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Collectivistic orientation moderates the effect of personal control on evaluations of societal disease-control measures: During and beyond the COVID-19 crisis in China

Nan Zhu[1] | **Yang Li**[2] | **Lei Chang**[1]

[1]Department of Psychology, University of Macau, Macau, China

[2]School of Social Informatics, Nagoya University, Nagoya, Japan

Correspondence
Lei Chang, Department of Psychology, Humanities and Social Sciences Building E21-3045, University of Macau, Macau 999078, China.
Email: chang@um.edu.mo

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Abstract

Two pre-registered studies examined people's psychological collectivism, personal control, and attitudes toward disease-control measures in the context of the COVID-19 crisis and more generalized contexts. Study 1 surveyed 819 residents in Shanghai in late May 2022 when they were undergoing a stringent city-wide lockdown caused by an outbreak of the Omicron variant. We found that participants' psychological collectivism attenuated the negative association between experiences of COVID-19 restrictions and personal control and enhanced the positive association between personal control and support for COVID-19 restrictions. Study 2 (N=403) recruited an online sample with diverse backgrounds and demographic characteristics and sought to extend the findings of Study 1 beyond the context of the COVID-19 pandemic. Participants were exposed to a series of hypothetical scenarios depicting a fictitious virus with varying fatality and transmissibility. As in Study 1, participants higher in psychological collectivism exhibited a stronger positive association between personal control and endorsement of stricter societal disease-control measures, but only in low-fatality, high-transmissibility situations. The implications of these findings for facilitating public support for disease-control efforts are discussed.

KEYWORDS

COVID-19 pandemic, cultural orientation, disease prevention, personal control, psychological collectivism, sense of control

1 | INTRODUCTION

On March 11, 2020, the World Health Organization declared the outbreak of COVID-19 disease a global pandemic. For the next 2 years, this highly transmissible disease prompted governments across the globe to issue various disease-control guidelines and measures (e.g., mobility restrictions, quarantine, and contact tracing) to constrain its spread (Hale et al., 2020; Harring et al., 2021). Some of these efforts have achieved greater success than others according to studies comparing disease-prevention-related behavioural data during the pandemic (Lu et al., 2021), which are likely linked to differential degrees of compliance and psychological support for disease-control measures (Clark et al., 2020). Indeed, there is evidence of cross-society and within-society variations in people's faith in or compliance with disease-control policies, likely mediated by their cultural orientations (Chen et al., 2021; Maaravi et al., 2021; Xiao, 2021). In particular, a collectivistic orientation might be conducive to social norms and cognitive tendencies that facilitate societal disease control (Shapouri, 2023) and might affect the balance between concerns for personal autonomy and societal disease-control efforts (Zhu et al., 2021).

2 | COLLECTIVISM AND DISEASE CONTROL

From an adaptive functional perspective, the psychological foundation for societal disease control is likely culturally shaped to fit the local ecological condition. In particular, a possible adaptive function of collectivistic values (e.g., ingroup loyalty, strong family ties, obedience rather than self-reliance) is to coordinate collective actions to minimize infections of novel pathogens in regions with high disease stress (Fincher & Thornhill, 2012; Shapouri, 2023). Cross-cultural comparisons provided some (but not unequivocal) support for this view (Cashdan & Steele, 2013; Fincher & Thornhill, 2012; reviewed by Shapouri, 2023). For example, research has found that historical (but not contemporary) pathogen prevalence at the regional level significantly predicted collectivistic orientation (Fincher et al., 2008), various indicators of conformity (Murray et al., 2011), and endorsement of group-focused moral concerns (e.g., loyalty toward ingroups, respect for authorities; Van Leeuwen et al., 2012), all of which are conceptually linked to collectivism and might facilitate societal disease-control efforts. Collectivism, in turn, predicted lower COVID-19 cases during the pandemic (Cho et al., 2022; Maaravi et al., 2021).

Importantly, the disease-prevention function of collectivism might also manifest at the individual level. Individual differences in collectivistic orientation or psychological collectivism (i.e., the tendency to attend to the needs of others belonging to the same group or society and accord priority to the group and societal goals; Jackson et al., 2006; Triandis, 2002) might be adapted to the social navigation requirement posed by temporal variations in local pathogen adversity (Thornhill & Fincher, 2014). Cross-society and within-society research has also generally linked collectivistic orientation to compliance with lockdown rules (Chen et al., 2021; Xiao, 2021), support for social distancing measures (Wang, 2021), disease-prevention intentions shown in social media data (F. Huang et al., 2020), and the likelihood of vaccination (Cho et al., 2022). Additionally, these effects seem to be adaptively adjusted by perceived threats of infectious diseases. Research showed that disease-protection factors such as vaccination attenuated individuals' xenophobic attitudes (J. Y. Huang et al., 2011), whereas feeling vulnerable to disease infection increased the tendencies of conformity (B. P. Wu & Chang, 2012). Nevertheless, existing research on the aforementioned pathogen prevalence perspective did not provide an in-depth explication of the psychological mechanism regarding how psychological collectivism might attenuate negative psychological consequences and promote support for coordinated disease-control efforts at the societal level.

2.1 | Personal control as a mechanism behind disease prevention

Personal control (i.e., individuals' beliefs about their capacities to bring about desired outcomes and avoid undesirable ones; Thompson, 2020) has been examined as a common psychological consequence as well as a potential mechanism behind individuals' attitude toward or compliance with disease-control measures (e.g., Clark et al., 2020; Li & Zhu, 2022; Šrol et al., 2021). Personal control has been theoretically and empirically linked to sense of autonomy, future-oriented behaviours, and health-promoting outcomes (e.g., Lachman & Weaver, 1998; Mittal & Griskevicius, 2014; Peterson & Stunkard, 1989; Rodin, 1986). Beneficial effects of personal control have been found even when the level of perceived control is unrealistic and when people face severe restrictions (Alloy & Clements, 1992; Thompson et al., 1993). Conversely, lack of control is linked to many negative consequences (Seligman, 1975). Both the uncertainty caused by the infectious disease and the negative consequences of the compulsory implementation of preventive measures (e.g., mental health issues triggered by social isolation, financial stress due to loss of income) might lead to the experience of a loss of personal control (Pietrabissa & Simpson, 2020; Usher et al., 2020), which is detrimental to personal health and well-being (Zhou et al., 2023). A lack of control is also conducive to a heightened endorsement of COVID-19 conspiracies (Šrol et al., 2021), which might dissuade people from adopting preventive behaviours (Allington et al., 2021; Imhoff & Lamberty, 2020).

Nevertheless, recent evidence showed that societal norms or regulations about disease control might also boost people's preventive behaviours when these are believed to be effective in reducing infection (Clark et al., 2020; Li & Zhu, 2022). This, in turn, might render people with higher personal control more supportive of such effective measures that protect them from the disease (Zhu, Lu, & Chang, 2020). Individuals with a greater sense of personal control should be more prepared to comply with and actively support actions to eliminate environmental threats (Thompson, 2020), which include societal disease-control measures in the face of communicable diseases. Indeed, one recent study found that personal control, through its negative effect on psychological stress, positively predicted participation in COVID-19 preventive efforts (e.g., promoting preventive practices) but negatively predicted compliance with COVID-19 preventive regulations among Chinese college students (Li & Zhu, 2022). Individuals were also more likely to endorse preventive measures when they believed that infections could be avoided (Chan et al., 2021; Clark et al., 2020), which might have boosted their personal control over the infection risk.

To reconcile these findings with the previous ones, one explanation is that psychological collectivism might "restructure" the relationship between personal control and societal disease control (Zhu, Lu, & Chang, 2020). Specifically, for collectivists who value collective safety to a greater degree than individualists do, the disease-control restrictions' detrimental effects on personal control should be attenuated by their effectiveness in reducing infection and mortality risks. Collectivists should also prefer to exert their personal control in ways that serve the collective goal (e.g., to contain the virus) rather than defying societal rules (e.g., breaking disease-prevention protocols and rules; Li & Zhu, 2022; Zhu, Lu, & Chang, 2020). Thus, the positive association between personal control and the support for stricter societal disease-control measures should be stronger for people endorsing collectivism to a greater degree. A recent cross-cultural comparison showed that Chinese individuals' collectivistic concerns were associated with greater tolerance of collective actions to reduce disease infection rates at the cost of individuals' autonomy and freedom, but similar effects were not found among US or Japanese individuals (Zhu et al., 2021). This pattern of findings might be attributable to elevated concerns among Chinese individuals for collective goals such as order and harmony (Hofstede & Bond, 1988) in the face of conflicts between the collective and individuals (Zhu, Hawk, & Smetana, 2020).

Finally, to the degree that people's support for societal disease-control measures reflects the activation of pathogen-avoidance mechanisms, such attitudes should be contingent on subjective evaluations of the disease threat. Indeed, research has shown that individuals' support for disease-prevention measures is moderated by contextual factors such as cultural norms and the perceived effectiveness of the preventive measures (Clark et al., 2020; Li & Zhu, 2022). Moreover, a recent study based on Internet search data in China indicates that after the Omicron variant (known for its low death risk) became the dominant strain, the negative psychological effects of societal restrictive measures began to outweigh the positive ones, suggesting that people are sensitive to the changing nature of the virus (Zhou et al., 2023). Thus, the aforementioned mechanism for the attitude toward societal disease-control measures involving personal control and psychological collectivism is likely adaptive when applied to a specific range of circumstances. Specifically, when implementing collective preventive actions bring about unclear or very small benefits (e.g., in response to pathogens with low fatality or low transmissibility), or are too costly, people should universally reduce their support for overly stringent societal restrictions. Conversely, pathogens with very high fatality should universally invoke strong disease control responses in any society. In both cases, individuals' personal control likely does not matter much for their support for disease-control efforts. We reason, however, that both personal control and psychological collectivism should matter for people's evaluation of societal disease-control measures when they face ambivalent disease threats generated by pathogens with low fatality but high transmissibility.

2.2 | The current research

The current research sought to deepen our understanding of the role of psychological collectivism in promoting societal disease-control efforts. The aforementioned reasoning leads to three hypotheses:

> **H1.** Prolonged experiences of COVID-19 restriction should have a stronger detrimental effect on personal control for people lower in psychological collectivism.
>
> **H2.** Personal control might have a stronger positive effect on the support for stricter societal disease-control measures among people higher in psychological collectivism.
>
> **H3.** These effects should be contingent on a specific range of perceived mortality and transmissibility of the disease (specifically, relatively low mortality and high transmissibility).

We sought to test these hypotheses in China, a society that managed to largely contain the spread of COVID-19 through societal disease-control measures (Burki, 2020) by the time of this research. Since early 2022, with the rest of the world gradually opening up, experts have begun to cast doubt on the benefits and viability of continuing strict zero-COVID policies in China (Guan & Zhong, 2022). Public opinions within China also vary greatly regarding harsh and costly societal restrictions in response to the resurgence of COVID-19, especially since the highly controversial Shanghai lockdown from March to May 2022 (Ni, 2022). Emerging evidence showed that the stringent lockdown measures imposed by the city government were linked to deteriorating social functioning and severe psychological health issues among adults and youths (Hall et al., 2023; Liu et al., 2023), especially for those with greater exposure to COVID-19 risks and poorer interaction quality with family and friends (J. Wu et al., 2023). Detailed discussions of the background of the 2022 Shanghai lockdown and its psychological impacts are included in the supplementary file Data S1 in the Supporting Information. Despite these concerns about the detrimental effects of draconian disease-control measures, people also worried that relaxing these measures would bring about disastrous consequences given the low natural immunity, diminishing effectiveness of

vaccines, and low per capita medical resources among the Chinese population (Shepherd & Chiang, 2022). Overall, our investigation was partly based on this special societal background, which provides a unique opportunity to examine the roles of psychological collectivism and personal control on attitudes toward societal disease-control measures.

Our two studies tested the effect of psychological collectivism on the relationship between personal control and societal disease prevention in two steps. In Study 1, we investigated the relationships among experienced COVID-19 restrictions (or the negative impacts of COVID-19), personal control, and support for restrictive disease-control measures during the period of city-wide lockdown in Shanghai (the study was conducted in late May 2022, near the end of the lockdown period). Unlike most previous research that examined collectivistic orientation as a straightforward predictor of responses related to disease prevention, we examined a moderated mediation model (Figure 1), wherein psychological collectivism also serves as the moderator of the psychological mechanism involving personal control. In this model, we also included perceived vulnerability and subjective social status as covariates, given that past research has shown that perceived susceptibility and socioeconomic status (SES) might be related to individuals' attitudes toward disease-control measures and health-related judgements in general (e.g., Brouard et al., 2020; Wang, 2021). Based on the findings of Study 1, which is seen as a special case, Study 2 (conducted in June 2022) focused on the association between personal control and endorsement of strict societal disease-control measures in more generalized conditions beyond the special circumstance of the COVID-19 crisis. Unlike previous research that compared different outbreak events involving different variants of COVID-19 (e.g., Zhou et al., 2023), we exposed participants to multiple hypothetical scenarios with fictitious viruses that differ in fatality and transmissibility. This allowed us to simultaneously examine participants' attitudes toward societal disease-control measures in a wider range of conditions and, in the meantime, minimize confounding factors that cannot be eliminated in real-world situations.

3 | STUDY 1

3.1 | Participants

We recruited a community sample of 819 Chinese adults (455 females and 364 males, M_{age} = 31.43, SD_{age} = 11.96) during a 1 week period in late May 2022 from various online channels (see Data S1 for a detailed description of the sampling processes, exclusion criteria, and detailed demographic distribution). All participants must have lived in Shanghai for at least 2 months since March 2022. Participants were diversified in their age groups, educational background, living area, and living conditions. They received a subject fee of 15 RMB (about 2.25 USD) after the completion of the questionnaire. The final sample size was smaller than the pre-registered sample size (1000) because of the exclusion of some invalid responses and early termination of the study in light of the changing COVID-19-related regulations in Shanghai. Details of the sampling processes and data exclusion criteria are documented in Data S1.

3.2 | Measures

The full list of measures for Study 1 (in both English and Chinese) is available on the OSF website (https://osf.io/3zvrb).

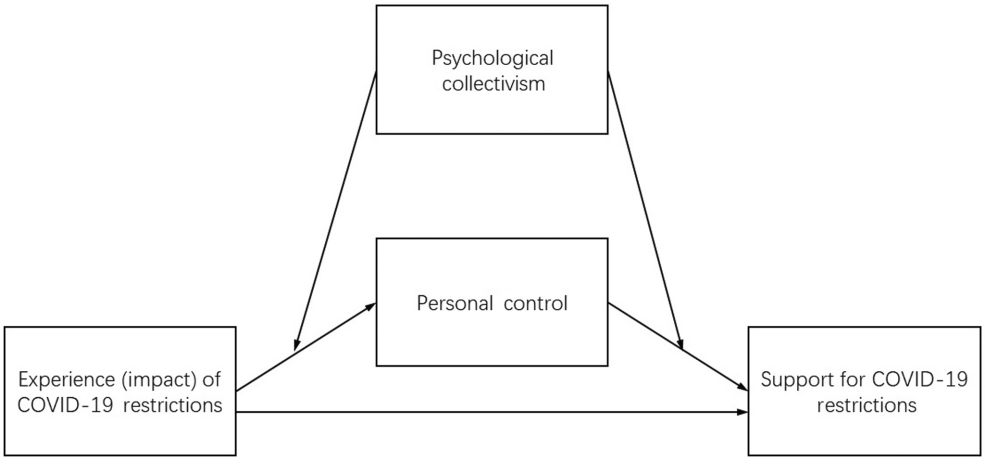

FIGURE 1 The hypothesized moderated mediation model in Study 1: Psychological collectivism moderates the relationships between experience of COVID-19 restrictions (or negative impacts of COVID-19) and personal control, and between personal control and support for COVID-19 restrictions. Personal control also serves as the mediator between experience of COVID-19 restrictions (or negative impacts of COVID-19) and support for COVID-19 restrictions.

3.2.1 | Psychological collectivism

Psychological collectivism was indicated by the average rating of a 15-item scale (Jackson et al., 2006) that asks about the respondents' participation in, and thoughts about, groups to which they currently belong or have belonged in the past. Participants indicated their agreement with each item (e.g., "I preferred to work in those groups rather than working alone," "I cared about the well-being of those groups") on a 6-point scale (1 = *strongly disagree*, 6 = *strongly agree*). The alpha coefficient of the 15 items was 0.90.

3.2.2 | Personal control

Personal control during the COVID-19 outbreak was measured using four items adapted from Lachman and Weaver (1998). Participants indicated their agreement with the following statements starting with "in the past three months, I feel that": (a) I can do just about anything that I really set my mind to; (b) whatever happens in the future mostly depends on me; (c) when I really want to do something, I can always find a way to succeed at it; and (d) whether or not I am able to get what I want is in my own hands. Responses for each item were provided on a 6-point scale (1 = *strongly disagree*, 6 = *strongly agree*). The average rating of the 4 items constituted the score of personal control (the alpha coefficient was 0.91).

3.2.3 | Experience of COVID-19 restrictions

Participants were asked to recall how long their district underwent a list of COVID-19 restrictions ("locking down residence compound," "transferring COVID-19-infected patients to mobile cabin hospital") in the past 3 months. The 10 items were rated from 1 (*never*) to 6 (*more than 2 months*) and their sum constituted the index of COVID-19 restriction experiences.

3.2.4 | Negative impact of COVID-19

Participants were asked to indicate on a 6-point scale (1 = *no impact at all*, 6 = *huge, intolerable impact*) the degree of the negative impact they experienced since the Omicron variant outbreak in early 2022 in aspects of (a) personal employment and education, (b) personal interpersonal relationships and social activities, (c) personal well-being (including emotional and physical health), (d) family economic condition, (e) home life and routines of the family (including personal hobbies), and (f) family members' well-being (including emotional and physical health). Similar aspects were identified in systematic measures and studies of the impacts of the pandemic (e.g., Grasso, Briggs-Gowan, Carter, et al., 2020; Grasso, Briggs-Gowan, Ford, & Carter, 2020). The average rating of the 6 items constituted the index of COVID-19 impacts (the alpha coefficient was 0.90).

3.2.5 | Support for COVID-19 restrictions

Participants were asked to rate the acceptability and necessity of a range of possible societal responses (e.g., shutting down non-essential businesses, compulsory disclosing of health and medical conditions) to prevent COVID-19 on a 6-point scale. The average ratings across all 22 items constituted the score of support for COVID-19 restrictions (the alpha coefficient was 0.98).

3.2.6 | Subjective socioeconomic status (SES)

We measured participants' subjective SES by slightly adapting the standard of the MacArthur scale of subjective social status (Adler et al., 2000). Specifically, participants were asked to think of a 9-rung ladder representing the social classes ranging from the lowest (1) to the highest (9) and to place themselves on such ladders in terms of financial resources (income and wealth), educational level, and occupational status, compared with other people in their community. The average rating of the 3 items comprised the index of subjective SES (the alpha coefficient was 0.82).

3.2.7 | Other measures

Participants also reported (a) whether they or their family have medical conditions (e.g., chronic disease, pregnancy) that might increase their vulnerability to serious symptoms of COVID-19 (vulnerability), (b) whether they have personally been infected with COVID-19, and (c) whether there have been COVID-19 infections in their community or among their family and friends. Additionally, participants indicated their level of education, whether they were local or non-local residents of Shanghai, their type of residence, and their types of jobs and employment (see Table S4 and Figures S1–S6 of the Supplementary Material for details).

3.2.8 | Additional feedback

Participants were allowed to provide comments after finishing the questionnaire regarding any additional information they wanted to share with the researchers.

3.3 | Statistical analysis

The original analytic plan for the data is detailed in our pre-registration on the OSF. Here, we highlight a

few deviations from the original plan. Consistent with the pre-registration, we used Model 58 in the PROCESS Macro in SPSS (Hayes, 2017) to examine the moderated mediation effects of personal control on the relationship between the experience of COVID-19 restrictions and participants' support for COVID-19 restrictions (the overall model is illustrated in Figure 1). A pre-registered confirmatory factor analysis showed that the measure of psychological collectivism belonged to a distinct factor from other measures (not reported here) related to cultural orientation and self-construal (i.e., self-expression and self-distinctiveness; details of the confirmatory factor analysis are reported in Data S1). Therefore, we decided to focus on psychological collectivism. Additionally, we simultaneously tested alternative models with the negative impact of COVID-19 as the independent variable. To correct for multiple-hypotheses biases, we adopted a more stringent standard of statistical significance, indicated by the absence of zero in 99% confidence intervals (CIs). Since in our models the indirect effects are nonlinear functions of the moderator, a general index of "moderated mediation" is not reported (Hayes, 2017).

3.4 | Results and discussion

The data that support the findings of this study are openly available on the OSF website at https://osf.io/3zvrb. Descriptive statistics and correlations among the main variables are reported in Table 1. Detailed demographic information and COVID-19-related information are reported in Data S1. In the Supplementary Material, we also reported descriptive statistics for the main variables and their comparisons across education levels (with or without a bachelor's degree), types of residences, and permanent resident status (local Shanghai residents vs. non-local residents; Table S4).

3.4.1 | Effects of permanent resident status

Before the main analysis, it is important to consider one potential factor that might bias people's judgements of COVID-19 restrictions and impacts. Compared with local Shanghai individuals who have permanent resident status and enjoy municipal benefits ($n=664$), non-local individuals without permanent resident status ($n=115$) were socioeconomically more vulnerable in the face of COVID-19 restrictions. If socioeconomic situations, rather than psychological factors, are predominant in people's judgements of COVID-19 restrictions, the latter group should exhibit lower support than the former group. Contrary to this expectation, however, we found that local Shanghai residents ($M=4.14$, $SD=1.27$) were less supportive of COVID-19 restrictions than non-local residents ($M=4.44$, $SD=1.08$), $t(817)=-2.70$, $p=0.007$, 95% CI [−0.52, −0.08], although the two groups reported similar experiences of restrictions and similar degrees of negative impact, $ts<2$, $ps>0.050$ (further results are reported in Table S4 of the Supplementary Material). This implies that psychological factors might be more pivotal than superficial differences in socioeconomic situations.

3.4.2 | Moderated mediation model

We examined the hypothesized moderated mediation models (Figure 1) using SPSS PROCESS Macro (Hayes, 2017), Model 58. Coefficients and confidence intervals were estimated using bias-corrected bootstrapping with 10,000 resamples. This model explicitly tests the moderating effect on both the predictor-to-mediator path and the mediator-to-outcome path. Alternative models were tested with different independent variables (experience of COVID-19 restrictions or negative impact of COVID-19). In all of these models, support for COVID-19 restrictions was the dependent variable,

TABLE 1 Study 1: Descriptive statistics and correlations among variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Psychological collectivism (1)	—								
Personal control (2)	0.34**	—							
Experience of restrictions (3)	−0.01	−0.23**	—						
Negative impact (4)	−0.02	−0.29**	0.20**	—					
Support for COVID-19 restrictions (5)	0.30**	0.45**	−0.06	−0.29**	—				
Sex (6)	0.01	0.04	0.01	−0.02	0.003	—			
Age (7)	0.13**	−0.06	−0.04	−0.07	−0.16**	0.03	—		
Subjective SES (8)	0.07	0.15**	0.01	−0.11*	−0.02	0.10*	0.01	—	
Vulnerability (9)	0.01	−0.09*	0.01	0.06	−0.02	0.03	0.06	0.03	—
M	4.29	3.88	50.80	3.91	4.19	—	31.43	5.30	0.10
SD	0.74	1.19	8.87	1.07	1.24	—	11.96	1.22	0.30

Abbreviation: SES, socioeconomic status.
*$p<0.01$; **$p<0.001$.

personal control was the mediator, psychological collectivism was the moderator, and sex, age, subjective SES, and vulnerability were covariates. All continuous predictors were mean-centred. In the regression results tables (Tables 2 and 3), we only report unstandardized regression coefficients because standardized coefficients are not scale-invariant and, therefore, cannot be appropriately interpreted with the presence of multiplicative interaction terms (Aiken et al., 1991).

In Model 1 (with experience of COVID-19 restrictions as the independent variable; Table 2), the predictors accounted for 22% of the variance in personal control, $F(7, 811) = 32.41$, $p < 0.001$, and 27% of the variance in support for COVID-19 restrictions, $F(8, 810) = 37.77$, $p < 0.001$. Experience of restrictions was associated with lower personal control but not directly associated with support for COVID-19 restrictions. Psychological collectivism was associated with higher personal control and greater support for COVID-19 restrictions. Personal control was also associated with stronger support for COVID-19 restrictions. Sex was not associated with either personal control or support for COVID-19 restrictions. Older participants indicated lower personal control and reduced support for COVID-19 restrictions, whereas the opposite trends were observed for participants with higher subjective SES. Participants with vulnerabilities, compared with those without vulnerabilities, reported lower personal control. However, vulnerability was not significantly associated with support for COVID-19 restrictions.

Importantly, we found a positive interaction between psychological collectivism and experience of restrictions on personal control, indicating that, for participants with stronger psychological collectivism, experienced restrictions had attenuated negative effects on personal control (supporting H1). Further, the interaction between psychological collectivism and personal control on support for COVID-19 restrictions was also positive, indicating that for participants with stronger psychological collectivism, personal control had a more positive effect on support for COVID-19 restrictions (supporting H2). Finally, we found that experience of restrictions was indirectly associated with reduced support for COVID-19 restrictions through personal control. Such negative indirect effect was significant at the 16th, 50th, and 84th percentiles of the value of psychological collectivism (indirect effects = −0.01, −0.01, −0.01; *BSE*s [bootstrapped standard errors] = 0.003, 0.002, 0.003; 99% CIs [−0.02, −0.01] [−0.02, −0.01] [−0.02, −0.001], respectively).

We also examined an alternative model with the negative impact of COVID-19 as the independent variable (other predictors were the same as in Model 1; Table 3). The predictors accounted for 24% of the variance in

TABLE 2 Study 1: Results of Model 1 (with experience of COVID-19 restrictions as the independent variable).

Variable	*B*	*SE*	*p*	99% CI of *B*
Outcome: personal control				
Constant	−0.28	0.19	—	—
Experience of restrictions (EXP)	−0.03	0.004	<0.001	[−0.04, −0.02]
Psychological collectivism (PSY)	0.57	0.05	<0.001	[0.44, 0.70]
EXP × PSY	0.02	0.01	0.001	[0.004, 0.03]
Sex	0.07	0.08	0.363	[−0.12, 0.27]
Age	−0.01	0.003	<0.001	[−0.02, −0.003]
Subjective SES	0.12	0.03	<0.001	[0.06, 0.18]
Vulnerability	−0.34	0.13	0.006	[−0.67, −0.02]
Outcome: support for COVID-19 restrictions				
Constant	5.19	0.20	—	—
Experience of restrictions (EXP)	0.002	0.004	0.694	[−0.01, 0.01]
Personal control (PER)	0.41	0.04	<0.001	[0.32, 0.50]
Psychological collectivism (PSY)	0.31	0.06	<0.001	[0.16, 0.45]
PER × PSY	0.14	0.04	<0.001	[0.05, 0.24]
Sex	−0.02	0.08	0.811	[−0.21, 0.17]
Age	−0.02	0.003	<0.001	[−0.02, −0.01]
Subjective SES	−0.10	0.03	0.002	[−0.18, −0.02]
Vulnerability	0.13	0.13	0.307	[−0.20, 0.46]

Abbreviations: CI, confidence interval; SES, socioeconomic status.

TABLE 3 Study 1: Results of Model 2 (with negative impact of COVID-19 as the independent variable).

Variable	*B*	*SE*	*p*	99% CI of *B*
Outcome: personal control				
Constant	−0.10	0.19	—	—
Negative impact (IMP)	−0.32	0.03	<0.001	[−0.41, −0.23]
Psychological collectivism (PSY)	0.59	0.05	<0.001	[0.45, 0.72]
IMP × PSY	0.13	0.04	0.001	[0.03, 0.23]
Sex	0.06	0.07	0.430	[−0.13, 0.25]
Age	−0.01	0.003	<0.001	[−0.02, −0.004]
Subjective SES	0.09	0.03	0.003	[0.03, 0.15]
Vulnerability	−0.28	0.12	0.022	[−0.60, −0.04]
Outcome: support for COVID-19 restrictions				
Constant	5.33	0.19	—	—
Negative impact (IMP)	−0.25	0.04	<0.001	[−0.35, −0.16]
Personal control (PER)	0.33	0.03	<0.001	[0.25, 0.42]
Psychological collectivism (PSY)	0.35	0.05	<0.001	[0.21, 0.48]
PER × PSY	0.15	0.04	<0.001	[0.06, 0.24]
Sex	−0.02	0.07	0.825	[−0.21, 0.17]
Age	−0.02	0.003	<0.001	[−0.03, −0.01]
Subjective SES	−0.11	0.03	<0.001	[−0.19, −0.04]
Vulnerability	0.16	0.12	0.186	[−0.15, 0.48]

Abbreviations: CI, confidence interval; SES, socioeconomic status.

personal control, $F(7, 811) = 36.40$, $p < 0.001$, and 31% of the variance in support for COVID-19 restrictions, $F(8, 810) = 46.41$, $p < 0.001$. The qualitative pattern of the results was the same as in Model 1, except that negative impact was also found to exert a direct and negative effect on support for COVID-19 restrictions. Negative impact had a negative indirect effect through personal control on support for COVID-19 restrictions at the 16th, 50th, and 84th percentiles of the value of psychological collectivism (indirect effects = −0.09, −0.11, −0.10; *BSE*s = 0.03, 0.02, 0.02; 99% CIs [−0.17, −0.04] [−0.16, −0.06] [−0.16, −0.04], respectively).

Overall, the results showed that both the perception of negative impacts and experience of societal disease-control restrictions were negatively associated with personal control for Shanghai residents during the city lockdown. Personal control, in turn, was associated with increased support for COVID-19 restrictions. As hypothesized, both associations were moderated by psychological collectivism, which also predicted elevated personal control and increased support for COVID-19 restrictions after controlling for other variables. These, however, might be fortuitous findings contingent on the special circumstances of the Shanghai lockdown. Therefore, we followed up with a second study using a more generalizable task.

4 | STUDY 2

Unlike Study 1, which examined participants' support of experienced societal disease-control measures, Study 2 sought to ascertain the generalizability of the findings of Study 1 by recruiting a new sample from most of the provinces of China and examined their attitude toward societal disease-control measures using hypothetical scenarios (not specific to the Shanghai lockdown or the COVID-19 pandemic). In particular, this also allowed us to manipulate the danger and transmissibility of a fictional virus. We expected that both higher danger and higher transmissibility would be associated with preferences for stricter disease-control measures. Further, the effects of personal control and its interaction with psychological collectivism on the evaluation of disease-control measures should be salient in low-danger or unknown conditions, but not in high-danger conditions, wherein the necessity and benefits of disease-control measures are more likely to be taken for granted.

Another change in Study 2 is the use of a new, bi-directional scale to assess participants' support for societal disease-control measures that used a 7-point scale ranging from −3 (*far too strict*) to 3 (*far too relaxed*), with the middle option representing "appropriate." Since our focus was on restrictive measures (rather than all possible disease-control measures), it made sense to assess participants' evaluation of the strictness of the measures directly.

4.1 | Participants and design

We recruited 403 Chinese adults (261 females and 139 males, $M_{age} = 30.54$, $SD_{age} = 7.54$) through the Credamo online data market, which has more than 2.8 million potential respondents in mainland China with diverse backgrounds and demographic characteristics (described in detail in https://www.credamo.com/#/samples). Our sample came from 29 out of 31 provinces of the Chinese mainland (except Qinghai and Tibet) with the largest proportions from Guangdong (15%), Shandong (13%), and Jiangsu (9%). Participants with valid responses received a subject fee of 8 RMB (about 1.2 USD). The rationales for the determination of the sample size and participant exclusion are detailed in the pre-registration.

The study conformed to a 4 (danger) by 5 (transmissibility) mixed design in which we manipulated the danger (fatality level) of the fictitious virus between subjects and the transmissibility of the virus within subjects. Participants were randomly assigned to different danger conditions.

4.2 | Measures

The full list of measures for Study 2 (in both English and Chinese) is available on the OSF website (https://osf.io/3zvrb). Participants completed the measures in the same order as presented below.

4.2.1 | Measures of psychological collectivism, personal control, and subjective SES

Psychological collectivism, personal control, and subjective SES were measured using the same scales as in Study 1 (alpha coefficients ranged from 0.89 to 0.93 for psychological collectivism, from 0.77 to 0.86 for personal control, and 0.85 to 0.87 for subjective SES across different conditions).

4.2.2 | Evaluation of disease-control measures

Participants were asked to imagine a series of hypothetical scenarios related to the spread of a virus (sharing some characteristics with COVID-19) and the actions taken to control it. Two key aspects of the virus were manipulated to simulate various disease-outbreak situations (the procedure for the development of the material is detailed in Data S1). Participants in various conditions face various levels of danger posed by the virus. In Conditions 1–4, the chance of serious illness or death caused by the virus was 30%, 10%, 2%, and 0.2%, respectively. In the meantime, participants were given various information regarding the transmissibility of a certain variant of the virus in

different blocks. In Blocks 1 to 4, cases that would result from a single case in 10 days without control were in the ranges of 2–3, 20–30, 200–300, and 2000–3000, respectively. In Block 5, participants were told that both the fatality level and the transmissibility of the new strain were unknown. In each block, participants responded to an identical list of questions regarding their judgements of the appropriateness of six disease-control measures, which were adapted from some of the COVID-19 restrictions used in the previous study (which can be applied to any similar disease-control situations), such as "locking down infected regions (city blocks or buildings)" and "police-enforced social distancing that limits gathering sizes to less than 5 people." These items were rated on a 7-point scale ranging from −3 (*far too strict*) to 3 (*far too relaxed*), with the middle option representing "appropriate." The six items representing the judgement of disease-control measures were averaged in each block, with higher values indicating a preference for stricter disease-control measures (alpha coefficients ranged from 0.82 to 0.95 across conditions and blocks).

4.3 | Results and discussion

The data that support the findings of this study are openly available on the OSF website at https://osf.io/3zvrb. Three participants were excluded due to incorrect responses to validation items. Detailed demographic information and descriptive statistics are reported in Data S1.

The statistical analyses described below have been pre-registered unless otherwise noted. Given the large number of analyses performed, we only report the significant findings of some of the pre-registered analyses. We first conducted separate analyses of variance (ANOVAs) on age, subjective SES, psychological collectivism, and personal control across different conditions. The results showed that none of these variables differed across conditions, $Fs \leq 1$, $ps > 0.100$.

4.3.1 | The effects of virus characteristics on judgement of disease-control measures

As shown in Figure 2, overall, participants in conditions with more dangerous viruses tended to prefer stricter measures. This qualitative trend held across all of the blocks, despite their variation in transmissibility. Participants also tended to prefer stricter measures in high-transmissibility blocks than in low-transmissibility blocks. Only in Block 1 (with the lowest transmissibility) did participants rate the disease-control measures to be too strict regardless of the danger of the virus. In Block 2, participants in lower danger conditions (0.2% or 2% chance of death or

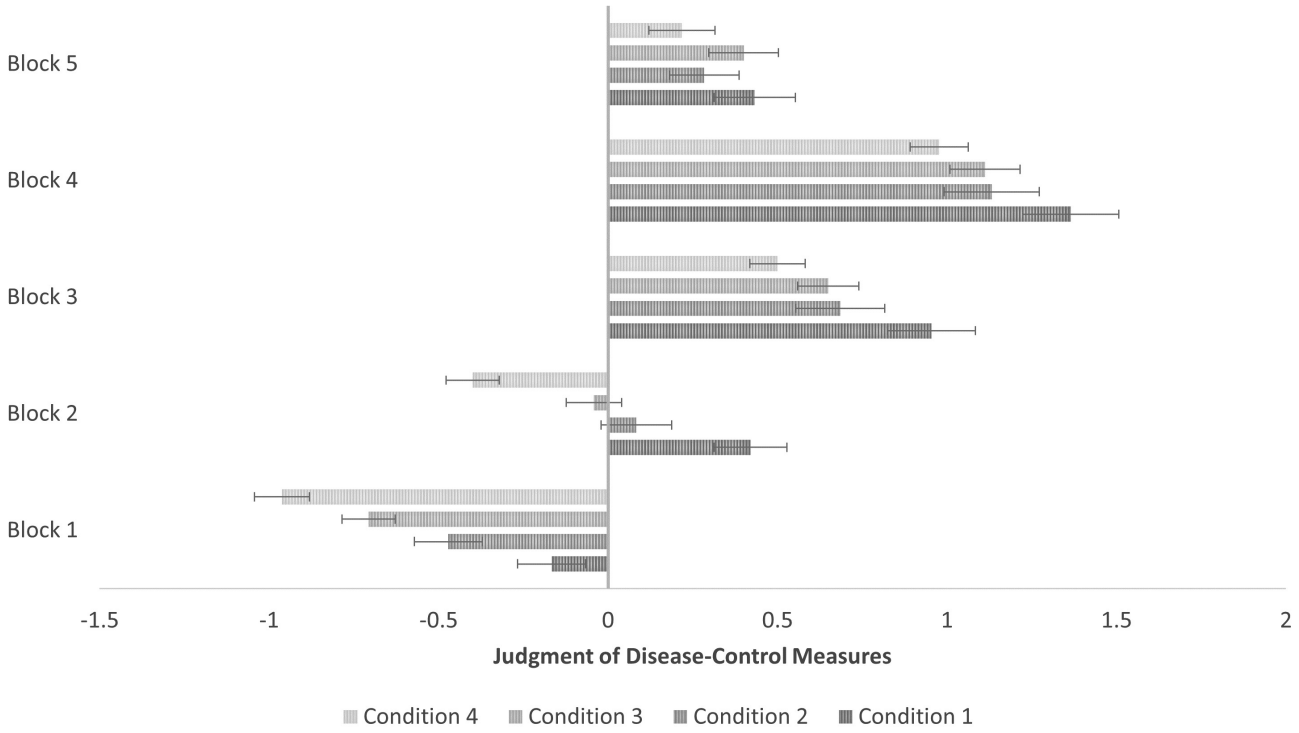

FIGURE 2 Study 2: Judgement of disease-control measures in various conditions and blocks. Conditions 1–4 represent various levels of "danger" posed by the virus in terms of the chance of death or serious illness (30% in Condition 1, 10% in Condition 2, 2% in Condition 3, and 0.2% in Condition 4). Blocks 1–4 represent various levels of "transmissibility" of the variants measured by the number of cases that would result from 1 case without any controlling measures in 10 days (2–3 in Block 1, 20–30 in Block 2, 200–300 in Block 3, and 2000–3000 in Block 4). In Block 5, participants in all conditions were told that both the transmissibility and the chance of death or serious illness are unknown.

serious illness), but not other conditions (the 10% and 30% conditions), considered the disease-control measures either too strict or as appropriate. In all other combinations of danger and transmissibility, the given disease-control measures were considered too relaxed.

A 4 (danger) × 5 (transmissibility) mixed ANOVA on the evaluation of disease-control measures produced a main effect of danger, $F(3, 396) = 7.04$, $p < 0.001$, $\eta_p^2 = 0.05$, and a main effect of transmissibility, $F(4, 1584) = 328.90$, $p < 0.001$, $\eta_p^2 = 0.45$, which were qualified by an interaction between danger and transmissibility, $F(12, 1584) = 2.84$, $p = 0.001$, $\eta_p^2 = 0.02$. Separate one-way ANOVAs were subsequently conducted within each block. We found that differences across conditions reached the corrected alpha level ($p < 0.01$) in the lowest transmissibility block, $F(3, 396) = 13.93$, $p < 0.001$, and the block with the second-lowest transmissibility, $F(3, 396) = 12.97$, $p < 0.001$, but not in blocks with higher or unknown transmissibility, Fs < 3, ps > 0.01. Post hoc comparisons using Tukey's Honestly Significant Difference test showed that in both lower-transmissibility blocks, participants' preference for strict disease-control measures was greater in the 30% condition than in the 2% or 0.2% conditions, and greater in the 10% condition than in the 0.2% condition, ps < 0.01. Overall, it seemed that transmissibility figured more prominently than danger in participants' preference for strict disease-control measures. However, when facing low-transmissibility viruses, participants would still prefer to take serious measures against the more dangerous viruses.

Next, we examined moderation models with the evaluation of disease-control measures as the dependent variable in each condition and block separately. The predictors were sex, age, subjective SES (as covariates), psychological collectivism, personal control, and their interaction. We only report significant findings below (statistical significance was determined by the absence of zero in 99% confidence intervals), summarized in Table 4. None of the predictors was significantly associated with participants' judgements of disease-control measures for any block in Condition 1, ps > 0.10. Personal control consistently and positively predicted the preference for strict measures in low-danger, high-transmissibility situations (Blocks 3 and 4 of Conditions 3 and 4). Additionally, it also positively predicted the preference for strict measures in Block 3 of Condition 2.

TABLE 4 Study 2: Summary of significant predictors of participants' judgement of disease-control measures across different conditions and blocks.

Condition	Block	Significant predictors	Model summary
Condition 1 (n = 99)	Block 1	None	$R^2 = 0.06$, $F(6, 92) = 0.91$, $p = 0.489$
	Block 2	None	$R^2 = 0.07$, $F(6, 93) = 1.24$, $p = 0.296$
	Block 3	None	$R^2 = 0.11$, $F(6, 93) = 1.82$, $p = 0.104$
	Block 4	None	$R^2 = 0.07$, $F(6, 94) = 1.24$, $p = 0.297$
Condition 2 (n = 100)	Block 1	None	$R^2 = 0.09$, $F(6, 92) = 1.60$, $p = 0.156$
	Block 2	None	$R^2 = 0.05$, $F(6, 93) = 0.84$, $p = 0.540$
	Block 3	PER: $B = 0.37$, $SE = 0.14$, $p = 0.008$, 99% CI [0.01, 0.74]	$R^2 = 0.23$, $F(6, 93) = 4.72$, $p < 0.001$
	Block 4	None	$R^2 = 0.09$, $F(6, 94) = 1.55$, $p = 0.169$
Condition 3 (n = 100)	Block 1	None	$R^2 = 0.06$, $F(6, 92) = 0.91$, $p = 0.491$
	Block 2	PSY: $B = 0.45$, $SE = 0.12$, $p < 0.001$, 99% CI [0.13, 0.77]	$R^2 = 0.22$, $F(6, 93) = 4.33$, $p = 0.001$
	Block 3	PER: $B = 0.60$, $SE = 0.16$, $p < 0.001$, 99% CI [0.19, 1.01] PER × PSY: $B = 0.69$, $SE = 0.20$, $p = 0.001$, 99% CI [0.16, 1.22]	$R^2 = 0.38$, $F(6, 93) = 9.51$, $p < 0.001$
	Block 4	PER: $B = 0.42$, $SE = 0.14$, $p = 0.003$, 99% CI [0.05, 0.79] PER × PSY: $B = 0.72$, $SE = 0.17$, $p < 0.001$, 99% CI [0.29, 1.15]	$R^2 = 0.27$, $F(6, 94) = 5.82$, $p < 0.001$
Condition 4 (n = 101)	Block 1	None	$R^2 = 0.08$, $F(6, 92) = 1.41$, $p = 0.220$
	Block 2	PSY: $B = 0.70$, $SE = 0.13$, $p < 0.001$, 99% CI [0.37, 1.04]	$R^2 = 0.36$, $F(6, 93) = 8.87$, $p < 0.001$
	Block 3	PER: $B = 0.60$, $SE = 0.17$, $p = 0.001$, 99% CI [0.15, 1.05] PER × PSY: $B = 0.68$, $SE = 0.22$, $p = 0.002$, 99% CI [0.11, 1.26]	$R^2 = 0.35$, $F(6, 93) = 8.48$, $p < 0.001$
	Block 4	PSY: $B = 0.51$, $SE = 0.19$, $p = 0.010$, 99% CI [0.003, 1.02] PER: $B = 0.49$, $SE = 0.15$, $p = 0.002$, 99% CI [0.09, 0.88] PER × PSY: $B = 0.74$, $SE = 0.18$, $p < 0.001$, 99% CI [0.27, 1.21]	$R^2 = 0.29$, $F(6, 94) = 6.39$, $p < 0.001$
All Conditions (N = 400)	Block 5	None	$R^2 = 0.02$, $F(6, 393) = 1.01$, $p = 0.420$

Note: Conditions 1–4 represent various levels of "danger" posed by the virus in terms of the chance of death or serious illness (30% in Condition 1, 10% in Condition 2, 2% in Condition 3, and 0.2% in Condition 4). Blocks 1–4 represent various levels of "transmissibility" of the variants measured by the number of cases that would result from 1 case without any controlling measures in 10 days (2–3 in Block 1, 20–30 in Block 2, 200–300 in Block 3, and 2000–3000 in Block 4). In Block 5, participants in all conditions were told that both the transmissibility and the chance of death or serious illness are unknown.

Abbreviations: CI, confidence interval; PER, personal control; PER × PSY, the interaction between personal control and psychological collectivism; PSY, psychological collectivism.

Psychological collectivism predicted the preference for strict measures in situations with moderately low danger and moderately low transmissibility (Block 2 of Condition 3), as well as some situations with low danger (Blocks 2 and 4 of Condition 4). Finally, interactions between personal control and psychological collectivism (in the direction that is consistent with H2) were found in low-danger, high-transmissibility situations (Figure 3).

Study 2 replicated the findings of Study 1 regarding the relationship among psychological collectivism, personal control, and support for COVID-19 restrictions in some conditions. Largely consistent with the prediction of H3, both the effects of personal control and its interaction with psychological collectivism were only significant in conditions wherein the benefit of these measures is not overwhelming (i.e. when the virus causes low fatality) but the infection risk without such measures is quite high (however, we did not detect any significant effect in unknown virus conditions). In these conditions, high levels of perceived personal control seemed to bias the participants toward endorsing strict measures, especially for those with high psychological collectivism. Further, participants with higher psychological collectivism were biased toward endorsing strict measures even when transmissibility was relatively low, suggesting that people who are more concerned with other group members and collective goals are more risk-averse vis-à-vis disease control.

The positive associations between personal control and support for strict measures in low-danger, high-transmissibility conditions seemed to contradict the claim that strict societal disease-prevention measures would undermine personal autonomy and a sense of control (Thompson, 2020). One explanation might be that individuals who are higher in personal control would also have enhanced prosocial concerns, which prompt them to endorse life-saving collective actions. Additionally, this effect should be more pronounced among individuals who scored higher, as opposed to those who scored lower, in psychological collectivism. As an explorative analysis, we examined individuals'

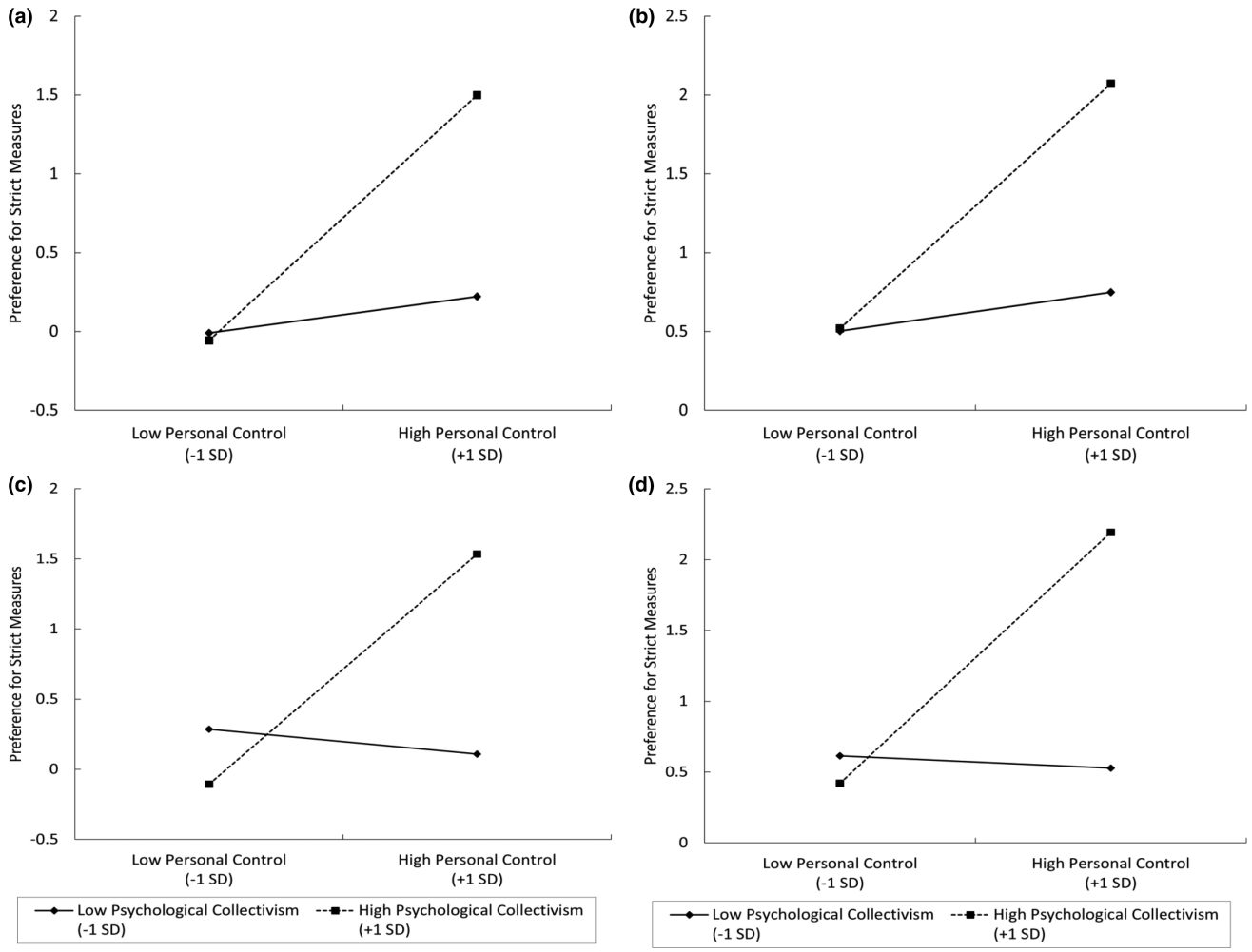

FIGURE 3 Study 2: Interactions between personal control and psychological collectivism on judgements of disease-control measures in Condition 3, Block 3 (a); Condition 3, Block 4 (b); Condition 4, Block 3 (c); and Condition 4, Block 4 (d).

reasons (adapted from Zhu et al., 2021) for their judgement of societal disease-control measures (reported in Data S1) and conducted a multiple regression analysis with prosocial reasoning (based on moral and societal concerns) as the dependent variable. The aforementioned predictions were supported by the results of the multiple regression analysis of prosocial reasoning. We found that after controlling for danger condition, sex, age, and subjective SES, higher psychological collectivism and higher personal control both predicted increased prosocial reasoning. A significant positive interaction between psychological collectivism and personal control revealed that for individuals with higher psychological collectivism, the association between personal control and increased prosocial reasoning was stronger.

5 | GENERAL DISCUSSION

The current research examined the judgements of concurrent disease-control measures by a community sample under a strict city lockdown and the evaluations of disease-control measures in hypothetical scenarios by an online sample recruited across China. We provided evidence regarding the hypothesized relationships among personal control, psychological collectivism, and disease-control measures. Specifically, both experiences of restrictive measures and negative impacts of COVID-19 had attenuated negative associations with personal control for individuals scoring higher than for those scoring lower on psychological collectivism. The former also showed a stronger positive association between personal control and the preference for strict disease-control measures. Additionally, Study 2 (using manipulated infectious-disease scenarios) revealed that this interaction between personal control and psychological collectivism was only found in response to ambivalent disease threats (low fatality but high transmissibility).

Both of our studies showed that personal control, in general, positively predicted individuals' support for strict disease-control measures. This is consistent with the view that personal control is conducive to active engagement in actions to eliminate environmental threats (Thompson, 2020). However, endorsement of societal disease-control measures should be distinguished from compliance with these measures. Indeed, Li and Zhu (2022) found that personal control was indirectly linked to lower, not higher, safety compliance regarding COVID-19 prevention regulations. Therefore, personal control might function as a double-edged sword for disease-prevention efforts. On the one hand, personal control boosts individuals' support for strict measures that aim at protecting everyone from infection. But on the other, individuals with higher personal control might not be enthusiastic about assuming the personal costs and responsibility of adhering to such measures.

Study 1 also showed that collectivism was generally associated with higher support for disease-control measures, which is consistent with existing findings linking collectivism to more serious attitudes toward COVID-19 prevention efforts (e.g., Chen et al., 2021; Wang, 2021; Xiao, 2021). This finding is also consistent with the pathogen prevalence theory (Shapouri, 2023), which argues that variations in local disease stress (especially infectious pathogens) are a key driving force behind the evolution of cultural values and relevant aspects of sociality and cognition (Thornhill & Fincher, 2014). In particular, variation in collectivistic values might have been selected based on its adaptive function as a flexible pathogen-avoidance mechanism (Schaller & Murray, 2008). Importantly, such an evolved psychological mechanism might facilitate various behavioural tendencies (e.g., xenophobic tendencies and conformity to collective norms; Murray et al., 2011; Wu & Chang, 2012), and support for societal disease-control measures are in line with such collectivistic tendencies.

However, compulsory implementation of disease-control measures in a society can be costly (both economically and psychologically), such that it cannot afford to enact these measures all the time against all types of pathogens. To find a specific range of pathogen conditions that are particularly sensitive to individual differences in psychological collectivism and personal control, we exposed participants to hypothetical viruses differing in death and infection risks in Study 2. This led to the finding that, controlling for other variables, psychological collectivism was only significantly associated with the support for stricter disease-control measures in certain low-fatality conditions. When the danger and infection risks are reasons enough for actions, psychological collectivism does not predict people's attitudes toward disease control. Additionally, we found that psychological collectivism enhanced the positive associations between personal control and support for stricter societal disease control only in a few conditions. This shows that even for collectivists, conformity toward collective actions and norms does not always trump individual rights and freedom (Zhu et al., 2021). Rather, societal norms and measures might be deployed and enforced at times when ambivalent disease threats (low fatality and high transmissibility) pose a great existential danger for closely knitted collectivistic communities.

The results of Study 2 showed that disease fatality and transmissibility might also have a direct impact on individuals' attitudes toward disease control. As recent studies have shown, risk perception related to COVID-19 infections positively predicted personal endorsement of protective behaviours (de Bruin & Bennett, 2020; Plohl & Musil, 2021; Wise et al., 2020). Our study, however, differed from these previous studies in that we (a) distinguished between risk caused by fatality and risk

caused by transmissibility, (b) manipulated these factors in hypothetical scenarios and considered the interaction between these two types of risks, and (c) focused on the endorsement of societal disease-control measures. As expected, both fatality and transmissibility were associated with an increased preference for strict disease-control measures. This finding has practical implications for the easing of COVID-19 restrictions. When facing viruses that are highly transmissible but have low fatality, individuals might tend to overestimate the risk, leading to persistent support for unnecessarily strict measures, which are especially costly when dealing with highly transmissible viruses like the Omicron variant of COVID-19.

A major limitation of the current research (especially Study 1) is that, given the constraints of time and resources, we did not use a systematic sampling method to better represent the vast population of Shanghai. Our study period was also cut short due to unexpected pressures related to the increasingly polarized public opinions and political debates regarding the zero-COVID policy (see Data S1 for detailed information) reported by some of our participants. Due to the concern that continuing our research might expose participants to such additional risks of misunderstanding and psychological pressure, we decided to end the study before reaching the planned sample size. Hence, when interpreting the results, we cannot rule out the possibility that some participants found it too stressful to reveal their true attitudes when facing certain "sensitive questions" in the survey. Another reason to terminate the study early was that the lockdown was to be lifted in June, which would change the underlying condition of Study 1. This, of course, also constrained our ability to conduct follow-up investigations. For example, a comparison between lockdown and post-lockdown periods would allow us to disentangle the special circumstantial factors related to the lockdown period from more generalizable psychological mechanisms that manifest with or without an ongoing lockdown.

Study 2 partly addressed this generalizability issue by recruiting a geographically more diverse sample. However, it is unknown whether the aforementioned finding regarding a higher preference for strict measures in the face of high viral transmissibility is limited to Chinese individuals (who might be overly concerned for the safety of vulnerable members of their family or society). As past research has shown, Chinese participants might be exceptional in their support for societal protection against disease risks (Zhu et al., 2021), which may constrain the generalizability of our findings. However, given the myriad individual-difference and social factors contributing to people's judgements of disease-control measures (e.g., Wang, 2021; Wise et al., 2020), limiting our sampling to a single society (such that all participants are exposed to the same information and regulations during a certain period) might be beneficial in eliminating confounding factors.

A third limitation of the current research is the correlational nature of the findings. To examine possible causal effects of personal control on attitudes toward disease-control measures, for instance, future investigations should consider experimental manipulation of personal control. Finally, it should be noted that personal control and psychological collectivism are by no means the only psychological factors contributing to attitudes toward disease control. Past research has focused on an array of psychological factors, including fear and perceived threats (Harper et al., 2020; Pakpour & Griffiths, 2020), risks and expectations (Lee & You, 2020; Wise et al., 2020), conspiracy beliefs (Imhoff & Lamberty, 2020), trust in science (Plohl & Musil, 2021), and political ideology (Calvillo et al., 2020). Nevertheless, future research would benefit from a synthesis of these factors with more generalized mechanisms like personal control and collectivistic orientation.

The take-home message of the current research is that personal control and collectivistic orientation interact with each other when contributing to people's disease-control attitudes under specific disease-risk configurations. Collectivistic orientation seems to favour strict disease-control measures and enhance the facilitative effect of personal control on people's support for societal restrictions, but such effects tend to manifest when the necessity of disease-control measures seems ambivalent (e.g., unlikely to cause deaths but very likely to spread across densely populated regions). In the face of such uncertainty, a sense of control (regarding societal measures to contain the spread of the virus) might invoke the duty of protecting vulnerable individuals within the society, which is bolstered by individuals' endorsement of collectivism.

AUTHOR CONTRIBUTIONS

Nan Zhu: Conceptualization; data curation; formal analysis; investigation; methodology; writing – original draft. **Yang Li:** Conceptualization; data curation; methodology; resources; visualization; writing – original draft; writing – review and editing. **Lei Chang:** Conceptualization; funding acquisition; supervision; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data of both studies are available on the OSF (https://osf.io/3zvrb/?view_only=6aa6493565834ba9a41294c2175d6b3e).

ETHICS STATEMENT

This research was reviewed and approved by the Psychology Department panel of University of Macau (2022).

RESEARCH MATERIAL AVAILABILITY STATEMENT

Documents containing the full list of measures used in Studies 1 and 2 (in both English and Chinese) are available onthe OSF website (https://osf.io/3zvrb).

PRE-REGISTRATIONS

The hypotheses, data collection plans, and data analytic plans were pre-registered on the Open Science Framework (OSF) website on 18 May 2022 for Study 1 (https://osf.io/vtucg) and on 8 June 2022 for Study 2 (https://osf.io/s8u2m).

ORCID

Lei Chang https://orcid.org/0000-0001-6457-0254

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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