported COVID-19 regulations as China imposed a lockdown (contrary to our expectations, but perhaps explained by some of the factors and dynamics we discuss here), and then returned to opposing these policies as hypothesized, perhaps because they perceived it safe to voice their views after China ended the lockdown.

Meanwhile egalitarians – group-oriented, but favoring fewer restrictions by external rules – may set their small group against the dominant hierarchical, politically centralized society (Boyle & Coughlin, 1994), exclude outsiders not sharing egalitarian values (Davy, 2021), and oppose expanding governmental power in risk management (Swedlow et al., 2020). This distrust of government could explain why Chinese egalitarians intend and take fewer protective actions, contradicting our hypothesis despite its validity among Americans and in Moyer et al. (2021), who found egalitarians most likely to wear masks. In the United States, egalitarians are allied with the scientific and bureaucratic hierarchists in the Democratic Party (Swedlow, 2008) and so are more likely than social and religious hierarchists allied with individualists in the Republican Party to defer to hierarchical CDC directives regarding COVID-19 protective measures.

Finally, while China continues to be strongly hierarchical, fatalism is also deeply embedded in traditional Chinese and other Asian cultures (Kirkland, 2005; Liu, 2018; Xue et al. 2016). It is intriguing that fatalism measures were more reliable among Chinese than among Americans. Studies of French cultural influences on risk, where fatalism also plays a large role, may help grasp fatalism's effects in China (Chauvin & Chassang, 2021). Although fatalists are a smaller proportion of the US population, they may have a disproportionate influence on risk, regulation, and behavior as they change their support for parties and candidates more frequently than the other cultural types. Differing findings regarding fatalist behavioral intentions via decreasing positive perceptions of protective actions between our study and Moyer et al. (2021) also need explanation. Perhaps fatalists' initial reaction (in spring 2020 in our study) was to perceive protective actions negatively and therefore not take or intend to take action, but by the Moyer survey in September fatalists not perceiving a COVID-19 threat nevertheless resigned themselves to wearing masks.

Explaining mixed findings

Our mixed findings – including uncertainty on whether these stem from real differences or methodological difficulties (below) – underscore challenges posed for

effective national comparisons. Yet our comparable relationships for hierarchism, despite reliability issues in China, shows potential for generalizing risk analysis findings across countries, beyond the emphasis so far on North America and Europe. Using GGCT and PADM to investigate further direct and indirect associations between cultural biases, public perceptions, and behavioral responses is warranted. Differences for two other PADM-derived mediators – trust in government among Chinese, risk perceptions among Americans – also merit follow-up to test generalizations across issues or other cross-national contrasts.

Multiple reasons might explain our mixed findings. First, hierarchical cultural bias may dominate and influence other cultural biases in an authoritarian political system like China's (Wildavsky, 2006). Chinese culture is not as culturally pluralized as – or perhaps is more subtly pluralized than—American culture. Second, our mixed results could derive from the low reliability of GGCT measures, and of most perceptions excluding trust in government, in China. Although measurement reliability did not seem to affect configural and metric invariance of the general model, it can cause problems. We suspect that some translated survey items may be poorly understood by Chinese or evoke certain response biases more than others. Ongoing cognitive interviews by the first author suggest that some translated GGCT survey items need to be adapted to both language and cultural contexts in China. For example, interview respondents said the item "Society is in trouble because people do not obey those in authority" can be confusing because "authority" can refer to people with political power but limited professional knowledge or to people who are experts with limited political power. Chinese respondents also hesitated to answer politically sensitive questions (e.g., the egalitarian item on equal distribution of power). Thus, further research complementing translation and back-translation with cognitive interviews and pilot studies could attribute these differences appropriately to real cultural differences, acquiescence bias or other response biases, and/or question phrasing which translates poorly conceptually across societies even if its literal translation is accurate. For research in China, face-to-face surveying without using a third-party recruiter (i.e., a commercial online panel) and hiring researchers who speak respondents' dialect also could reduce response biases and political fear and improve survey response reliability. Our Chinese sample shows that egalitarianism correlated positively with both hierarchism and individualism, contrasting with previous evidence of negative or nonsignificant correlations between egalitarianism and these two alternative cultural biases (Johnson & Swedlow, 2021; Xue et al., 2016). Given that one of those previous studies also used a Chinese sample, the difference likely lies in either use of different cultural measures or variability across samples.

Assessing the mediating role of value congruence may also be important (Johnson, 2022; Yuan & Swedlow, 2022). Holding the same value as a group or organization, for example, the government, may not be sufficient to determine public support for or compliance with specific protective policies designed by the government. For example, individualists may distrust government because they see it as an instance of hierarchy (Mayorga & Johnson, 2019; Shi, 2015; Tumlison et al., 2017). However, when it comes to specific protective policies, individualists may oppose government bans on public gatherings while supporting voluntary vaccination because the former restricts while the latter allows free choice.

Studying compliance with COVID-19 protective policies in China, Yuan and Swedlow (2022) find that the effects of cultural biases on public support and compliance vary not only with cultural biases but by how these are mediated through value congruence with particular protective policies. As hypothesized, hierarchical cultural biases increase public support for and compliance with social distancing and a vaccine mandate both directly and (indirectly) through value congruence. By contrast, as hypothesized, fatalistic cultural biases decrease public support for and compliance with social distancing both directly and (indirectly) through lack of value congruence and individualistic biases decrease public support for and compliance with social distancing and a vaccine mandate both directly and (indirectly) through lack of value congruence. However, the hypothesized effects of fatalistic biases did not hold for the vaccine mandate.

Our findings above suggest that cultural biases, which are unmentioned in PADM, have important effects which need to be addressed. We cannot rule out that their effects are mediated through such existing features of the PADM as "social cues" (given that one's social environment may include norms about perceptions and behaviors reflecting these biases) or "situational facilitators" or "situational impediments" that are assumed to modify behavioral responses (Lindell & Perry, 2012). Yet these are all part of a model that emphasizes decisions by individuals, whereas cultural bias is usually taken to be expressed as part of group interactions. Our research findings support future PADM research taking these social factors more into account in assessing how people respond to regulatory and other efforts regarding hazard response.

We also made contributions to GGCT from three aspects: first, the finding that the hierarchical cultural bias was consistently associated with protective action across behaviors and countries, primarily through positive protective action perceptions, highlights the ability of GGCT to predict responses to this particular kind of hazard (as other biases may be more alert to other kinds of hazards). This cross-national, cross-behavioral finding bolsters the applicability of the theory given the mixed, and often weak, findings in the literature more generally.

Second, the high variability in findings regarding nonhierarchical biases and mediators (trust in government in China, risk perception in the United States) across protective behaviors challenges GGCT to develop understandings of these dynamics that can be used to predict future associations, rather than as merely post hoc explanations. GGCT is intended to be a very general theory that can apply both within and across societies, and in historical as well as contemporary analyses, but our findings seem to tap more than a mere adaptation of the theory to the circumstances of the moment. Some of this variability may be understood through more detailed (including qualitative) research on why people endorsing a given cultural bias thought differently about one protective behavior versus another. But GGCT theory also needs to grapple with these issues so that empiricists have a better idea in advance of what variability they might find, and why.

Third, our speculations suggest that further work should compare cultural effects to those of other potential exogenous variables, even though our PADM-derived mediators – perceptions of threat, protective actions, and stakeholders – already include many factors (perceived risk, response and personal efficacy, and trust) accounted for in behavioral models.

Fourth, our reliability findings also point to the need further to develop valid cultural bias measures. Although GGCT has been deployed in survey research in many nations, and such associations found in several, there has been concern that these are often weaker than those found in North American research, suggesting that the survey implementation of the theory is too US-centric. Our reliability findings, and the lead author's cognitive interviewing in China independent of this study, suggest that the particular GGCT items we used are more problematic overall in China than in the United States. Yet simultaneously we find that the fatalism index is much more reliable in China than in the United States, an unexpected finding given both the assumed US-centric nature of GGCT survey measures in general and the generally low attention to fatalism as a cultural bias in the theoretical and empirical literatures. This finding points to the need to improve both GGCT survey items and understanding of their cross-cultural (in)variance.

One promising, as-yet-unexplored avenue for operationalizing GGCT is to use cultural value measures developed by other researchers for which multicountry datasets already exist. Güss & Tuason (2021) operationalized individualism, egalitarianism, and hierarchism to study culture's effects on COVID-19 death rates globally using measures of Schwartz (1994) and Hofstede (2001). A similar operationalization has been suggested for operationalizing GGCT (Maleki & Hendriks, 2014). Findings by Johnson (2022) and Yuan and Swedlow (2022) suggest that value congruence should be included as a mediator in studies of cultural influences on policy and regulatory compliance.

Practical implications

This research also has implications for regulatory compliance, particularly in the United States where our results were more consistent across measures and behaviors but also partly in China. First, this research highlights protective action perceptions in the PADM, including perceived efficacy of protective actions and resource-related attributions, which prompt behavioral intentions in both countries. Underlining how well such behaviors can work to protect people, and how easily they can be implemented, seems a prudent focus for public health communication. However, our findings – if they generalize – suggest that public health officials in both countries may need to be more cautious about other processes by which people make protective action decisions. Many risk communications aim to raise the general public's awareness of threat, prompting them to adopt more protective behaviors. Our research suggest that such campaigns may not be always uniformly successful: trust in government may influence protective behaviors more among Chinese, while risk perception may be more influential among Americans.

Second, regulators in both countries should craft messages regarding protective actions that are culturally congenial to target audiences and realize the varied obstacles to implementing protective actions in diverse cultural groups. While our research results are not at odds with previous suggestions that protective actions should be framed as effective in protecting both individuals and their community from risks, we further suggest that both researchers and practitioners should be aware of cultural differences in accepting and rejecting risk-related information. For example, it may be easier to communicate with hierarchists than others like fatalists,

who distrust government and have less favorable perceptions of government and protective actions. The conventional risk communication suggestion would be to adapt one's message to the specific characteristics and preferences of one's varied audiences, including their cultural biases (e.g., compliance with physical distancing will avoid lockdowns that hamper individualists' economic opportunities).

However, this strategy can present challenges, as the example of fatalists illustrates. Public health research has revealed that noncompliance stems from fatalists' perception that trying to protect themselves from health risks is senseless because of the uncontrollable causes of risks (Davison et al, 1992; Meyer-Weitz, 2005; Jamieson & Romer, 2008; Entwistle, 2021). Messaging that begins by emphasizing the unpredictability of risk may appeal to fatalists as showing that "they get me," but the needed next step – for example, emphasizing that fatalists can still reduce potential for infection by wearing masks or potential for hospitalization by getting vaccinated – may still conflict with fatalists' assumption that they cannot control their lives. Perhaps in this case a culturally consistent message can persuade fatalists to comply if that message acknowledges that only partial control of risks is possible, but "partial" is better than none, and luck favors those who try to help themselves and/or accept the help of others. A backup strategy, based on the premise that information campaigns intended to prompt rational changes of behaviors can be adversely affected by fatalists' passivity, is that default nudges may be an effective driver of behavior change (Sims & Bauman, 1972; Sunstein, 2017). For example, one could ensure that masks are given to everyone entering crowded places or that vaccines are injected in everyone unless they explicitly refuse them. However, a criticism has been that default nudges might maneuver fatalists into positions they would not rationally adopt (Entwistle, 2021). Understanding how to motivate people to choose to protect themselves is ethically important, but nudging fatalists may be seen as comparatively less ethically objectionable, as they see high risk (e.g., Johnson & Swedlow, 2021) but do not see a way to reduce risk on their own.

Third, regulators should realize that some cultural groups may have different perceptions in different countries. For example, Chinese individualists appear to perceive the risk as high and trust government, but American individualists seem to perceive the risk as low, perceive protective actions unfavorably, and distrust government. American egalitarians may perceive the risk as high, trust government, and have favorable perceptions, but Chinese egalitarians may distrust government. Similarly, public health officials should also become aware of the different ways cultural bias, behavioral intentions, and protective actions are associated across countries. For example, while fatalism may be an obstacle to adopting protective actions like wearing masks and avoiding gatherings in China, individualism and egalitarianism can be an obstacle to Americans wearing masks. These cultural differences between and within countries regarding protective actions, trust in government, and risk perceptions should be considered by public health officials in their design of risk management and risk communication programs regarding protective actions. Our research results continue to support CT scholars' suggestion that regulators must transform risk management into a "clumsy institution" in which none of the voices – that is, hierarchists' advocacy of command and control measures while fatalists ask "why bother?" – is excluded (Schapiro, 1988; Adams & Thompson, 2002; Parrado, 2020). Moreover, the complex relationship among

cultural biases, perceptions, and behaviors across two countries further reminds us that individualists may not automatically have a negative attitude, while egalitarians may not automatically have a positive attitude toward government and protective actions. Rather, their perceptions and attitudes may depend on whether they perceive that risk-related actions and organizations are congruent with their values (Yuan & Swedlow, 2022), for example, individualists relying on technology or the market and egalitarians insisting on community-level engagement in risk management. Value congruence can be an important mediator of cultural influences on policy and regulatory compliance.

Limitations

Limitations of our study, including some already mentioned, include:

1) using opportunity samples, which limits ability to generalize point estimates of descriptive statistics to the respective countries' adult populations, and different approaches to opportunity sampling in the two countries;
2) we could not control for the dynamics of either COVID-19's spread, or of public health measures, in either country, so that even if we had been able to launch our two surveys on the same date, we could not have tapped public views and behavioral intentions with both countries at the same "stage" of pandemic evolution and control. For example, the Chinese survey occurred when national guidelines on mask wearing had been promulgated and all provinces had reopened, while the US survey occurred under federal social distancing recommendations, and with diverse state policies on shutdowns and mask mandates (Figure 1). Therefore, different findings might reflect differences in actual risk condition between the two countries instead of or complementing differences in model applicability; for example, survey research conducted in February 2020, early in COVID-19's presence in China, found some results similar to our US research findings (e.g., a negative effect of individualism on trust in government; Yuan, 2021), as did research conducted later in the pandemic (in late May/early June 2020), when individualists did not support COVID-19 protective policies (Yuan & Swedlow, 2022). Moreover, given the divergence of COVID-19 incidence (and non-COVID-19, in prior epidemics) across countries in general, plus diversity in government regimes and pandemic policy implementation across countries, we reject the notion of a single pathway for pandemic evolution by which social scientists could schedule cross-national comparisons to ensure their national samples face the same context ("pandemic stage"). This is an uncontrollable and unquantifiable source of noise in our comparisons, but we think that the convergence of many of our results and observation of some expected cross-national differences yield a robust comparison;
3) use of cross-sectional analyses here to match up a one-time China survey with a US longitudinal panel study prevents causal claims, as only correlational claims are warranted (compare Li et al., 2021);
4) cross-national comparison using the same model must be done carefully to avoid misinterpretations (Johnson, 1991): for example, while our two

samples both use national versus college student samples, and both samples are more educated and younger than adults in their respective countries, these similarities preclude us deciding that the samples are equally representative or nonrepresentative of their respective nations' views;

5) greater unreliability of perception and particularly cultural bias measures in the Chinese versus the American sample, which may reflect some mix of cross-cultural differences, problematic conceptual as opposed to literal translation, and/or poor measurement of cultural biases and social relations in the original measures; and

6) removal of inattentive survey respondents (257 in the Chinese sample, 175 United States) was intended to improve stability overall and in fact improved model fit, but some results changed.

Conclusions

Regulation in general and regulatory compliance in particular as multidisciplinary fields in practice and interdisciplinary fields in aspiration have to grapple with many issues and dimensions simultaneously, as exemplified by our COVID-19 pandemic test bed. Regulators have had mixed success at best in getting compliance with protective actions, by both ordinary citizens and policymakers, across countries and time periods. Grasping what levels of compliance exist, and why, is critical to increasing success rates, but the traditional focus of regulatory studies – and most social science generally – on samples from WEIRD societies (Western, educated, industrialized, rich, and democratic; Henrich et al., 2010) limits generalization severely, and comparisons across WEIRD societies are not much more frequent. Our comparative analysis of a WEIRD and a non-WEIRD society suggests similarities and differences across cultural biases and/or countries in the associations between public perceptions and protective behaviors.

By using the PADM and the GGCT jointly, this research put two important streams of scholarship in conversation: studies of public health policy, on the one hand, and research on culturally motivated reasoning, on the other. The current study is not the first to apply PADM in United States and China (Wang & Liu, 2018; Wei et al., 2018), but our research is the first to apply the same model and measures to the same hazard at (roughly) the same time in both. In both countries, PADM helps to specify the pathways and mechanism for the formation and changes of public perceptions and policy compliances among four cultures proposed by GGCT. In particular, our comparative research found similarities in the role of perception of protective actions and differences in the role of risk perception and trust in government in influencing protective actions among individuals with different cultural biases in the two countries. In both countries, hierarchism increases protective behaviors via protective action perceptions. However, other effects of public perceptions on protective behaviors and indirect effects of cultural bias on protective behaviors via risk perceptions and protective actions vary across countries.

The PADM currently relies upon information sources (e.g., hazard warnings, official messages, media content, informal communications with family, friends, and others, etc.), receiver characteristics (e.g., demographics), and whether people

are able to access, attend to, and comprehend the information as expected producers of the perceptions that foster (or not) protective intentions and actions. But the PADM does not explain why there is variance in perceptions other than variance arising from available information. Further, the PADM does not explain why cultural differences in public perceptions exist. GGCT suggests that this is because individuals' cultural biases derived from their way of life or culture lead them to form their attitudes toward risks, risk-related organizations (e.g., the government), and policies to support the cultures with which they identify. We found evidence validating GGCT's expected relationships for hierarchical and fatalistic cultural biases and trust in government and protective action perceptions for both countries. Meanwhile, our findings that egalitarianism and individualism had opposite effects in the United States and China may reflect larger between-country differences. As GGCT suggests, a given cultural bias may express itself differently depending on which cultures dominate within a society (Chauvin & Chassang, 2021; Wildavsky, 2006). The history of relations among cultural biases including shifting and varying cultural coalitions within these societies (Chai & Wildavsky, 1998; Hood, 1998) and their changing and different influences on policy support and regulatory compliance, including via value congruence, may contribute to the variation we found.

It bears noting that the cultural differences between two countries may explain the lower reliability of the Chinese results. For example, translation and back-translation of survey items measuring cultural biases may be insufficient to adapt to the cultural context in China. Under Chinese culture, the term "authority" can be confusing because it can refer to people with political power but limited professional knowledge, or to people who are experts with limited political power (Yuan & Swedlow 2022). Moreover, in an authoritarian political system with extensive surveillance and strict censorship-related practices made more visible during COVID-19, Chinese respondents may be hesitant to answer questions such as "Society works best if power is shared equally" measuring egalitarian cultural bias, especially in the online survey. However, such problems may not exist in the United States. Therefore, how to improve the applicability of survey items in Chinese language and cultural contexts, ensure the respondents' security and anonymity, and build respondents' trust in researchers are particularly important for future research.

Our research has practical implications as well: first, while many risk communications aim to raise the general public's awareness of threat, prompting them to adopt more protective behaviors in Western countries, such campaigns may not be always uniformly successful in collectivistic society like China. Rather, fostering trust in government may be more effective in implementing protective actions in China than the United States regardless of individuals' cultural biases. Second, our findings about the indirect effects of subcultures on protective behaviors via influencing protective actions in both countries support the suggestions that crafting messages appealing to diverse cultural groups may foster the implementation of protective actions. However, third, our mixed findings suggest that risk management practitioners should be cautious that the *particular* perceptions toward risk, government, and protective actions that are culturally congenial to target audiences may vary with both national cultures and specific protective actions. In particular, while American individualists may be reluctant to adopt protective behaviors because they perceive the risk as low and perceive protective actions

unfavorably, it is not a problem for Chinese individualists, at least during the period of our study, although Chinese individualists show expected distrust of government and expected resistance to COVID-19 measures before and after our survey, respectively. Chinese public health officials need to approach egalitarians and fatalists who distrust government differently from hierarchists to be persuasive with them. This probably goes for individualists as well.

Paralleling these practical difficulties varying across hazards are long-standing theoretical challenges regarding both how to characterize standard (cross-hazard) models of factors in protective versus risky behavior, risk perception, and trust, and the role (if any) of more distal factors – including but not restricted to cultural biases – in hazard responses. The multifactorial mediation models tested here in China and the United States clearly did not resolve all practical and theoretical issues but exemplify the regulatory research needed to address them. We encourage our colleagues to join us in this pursuit.

References

Adams, J.G. and M. Thompson. 2002. "Taking Account of Societal Concerns About Risk: Framing the Problem." *Research Report for the Health and Safety Executive* **2002**.

Bargain, O., A. Ulugbek. 2020. *Poverty and Covid-19 in Developing Countries*. Bordeaux: Bordeaux University.

Bazzi, S., M. Fiszbein and M. Gebresilasse. 2021. "Rugged Individualism and Collective (in)action during the COVID-19 Pandemic." *Journal of Public Economics* **195**: 104357.

Bearth, A., L. Luchsinger and M. Siegrist. 2021. "Reactions of Older Swiss Adults to the COVID-19 Pandemic: A Longitudinal Survey on the Acceptance of and Adherence to Public Health Measures." *Social Science & Medicine* **280**: 114039. https://doi.org/10.1016/j.socscimed.2021.114039

Bergquist, S., T. Otten and N. Sarich. 2020. "COVID-19 Pandemic in the United States." *Health Policy and Technology* **9** (4): 623–638.

Bi, X., Q. Zhang, K. Fan, S.Y. Tang, H.W. Guan, X.Q. Gao, Y. Cui, Y. Ma, Q.H. Wu, Y.H. Hao, N. Ning and C. Liu. 2021. "Risk Culture and COVID-19 Protective Behaviors: A Cross-sectional Survey of Residents in China." *Frontiers in Public Health* **9**: 686705. https://doi.org/10.3389/fpubh.2021.686705

Boese-Schlosser, V.A., M. Bayerlein, S. Gates, K. Kamin and S.M. Murshed. 2023. *Trust Issues? How being Socialised in an Autocracy Shapes Vaccine Uptake*. Discussion Paper SP V 2023-502 Wissenschaftszentrum Berlin für Sozialforschung. https://bibliothek.wzb.eu/pdf/2023/v23-502.pdf

Boyle, R.P. and R.M. Coughlin. 1994. Conceptualizing and Operationalizing Culture Theory Variables. In *Politics, Policy and Culture*, eds. D.J. Coyle and R.J. Ellis. New York: Westview Press. pp. 191–218.

Brcka-Lorenz, A., Y. Chiang and T. Nelson Laird. 2013. Internal Consistency. FSSE [Faculty Survey of Student Engagement] Psychometric Portfolio. Downloaded from fsse.indiana.edu/pdf/pp/2013/FSSE13_Internal_Consistency_Reliability.pdf. 11 October 2017.

Brewer, N.T., N.D. Weinstein, C.L. Cuite and J.E. Herrington. 2004. "Risk Perceptions and Their Relation to Risk Behavior." *Annals of Behavioral Medicine*, **27** (2): 125–130.

Briggs, S.R. and J.M. Cheek. 1986. "The Role of Factor Analysis in the Evaluation of Personality Scales." *Journal of Personality*, **54** (1): 106–148.

Brouard, S., P. Vasilopoulos and M. Becher. 2020. "Sociodemographic and Psychological Correlates of Compliance with the COVID-19 Public Health Measures in France." *Canadian Journal of Political Science* **16** (4): 1–6.

Chai, S., M. Kim and M. Liu. 2009. "Cultural Comparisons of Beliefs and Values: Applying the Grid-group Approach to the World Values Survey." *Beliefs and Values*, **1** (2): 193–208.

Chai, S. and A. Wildavsky. 1998. Cultural Change, Party Ideology, and Electoral Outcomes. In *Culture and Social Theory*, eds. A. Wildavsky. New Brunswick, NJ: Transaction Publishers. pp. 299–316.

Chauvin, B. and I. Chassang. 2021. "Cultural Orientation and Risk Perception: Development of a Scale Operating in a French Context." *Risk Analysis*. https://doi.org/10.1111/risa.13859

Cheung, H., L. Mazerolle, H.P. Possingham, K.-P. Tam and D. Biggs. 2020. "A Methodological Guide for Translating Study Instruments in Cross-cultural Research: Adapting the 'Connectedness to Nature' Scale into Chinese." *Methods in Ecology and Evolution* **11** (11): 1379–1387.

Christensen, T. and L. Ma. 2021. "Comparing SARS and COVID-19: Challenges of Governance Capacity and Legitimacy." *Public Organization Review* **21**: 629–645.

Clark, L.A. and D. Watson. 1995. "Constructing Validity: Basic Issues in Objective Scale Development." *Psychological Assessment*, **7** (3): 309–319.

Cornia, A., K. Dressel and P. Pfeil. 2016. "Risk Cultures and Dominant Approaches Towards Disasters in Seven European Countries." *Journal of Risk Research* **19** (3): 288–304.

Dai, B., D. Fu, G. Meng, B. Liu, Q. Li and X. Liu. 2020. "The Effects of Governmental and Individual Predictors on COVID-19 Protective Behaviors in China: A Path Analysis Model." *Public Administration Review* **80**(5): 797–804.

Davison, C., S. Frankel and G. Davey Smith. 1992. "The Limits of Lifestyle: Re-Assessing 'Fatalism' in the Popular Culture of Illness Prevention." *Social Science and Medicine* **34** (6): 675–685.

Davy, B. 2021. "Social Distancing and Cultural Bias." *Journal of the American Planning Association* **87**(2): 159–166.

de Vaus, D. 2002. Analyzing Social Science Data: 50 Key Problems. In *Data Analysis*. Thousand Oaks, CA, Sage.

Devine, D., J. Gaskell, W. Jennings and G. Stoker. 2020. "Covid19? Trust and the Coronavirus Pandemic: What Are the Consequences of and for Trust? An Early Review of the Literature." *Political Studies Review* **19**: 274–285.

Douglas, M. 1999. "Four Cultures: The Evolution of a Parsimonious Model." *GeoJournal* **47** (3): 411–415.

Douglas, M. and A. Wildavsky. 1983. *Risk and Culture an Essay on the Selection of Technological and Environmental Dangers*. University of California Press. https://doi.org/10.1525/9780520907393

Dryhurst, S., C.R. Schneider, J. Kerr, A.L.J. Freeman, G. Recchia, A.M. van der Bles, D. Spiegelhalter and S. van der Linden. 2020. "Risk Perceptions of COVID-19 Around the World." *Journal of Risk Research* **23**(7–8): 994–1006.

Earle, T. and M. Siegrist. 2008. "Trust, Confidence and Cooperation Model: A Framework for Understanding the Relation Between Trust and Risk Perception." *International Journal of Global Environmental Issues* **8** (1): 17–29.

Elazar, D.J. 1994. *The American Mosaic: The Impact of Space, Time, and Culture on American Politics*. Boulder, CO: Westview Press.

Entwistle, T. 2021. "Why Nudge Sometimes Fails: Fatalism and the Problem of Behaviour Change." *Policy & Politics* **49**(1): 87–103.

Falk, R.F. and N. Miller. 1992. "A Primer for Soft Modelling, University of Akron Press, Akron, Ohio. Fisher, D. and Smith, S. (2011). Cocreation is Chaotic: What it Means for Marketing when no one has Control." *Marketing Theory* **11** (3): 325–350.

Favre, M., B. Swedlow and M. Verweij. 2019. "A Cultural Theory and Model of Power Relations." *Journal of Political Power* **12** (2): 245–275.

Fishbein, M.F. and I. Ajzen. 2010. *Predicting and Changing Behavior: The Reasoned Action Approach*. Psychology Press.

Fornell, C. and D.F. Larcker. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error." *Journal of Marketing Research* **18** (1): 39–50.

Green, E.G.T., J.-C. Deschamps and D. Páez. 2005. "Variation of Individualism and Collectivism Within and Between 20 Countries: A Typological Analysis." *Journal of Cross-Cultural Psychology* **36** (3): 321–339.

Grendstad, G. 2003. "Reconsidering Nordic Party Space." *Scandinavian Political Studies* **26** (3): 193–217.

Güss, C.D. and M.T. Tuason. 2021. "Individualism and Egalitarianism can Kill: How Cultural Values Predict Coronavirus Deaths Across the Globe." *Frontiers in Psychology* **12**: 620490.

Hair, J.F., G.T.M. Hult, C.M. Ringle, M. Sarstedt. 2017. *A Primer on Partial Least Squares Equation Modeling (PLS-SEM)*, 2nd ed. Thousand Oaks, CA, USA: Sage Publication, Inc.

Hair, J.F., C.M. Ringle and M. Sarstedt. 2011. "PLS-SEM: Indeed a Silver Bullet." *Journal of Marketing Theory and Practice* **19** (2): 139–151.

Harper, C.A., L.P. Satchell, D.Fido and R.D. Latzman. 2020. "Functional Fear Predicts Public Health Compliance in the COVID-19 Pandemic." *International Journal of Mental Health and Addiction* **19** (5): 1875–1888.

Hayes, A. 2021. *Simple Random Sample*. Investopedia. Retrieved from https://www.investopedia.com/terms/s/simple-random-sample.asp

Henrich, J., S.J. Heine and A. Norenzayan. 2010. "The Weirdest People in the World?" *Behavioral and Brain Sciences* **33**(2-3): 61–83.

Hofstede, G. 2001. *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations*, 2nd ed. Sage.

Hofstede, G. 2011. "Dimensionalizing Cultures: The Hofstede Model in Context." *Online Readings in Psychology and Culture* **2** (1): 8. https://doi.org/10.9707/2307-0919.1014

Hood, C. 1998. *The Art of the State: Culture, Rhetoric, and Public Management*. Oxford University Press.

Jamieson, P.E. and D. Romer. 2008. "Unrealistic Fatalism in U.S. Youth Ages 14 to 22: Prevalence and Characteristics." *Journal of Adolescent Health* **42** (2): 154–160.

Jenkins-Smith, H.C. and W.K. Smith. 1994. Ideology, Culture, and Risk Perception. In *Politics, Policy, and Culture*, eds. D.J. Coyle and R.J. Ellis. Westview Press, pp. 17–32.

Johnson, B.B. 1991. "Risk and Culture Research: Some Cautions." *Journal of Cross-Cultural Psychology* **22** (1): 141–149.

Johnson, B.B. 2017. "Explaining Americans' Responses to Dread Epidemics: An Illustration with Ebola in Late 2014." *Journal of Risk Research* **20** (10): 1338–1357.

Johnson, B.B. 2019. "Americans' Views of Voluntary Protective Actions Against Zika Infection: Conceptual and Measurement Issues." *Risk Analysis* **39**(12): 2694–2717.

Johnson, B.B. 2022. "Affect Toward the Policy Option Versus the Hazard Differentially Mediates Cultural Effects on Americans' Zika Risk Perceptions and Policy Support: Comparing the Solution Aversion-based Model and the Affect Heuristic-cultural Cognition Theory Model." *Human and Ecological Risk Assessment: An International Journal* **28** (3–4): 281–315.

Johnson, B.B. and M. Mayorga. 2021a. "Americans' Early Behavioral Responses to COVID-19." *Human and Ecological Risk Assessment: An International Journal* **27** (7): 1733–1746.

Johnson, B.B. and M. Mayorga. 2021b. "Temporal Shifts in Americans' Risk Perceptions of the Zika Outbreak." *Human and Ecological Risk Assessment: An International Journal* **27** (5): 1242–1257.

Johnson, B.B. and B. Swedlow. 2021. "Cultural Theory's Contributions to Risk Analysis: A Thematic Review with Directions and Resources for Further Research." *Risk Analysis* **41** (3): 429–455.

Johnson, B.B., B. Swedlow and M.W. Mayorga. 2020. "Cultural Theory and Cultural Cognition Theory Survey Measures: Confirmatory Factoring and Predictive Validity of Factor Scores for Judged Risk." *Journal of Risk Research* **23** (11): 1467–1490.

Jones, M.D. 2014. "Communicating Climate Change: Are Stories Better than "Just the Facts"?" *Policy Studies Journal* **42** (4): 644–673. https://doi.org/10.1111/psj.12072

Jørgensen, F., A. Bor and M.B. Petersen. 2021. "Compliance Without Fear: Individual-level Protective Behaviour during the First Wave of the COVID-19 Pandemic." *British Journal of Health Psychology* **26** (2): 679–696.

Kahan, D.M. 2012. Cultural Cognition as a Conception of the Cultural Theory of Risk. In *Handbook of Risk Theory Epistemology, Decision Theory, Ethics, and Social Implications of Risk*, eds. Sabine Roeser, Rafaela Hillerbrand, Per Sandin and Martin Peterson. New Haven, CT, USA: Yale University, pp.725–759.

Kahan, D.M. 2015. "What is the "Science of Science Communication"?" *Journal of Science Communication* **14** (3): 1–10.

Kim, H.K. and Y. Kim. 2019. "Risk Information Seeking and Processing about Particulate Air Pollution in South Korea: The Roles of Cultural Worldview." *Risk Analysis* **39** (5): 1071–1087.

Kim, Y., W. Zhong, M. Jehn and L. Walsh. 2015. "Public Risk Perceptions and Preventive Behaviors during the 2009 H1N1 Influenza Pandemic." *Society for Disaster Medicine and Public Health* **9** (2): 145–154.

King, G., C.J.L. Murray, J.A. Salomon and A. Tandon. 2004. "Enhancing the Validity and Cross-cultural Comparability of Measurement in Survey Research." *American Political Science Review* **98** (1): 191–205.

Kirkland, R. 2005. *Taoism: The Enduring Tradition*. Routledge.

Kwiringira, J.N., P. Ariho, H. Zakumumpa, J. Mugisha, J. Rujumba and M.M. Mugisha. 2019. "Livelihood Risk, Culture, and the HIV Interface: Evidence from Lakeshore Border Communities in Buliisa District, Uganda." *Journal of Tropical Medicine* **2019**: 6496240. https://doi.org/10.1155/2019/6496240

Li, H., X. Chen and H. Huang. 2020. "The Novel Coronavirus Outbreak: What can be Learned from China in Public Reporting?" *Global Health Research and Policy* **5**: 9.

Li, Y., S. Luan, Y. Li, J.Wu, W. Li and R. Hertwig. 2021. "Does Risk Perception Motivate Preventive Behavior During a Pandemic? A Longitudinal Study in the United States and China." *American Psychologist* **77** (1): 111–123.

Lindell, M.K. and R.W. Perry. 2012. "The Protective Action Decision Model: Theoretical Modifications and Additional Evidence." *Risk Analysis* **32** (4): 616–632.

Lindell, M.K., C.S. Prater, H.C. Wu, S.-K. Huang, D.M. Johnston, J.S. Becker and H. Shiroshita. 2016. "Immediate Behavioural Responses to Earthquakes in Christchurch, New Zealand, and Hitachi, Japan." *Disasters* **40** (1): 85–111.

Lindenberg, S., F. Six and K. Keizer. 2020. Social Contagion and Goal Framing: The Sustainability of Rule Compliance. In *Cambridge Handbook of Compliance*, eds. D. Daniel Sokol and Benjamin van Rooij. Cambridge: Cambridge University Press.

Liu, L.-Y. 2018. "How Radical is Too Radical? Public Perception of Taiwanese Environmental Nonprofit Organizations' Activism." *Social Science Quarterly* **99** (4): 1426–1445.

Liu, Z. and J. Yang. 2021. "Public Support for COVID-19 Responses: Cultural Cognition, Risk Perception, and Emotions." *Health Communication*. https://doi.org/10.1080/10410236.2021.1965710

Lounsbury, J.W., R.A. Saudargas, L.W. Gibson and F.T. Leong. 2005. "An Investigation of Broad and Narrow Personality Traits in Relation to General and Domain-specific Life Satisfaction of College Students." *Research in Higher Education* **46** (6): 707–729.

Luo, C., A. Chen, B. Cui and W. Liao. 2021. "Exploring Public Perceptions of the COVID-19 Vaccine Online from a Cultural Perspective: Semantic Network Analysis of Two Social Media Platforms in the United States and China." *Telematics and Informatics* **65**: 101712.

Maleki, A. and F. Hendriks. 2014. "Grid, Group, and Grade: Challenges in Operationalizing Cultural Theory for Cross-national Research." *Cross-Cultural Research*. https://journals.sagepub.com/doi/abs/10.1177/1069397114555843

Mayer, A. and E.K. Smith. 2019. "Unstoppable Climate Change? The Influence of Fatalistic Beliefs about Climate Change on Behavioural Change and Willingness to Pay Cross-nationally." *Climate Policy* **19** (4): 511–523.

Mayorga, M.W. and B.B. Johnson. 2019. "A Longitudinal Study of Concern and Judged Risk: The Case of Ebola in the United States, 2014–2015." *Journal of Risk Research* **22** (10): 1280–1293.

Meyer-Weitz, A. 2005. "Understanding Fatalism in HIV/AIDS Protection: the Individual in Dialogue with Contextual Factors." *African Journal of AIDS Research* **4**(2): 75–82.

Milfont, T.L. and R. Fischer. 2015. "Testing Measurement Invariance Across Groups: Applications in Cross-cultural Research." *International Journal of Psychological Research* **3** (1): 111–130.

Moyer, R.M., G. Song, Natalie Jackson. 2021. "Face Coverings during the Pandemic?" *World Medical & Health Policy* **13** (4): 616–633.

Ngonghala, C.N., E.A. Iboi and A.B. Gumel. 2020. "Could masks curtail the post-lockdown resurgence of COVID-19 in the US?." *Mathematical Biosciences* **329**: 108452.

Olli, E. and B. Swedlow. 2022. "Cultural Theory, Rejection of Cultural Bias, and Party Preference." *Party Politics*.

Parrado, S. 2020. "The Culture of Risk Regulation: Responses to Environmental Disasters." *Regulation & Governance* **14** (3): 599–615.

Pfattheicher, S., L. Nockur, R. Böhm, C Sassenrath, M.B. Petersen. 2020. "The Emotional Path to Action: Empathy Promotes Physical Distancing and Wearing face Masks During the COVID-19 Pandemic." *Psychological Science* **31** (11): 1363–1373.

Powe, B.D. and R. Finnie. 2003. "Cancer Fatalism: the State of the Science." *Cancer Nursing* **26** (6): 454–65. https://doi.org/10.1097/00002820-200312000-00005

Reinders Folmer, C.P., M.A. Brownlee, A.D. Fine, E.B. Kooistra, M.E. Kuiper, E.H. Olthuis, et al. 2021. "Social Distancing in America: Understanding Long-term Adherence to COVID-19 Mitigation Recommendations." *PLoS ONE* **16** (9): e0257945. https://doi.org/10.1371/journal.pone.0257945

Ripberger, J.T., K. Gupta, C.L. Silva and H.C. Jenkins-Smith. 2014. "Cultural Theory and the Measurement of Deep Core Beliefs within the Advocacy Coalition Framework." *Policy Studies Journal* **42** (4): 509–527.

Rohrmann, B. and H. Chen. 1999. "Risk Perception in China and Australia: An Exploratory Crosscultural Study." *Journal of Risk Research* **2** (3): 219–241.

Schapiro, M. 1988. "Introduction: Judicial Selection and the Design of Clumsy Institutions." *Southern California Law Review*, **61**: 1559–1569.

Schwartz, S.H. 1994. Beyond Individualism/Collectivism: New Cultural Dimensions of Values. In *Cross-Cultural Research and Methodology Series. Vol. 18. Individualism and Collectivism: Theory, Method, and Applications*, eds. Kim U., Triandis H. C., Kâgitçibaşi Ç., Choi S.-C., Yoon G.. Thousand Oaks, CA: Sage Publications, pp. 85–119.

Shi, T. 2015. *The Cultural Logic of Politics in Mainland China and Taiwan*. Cambridge University Press.

Siegrist, M. and A. Bearth. 2021. "Worldviews, Trust, and Risk Perceptions Shape Public Acceptance of COVID-19 Public Health Measures." *Proceedings of the National Academy of Sciences* **118** (24): e2100411118. https://doi.org/10.1073/pnas.2100411118

Siegrist, M., L. Luchsinger, and A. Bearth. 2021. "The Impact of Trust and Risk Perception on the Acceptance of Measures to Reduce COVID-19 Cases." *Risk Analysis* **41** (5): 787–800.

Siegrist, M. and A. Zingg. 2014. "The Role of Public Trust During Pandemics: Implications for Crisis Communication." *European Psychologist* **19** (1): 23–32.

Sims, J.H. and D.D. Baumann. 1972. "The Tornado Threat: Coping Styles of the North and South." *Science* **176**: 1386–1392.

Singleton, B.E. and R. Lidskog. 2018. "Science, Red in Tooth and Claw: Whaling, Purity, Pollution and Institutions in Marine Mammal Scientists' Boundary Work." *Environment and Planning E: Nature and Space* **1** (1-2): 165–185.

Six, F., S. de Vadder, M. Glavina, K. Verhoest and K. Pepermans. 2021. "What Drives Compliance with COVID-19 Measures Over Time? Explaining Changing Impacts with Goal Framing Theory." *Regulation & Governance*. https://doi.org/10.1111/rego.12440

Song, G., C. Silva and H. Jenkins-Smith. 2014. "Cultural Worldview and Preference for Childhood Vaccination Policy." *Policy Studies Journal* **42** (4): 528–554.

Sunstein, C.R. 2017. "Nudges that Fail." *Behavioural Public Policy* **1** (1): 4–25.

Swedlow, B., J.T. Ripberger, L-Y. Liu, C.L. Silva, H. Jenkins-Smith and B.B. Johnson. 2020. "Construct Validity of Cultural Theory Survey Measures." *Social Science Quarterly* **101** (6): 2332–2383.

Terpstra, T. and M.K. Lindell. 2013. "Citizens' Perceptions of Flood Hazard Adjustments: An Application of the Protective Action Decision Model." *Environment and Behavior* **45** (8): 993–1018.

Thompson, M., R. Ellis and A. Wildavsky. 1990. *Cultural Theory*. Westview Press.

Tikir, A. and B. Lehmann. 2011. "Climate Change, Theory of Planned Behavior and Values: A Structural Equation Model with Mediation Analysis." *Climatic Change* **104**: 389–402.

Traub, R.E. 1994. *Reliability for the Social Sciences: Theory and Applications*. Thousand Oaks, CA: Sage.

Trizano-Hermosilla, I. and J.M. Alvarado. 2016. "Best Alternatives to Cronbach's Alpha Reliability in Realistic Conditions: Congeneric and Asymmetrical Measurements." *Frontiers in Psychology* **7** (769): 1–8. https://doi.org/10.3389/fpsyg.2016.00769

Tumlison, C., R. Moyer and G. Song. 2017. "The Origin and Role of Trust in Local Policy Elites' Perceptions of High-Voltage Powerline Installations in the State of Arkansas." *Risk Analysis* **37** (5): 1018–1036.

Wang, F. and H. Liu. 2018. "Comparing the Adoption of Protective Behaviors: The Framing Effects of National Culture and Hazard Onset Type." *Human and Ecological Risk Assessment: An International Journal* 24 (7): 1813–1837.

Wang, F., J. Wei, S. Huang, M.K. Lindell, Y. Ge and H. Wei. 2018. "Public Reactions to the 2013 Chinese H7N9 Influenza Outbreak: Perceptions of Risk, Stakeholders, and Protective Actions." *Journal of Risk Research* 21 (7): 809–833.

Wang, Y., J. Leach, J. Kim and S. Lee. 2023. "Support for COVID-19 Mandatory Vaccination in the United States: Examining the Role of Cultural Worldviews, Risk-benefit Perceptions, and Trust in Scientists." *Journal of Science Communication* 22(02): A03.

Wei, H.-L., M.K. Lindell, C.S. Prater, J. Wei and F. Wang. 2020. "Texas Households' Expected Responses to Seasonal Influenza." *Journal of Risk Research* 24 (11): 1405–1425.

Wei, H.-L., M.K. Lindell, C.S. Prater, J. Wei, F. Wang and Y.G. Ge. 2018. "Perceived Stakeholder Characteristics and Protective Action for Influenza Emergencies: A Comparative Study of Respondents in the United States and China." *International Journal of Mass Emergencies and Disasters* 36 (1): 52–70.

Weinstein, N.D. 1988. "The Precaution Adoption Process." *Health Psychology* 7 (4): 355–386.

Weinstein, N.D. and P.M. Sandman. 1992. "A Model of the Precaution Adoption Process: Evidence from Home Radon Testing." *Health Psychology* 11 (3): 170–180.

White, M.P. and B.B. Johnson. 2010. "The Intuitive Detection Theorist (IDT) Model of Trust in Hazard Managers." *Risk Analysis* 30 (8): 1196–1209.

Wildavsky, A. 2006. *Cultural Analysis: Politics, Public Law, and Administration*. New Brunswick, NJ: Transaction Publishers.

World Health Organization (WHO). 2023. WHO Coronavirus (COVID-19) Dashboard. https://covid19.who.int

Xue, W., D.W. Hine, A.D.G. Marks, W.J. Phillips and S. Zhao. 2016. "Cultural Worldviews and Climate Change: A View from China." *Asian Journal of Social Psychology* 19 (2): 134–144.

Yu, N. and F. Shen. 2013. "Benefits for Me or Risks for Others: A Cross-Culture Investigation of the Effects of Message Frames and Cultural Appeals." *Health Communication* 28 (2): 133–145.

Yuan, M. 2021. "Explaining Chinese Reactions to COVID-19 During the Outbreak: A Systematic Illustration." *Frontiers in Public Health* 8 (9): 727369

Yuan, M., J. Zeng, B. Swedlow and R. Qi. 2022. "Environmental Concern among Chinese Youth: The Roles of Knowledge and Cultural Bias." *Environmental Education Research* 28 (10): 1472–1489.

Yuan, Meng and B. Swedlow. 2022. "Chinese Cultural Biases, Value Congruence, and Support for and Compliance with Protective Policies During the COVID-19 Pandemic." *Review of Policy Research*.

Zeng, J., M. Jiang and M. Yuan. 2020. "Environmental Risk Perception, Risk Culture, and Pro-environmental Behavior." *International Journal of Environmental Research and Public Health* 17 (5): 1750.

Zhang, A.X. 2021. "Understanding the Cultural Orientations of Fear Appeal Variables: A Cross-Cultural Comparison of Pandemic Risk Perceptions, Efficacy Perceptions, and Behaviors." *Journal of Risk Research* 24 (3-4): 432–448.

Zhang, Y., S. Liu, and J.A. Jun. 2022. "A Comparative Study on the Cultural Dimensions and Health Perception of the COVID-19 Pandemic Between China and the United States." *Healthcare* 10 (6): 1081.

Zhou, W., B. Tang, Y. Bai, Y. Shao, Y. Xiao and S. Tang. 2022. "The Resurgence Risk of COVID-19 in China in the Presence of Immunity Waning and ADE: A Mathematical Modelling Study." *Vaccine* 40(49): 7141–7150.